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Appendix K. Wildlife Targets

The goal for this appendix is to provide the rationale for the target methylmercury concentrations that should protect all wildlife in California. These wildlife targets will be used to establish water quality objectives for mercury to protect wildlife that will be part of the Provisions. Such wildlife targets have already been calculated as part of several different projects. This analysis (Appendix K) is partly a compilation of information from those previous projects, with frequent references to them. These previous projects are briefly described below.

In 2000, the United States Fish and Wildlife Service (USFWS) determined that the draft California Toxics Rule criteria for mercury (and other constituents) would not protect several threatened and endangered species. This decision was published in the Draft Jeopardy Ruling and Final Biological Opinion on the California Toxics Rule (USFWS & National Marine Fisheries Service (NMFS) 2000). As part of this determination, the USFWS determined protective methylmercury targets for wildlife. Later, the USFWS produced another detailed analysis of protective targets for threatened and endangered species in 2003 (USFWS 2003). This analysis was performed to determine if the United States Environmental Protection Agency's (U.S. EPA) human health criteria would provide adequate protection for threatened and endangered species (U.S. EPA 2001). The USFWS determined that the human health criteria would not be protective for California least tern, the Yuma Ridgeway's rail and possibly the light-footed Ridgeway's rail (formerly known as clapper rails).

Several California Regional Water Quality Control Boards (Regional Water Boards) have also developed protective targets for wildlife species in the development of site-specific water quality objectives as part of total maximum daily loads (TMDLs). The Central Valley Regional Water Board developed wildlife values as part of the site-specific objectives for Clear Lake, Cache Creek, and the Sacramento-San Joaquin Delta and Yolo Bypass (Central Valley Water Board 2002, 2005, 2010). The San Francisco Bay Regional Water Board developed site-specific objectives to protect wildlife for the Guadalupe River Watershed and Walker Creek (San Francisco Bay Water Board 2008a, 2008b). The USFWS reviewed the wildlife targets for Cache Creek (developed by the Central Valley Water Board) and calculated the wildlife targets for Guadalupe River Watershed. Additionally, the USFWS 2003 report incorporates information from Canada's water quality criterion (Canadian Council of Ministers of the Environment 2000), the Mercury Study Report to Congress (U.S. EPA 1997a,b), and the Great Lakes Initiative (U.S. EPA 1995).

K.1 Species of Concern

Considering the bioaccumulation and biomagnification of methylmercury in the aquatic food web, the upper trophic level wildlife species (i.e., predatory birds and mammals) are thought to have the greatest risk from exposure to methylmercury. Therefore, research into the effects of

methylmercury on wildlife has generally focused on birds and mammals that prey directly on fish and other aquatic organisms. Piscivorous (fish eating) birds and mammals are generally higher order predators than, for example, aquatic-dependent reptiles and amphibians, which may result in a greater potential for dietary exposure and subsequent toxicity. This same concept of greater potential risk to higher order piscivorous species may also hold for top predators that in turn prey on piscivorous wildlife (*e.g.*, a peregrine falcon preying on piscivorous waterfowl), due to the successive trophic level biomagnification. A list of species of concern was compiled from the previous analyses (below). Marine wildlife was excluded from this analysis because the geographic scope of the Provisions does not include the ocean.

Species that were included in the USFWS evaluation of the U.S. EPA methylmercury human health criterion are listed below (USFWS 2003). All of these species are federally listed as threatened or endangered, except the bald eagle which was delisted in 2007. Figure K-1 shows geographic locations where these species have been observed in California.

Bald Eagle (*Haliaeetus leucocephalus,* delisted in 2007)
California Least Tern (*Sterna antillarum browni*)
California Ridgeway's Rail (*Rallus obsoletus*)*
Light-Footed Ridgeway's Rail (*Rallus obsoletus levipes*)*
Yuma Ridgeway's Rail (*Rallus obsoletus yumanensis*)*
Western Snowy Plover (*Charadrius alexandrinus nivosus*)
Southern Sea Otter (*Enhydra lutris nereis*)

*Note that Ridgeway's rails were formerly a clapper rails, *Rallus longirostris.*

Threatened and endangered species that were considered in the USFWS Final Biological Opinion (USFWS & NMFS 2000) were similar to the above, except that the Final Biological Opinion did not include western snowy plover, while it did include the marbled murrelet. The marbled murrelet feeds mostly in the open ocean (CDFW 1990) which is beyond the geographic scope of this objective.

The California least tern, California Ridgeway's rail, light-footed Ridgeway's rail, and Yuma Ridgeway's Rail, and bald eagle are listed as endangered species and fully protected species under the California Endangered Species Act of 1984. This legislation requires State agencies to consult with the California Department of Fish and Wildlife (CDFW) on activities that may affect a State-listed species. Western Snowy Plover and the Southern Sea Otter are not on the State's list of threatened or endangered species.

The goal of water quality objectives is not just to protect threatened and endangered wildlife but all wildlife. Regional Water Boards included several other wildlife species in the development of site-specific objectives. Development of the Cache Creek site-specific objectives (Central Valley Water Board 2005) examined values for the following species:

Mink (*Mustela vison,* recently changed to *Neovison vision*)
River Otter (*Lutra canadensis*)
Belted Kingfisher (Mega*ceryle alcyon*)
Common Merganser (*Mergus merganser*)
Western Grebe (*Aechmophorus occidentalis*)
Double-crested Cormorant (*Phalacrocorax auritus*)
Osprey (*Pandion haliaetus*)
Bald Eagle (*Haliaeetus leucocephalus*)
Peregrine Falcon (*Falco peregrinus*)

These same species were used for the Sacramento-San Joaquin Delta site-specific objectives, in addition to the California least tern and the western snowy plover (Central Valley Water Board 2010)

Development of the Clear lake and Guadalupe River Watershed site-specific objectives (Central Valley Water Board 2002, USFWS 2005) included a few of the above species, and also considered:

Great blue heron (*Ardea herodias*)
Forster's tern (*Sterna forsteri*)
Common loon (*Gavia immer*)

For this analysis, additional species of concern were sought out in CDFW's current list of threatened and endangered species in California and in a list of birds in the Salton Sea (CDFW 2013, 2012). The list was reviewed for other piscivorous wildlife that feed in California inland surface waters, enclosed bays and estuaries. No additional species were identified that were clearly at high risk, some of the species that were considered more in depth are discussed later, in Section K.10 of this appendix.

K.2 Calculation of Protective Wildlife Values

The USFWS used the following equation to calculate a protective concentration for the overall diet of a given species (USFWS 2003). This calculation is based on information about the organism's body weight and daily food consumption.

$$WV = \frac{RfD \times BW}{FIR} \quad (1)$$

where,

WV = Wildlife Value (mg/kg in diet)
RfD = Reference Dose (mg/kg of body weight/day)
BW = Body Weight (kg) for species of concern
FIR = Total Food Ingestion Rate (kg of food/day) for species of concern

The wildlife value is essentially a safe concentration of methylmercury in the diet for a particular wildlife species. More specifically, a wildlife value "represents the overall dietary concentration

of methylmercury necessary to keep the daily ingested amount at or below a sufficiently protective reference dose. Reference doses (RfD) may be defined as the daily exposure to a toxicant at which no adverse effects are expected" (USFWS 2003). The reference dose used in this appendix was from a study in mallard ducks, the same as used by USFWS (USFWS 2003). The use of the mallard reference dose was also supported by data in great egrets (Bouton et al. 1999 and Spalding et al. 2000 a,b, discussed in USFWS 2003).

Equation 1 converts a protective RfD into an overall dietary concentration (in mg/kg in diet). Table K-1 shows the calculated wildlife values for all species of concern listed in the previous section.

Table K-1. Wildlife Values (mg/kg in diet)

Species	RfD (mg/kg/day)	Body Weight (kg)	FIR (kg/day)	Wildlife Value[a] (mg/kg in diet)
Mink	0.018	0.60	0.140	0.077
River otter	0.018	6.70	1.124	0.107
Belted kingfisher	0.021	0.15	0.068	0.046
Common merganser	0.021	1.23	0.302	0.085 (0.099[b])
Western grebe	0.021	1.19	0.296	0.084
Double-crested cormorant	0.021	1.74	0.390	0.094
Osprey	0.021	1.75	0.350	0.105 (0.112[b])
Bald eagle	0.021	5.25	0.566	0.195 (0.184[c])
Peregrine falcon	0.021	0.89	0.134	0.139
Southern sea otter [FT]	0.018	19.8	6.5	0.055
California least tern [FE]	0.021	0.045	0.031	0.030
California Ridgeway's rail [FE]	0.021	0.346	0.172	0.042
Light-footed Ridgeway's rail [FE]	0.021	0.271	0.142	0.040
Yuma Ridgeway's rail [FE]	0.021	0.271	0.142	0.040
Western snowy plover [FT]	0.021	0.041	0.033	0.026
Great blue heron	0.021	2.20	0.378	0.122 [b]
Forster's tern	0.021	0.16	0.071	0.047 [b]
Common loon	0.021 [d]	4 [d]	0.800 [d]	0.105

[a] from the USFWS Cache Creek Targets (USFWS 2004) and the USFWS Evaluation of the U.S. EPA Human Health Criterion (USFWS 2003), except as otherwise noted
[b] from Guadalupe River Watershed targets (USFWS 2005)
[c] the two references (USFWS 2004 and USFWS 2003) provided different values
[d] from Clear Lake analysis (Central Valley Water Board 2002)
[FT /FE] on federal list of threated or endangered species

Food ingestion rates (FIR, kg of food/day) for species of concern were taken from existing reports by the USFWS or Water Boards (see Table K-1 above). In general, food ingestion rates for birds that prey on fish are higher than food ingestion rates for birds that prey on terrestrial animals. This is because fish do not provide as much energy as birds and mammals, on an ounce-for-ounce basis (USFWS 2004).

Next, the USFWS considered the kind of fish to which the wildlife value should apply. Fish may fall into trophic level 2, 3, or 4 (TL2, TL3, or TL4) depending on their position in the food web. The methylmercury concentrations in the fish flesh will depend on the position of the fish on the food web; organisms higher on the food web accumulate more methylmercury. Trophic levels used in this evaluation were based on definitions provided in USFWS 2003, U.S. EPA 1997b:

Trophic Level 1 – Plants and detritus (*e.g.*, periphyton, phytoplankton)
Trophic Level 2 – Herbivores and detritivores (*e.g.*, copepods, water fleas)
Trophic Level 3 – Predators on trophic level 2 organisms (*e.g.*, minnows, sunfish, suckers)
Trophic Level 4 – Predators on trophic level 3 organisms (*e.g.*, bass, pikeminnow)

If a wildlife species consumes only equivalently sized fish from one trophic level, then the wildlife value may be used as the protective target for that trophic level. On the other hand, if a wildlife species consumes prey from more than one trophic level, the methylmercury in each trophic level should be considered when applying the wildlife value. Therefore, an understanding of the dietary composition for these wildlife species is needed to determine the limiting methylmercury concentrations for each trophic level to protect wildlife.

The USFWS and Regional Water Boards determined the diet for each species by reviewing the scientific literature for a particular species or by extrapolating from information about a similar species. The diets were then categorized by the relative portion from each trophic level that they consumed. The diet composition for each species is shown in Table K-2. The USFWS originally categorized diet only by trophic level (e.g. TL2, TL3 or TL4), while subsequent evaluations by the USFWS and the Regional Water Boards subdivided the diet into specific sizes ranges (e.g. TL3 less than 150 mm or TL3 150 – 500 mm, USFWS 2003). For light-footed Ridgeway's rail, California Ridgeway's rail, snowy plover and otter, all prey species that were classified as TL3 by the USFWS are still classified as simply TL3 in this analysis (USFWS 2003). These species included various species of crabs (Cancer spp.), nassa mud snails (scavengers), fish (killifish, longjaw mudsuckers), and crayfish. The diet for Californian Least tern was revised as described below. For bald eagle, the more recent diet composition from the USFWS was used (USFWS 2004), which was based on a publication by Jackman et al. (Jackman et al. 1999). However, a more recent article by Jackman et al. suggest that the proportion of TL4 fish, particularly bass, in the diet of eagles that live near reservoirs can be much higher than the previous findings, at 55% (Jackman et al. 2007).

Table K-2. Trophic Level (TL) Compositions (Expressed as Decimal Fractions) for Wildlife Species, Including Omnivorous Birds (OB), Piscivorous Birds (PB) and Other Foods (OF)

Species	TL2	TL2/3 < 50 mm	TL3 < 150 mm	TL3 150 – 500 mm	TL4 150 – 500 mm	OB	PB	OF
Mink			1.00					
River otter			0.80		0.20			
Belted kingfisher			1.00					
Common Merganser				1.00				
Western grebe				1.00[a]				
Double-crested cormorant			1.00					
Osprey				0.90	0.10			
Bald eagle				0.58	0.13	0.13	0.05	0.11
Peregrine falcon						0.10	0.05	0.85
Southern sea otter	0.80		0.20					
California least tern		1.00						
California Ridgeway's rail	0.85		0.05					
Light-footed Ridgeway's rail	0.82		0.18					
Yuma Ridgeway's rail	0.23		0.72					0.05
Western snowy plover	0.25							.75
Great blue heron			1.00[b]					
Forster's tern		1.00[b]						
Common loon				0.80[c]				

Note: most data are from the USFWS evaluation of the U.S. EPA human health criterion (Table 4, USFWS 2003), the USFWS Cache Creek targets (Table 4, USFWS 2004) and the Sacramento-San Joaquin Delta targets (Table 4.1 and Table 4.3, Central Valley Water Board 2010), except as otherwise noted.

[a] The U.S. Geological Survey grebe study team caught fish 18 – 123 mm as representative grebe prey (Ackerman et al. 2015). Also, fish found in the stomachs of western grebes were 27 – 88 mm (1 – 3.5 in) long (CDFW 1990). In any case, the larger size (used in Table K-2) is more protective.

[b] from Guadalupe River Watershed targets (Table 4 and 5, USFWS 2005).

[c] from Clear Lake targets (Table C-3, Central Valley Water Board 2002), reclassified based on the 200 – 400 mm size and CDFW 1990. Clear Lake report has the loon diet as "TL2" but "200 – 400 mm". Because of the size the fish are shown here as TL3. The CDFW life history account for loon: "Diet varies; usually about 80% fish, with crustaceans the next largest item… Most fish eaten are not sought by humans…" Burgess and Meyer report "We sampled small fish (76 – 127 mm in length) typically consumed as prey by loons (Barr 1996)"

For the California least tern, an additional diet category was developed by the USFWS. The USFWS recommended a protective target for terns for TL3 less than 50 mm based on the very small fish this species preys upon (USFWS 2004). This category was also used in the Guadalupe River Watershed target for Forster's tern (USFWS 2005), and this category is included in this analysis (Table K-2). In the environment it may be difficult to distinguish if a small fish is TL2 or TL3; therefore, the category was defined as TL2/3 less than 50 mm.

The Yuma Ridgeway's rail primarily preys upon crayfish (estimated to be 90% of the diet) along with small contribution from other TL2 organisms (isopods, damselfly nymphs, mollusks) and some non-aquatic organisms (USFWS 2003). The USFWS classified the crayfish as trophic level (TL) 2.8 and the whole diet was categorized as 72 % TL3 and 23 % TL2, with another 5% in non-aquatic plants or animals (USFWS 2003). This classification is shown in Table K-2. Yuma Ridgeway's rail is one of the more sensitive species that may influence the final recommended water quality objectives.

K.3 Calculation of Targets for Species that Eat from only One Trophic Level

The information on the diet of each species (Table K-2) was used to identify the species that only consumed prey from one trophic level. For these species the wildlife value (Table K-1) was used as the target. Targets for mink, belted kingfisher, double crested cormorant, great blue heron, Forster's tern, California least tern, and western snowy plover were derived this way. The resulting values are shown in Table K-3. The USFWS considered that food other than fish or birds ("other foods") had negligible amounts of methylmercury (USFWS 2003). For example, for western snowy plover the wildlife value was assigned to the TL2 portion of the diet and the "other food" portion was ignored.

K.4 Calculation of targets for species that consume prey from multiple trophic levels

K.4.1 Approaches for Including Multiple Trophic Levels

For wildlife that consume prey from *more than one trophic level* the analysis is more complex. As mentioned above, the wildlife value represents an average concentration of methylmercury in the overall diet necessary to keep the organism's daily ingested amount at or below the reference dose. Considering that the wildlife species may feed on organisms in multiple tropic levels, the wildlife value can also be expressed using Equation 2 (USFWS 2003):

$$WV = (\%TL2 \times [Hg]TL2) + (\%TL3 \times [Hg]TL3) + (\%TL4 \times [Hg]TL4) \quad (2)$$

where,

%TL2 = Percent of trophic level 2 biota in diet
%TL3 = Percent of trophic level 3 biota in diet
%TL4 = Percent of trophic level 4 biota in diet
[Hg]TL2 = concentration in food from trophic level 2
[Hg]TL3 = concentration in food from trophic level 3
[Hg]TL4 = concentration in food from trophic level 4

[Hg]TL2, [Hg]TL3 and [Hg]TL4 can be related using values derived from the relationships of bioaccumulation and biomagnification between trophic levels, expressed as **food chain multipliers (FCM)**.

FCM2/3= Food chain multiplier from TL2 to TL3 biota
FCM3/4 = Food chain multiplier from TL3 to TL 4 biota

The [Hg]TL3 and [Hg]TL4 terms can then be expressed as functions of [Hg]TL2:

$$[Hg]TL3 = [Hg]TL2 \times FCM3/2 \quad (3)$$

$$[Hg]TL4 = [Hg]TL2 \times FCM3/2 \times FCM4/3 \quad (4)$$

This allows Equation 2 to be rearranged, substituting food chain multiplier equivalents, as:

$$WV = (\%TL2 \times [Hg]TL\ 2) + (\%TL3 \times [Hg]TL2 \times FCM\ 3/2) + (\%TL4 \times [Hg]TL2 \times FCM\ 3/2 \times FCM4/3) \quad (5)$$

This equation can then be solved for the mercury concentration in the lowest trophic level:

$$[Hg]TL2 = WV / [(\%TL2) + (\%TL3 \times FCM3/2) + (\%TL4 \times FCM3/2 \times FCM4/3)] \quad (6)$$

Once the concentration in TL2 is determined, the concentration in the remaining trophic levels can be calculated by rearranging equations 3 and 4 above.

To translate between methylmercury concentrations in the different trophic levels one can use food chain multipliers, as described above, or **trophic level ratios (TLR)**. Trophic level ratios represent the concentration relationship between similarly sized fish feeding at different positions in the food web (also referred to as a food chain). Food chain multipliers on the other hand, assume that there is a direct predator-prey relationship between the trophic levels, with methylmercury concentrations in the higher trophic level fish resulting from ingesting the methylmercury found in fish from the next lower trophic level. However, as an example, the Cache Creek TMDL staff report points out, a 350 mm sunfish (TL3) is too large to be consumed by a 350 mm smallmouth bass (TL4). That is why this relationship is not described by food chain multipliers (Central Valley Water Board 2005).

The USFWS pointed out that trophic level ratios provide an equally valid way to develop fish tissue targets, with the following caveats: 1) the fish prey of the wildlife species of concern must be approximately the same size, regardless of trophic level, and 2) the resultant limiting concentrations calculated with these trophic level ratios are applied to the appropriate size classes of fish (*i.e.*, using the example of bass and sunfish provided above, the limiting concentration for TL3 must be applied to fish 250 mm or larger, *not* to the small individuals that

would be preyed upon by large TL4 fish). Both caveats stem from the general trend of increasing tissue methylmercury concentrations with increasing fish size (Davis et al. 2010, Davis et al. 2013).

While California TLRs were derived for this analysis, California specific FCMs could not be calculated, since sufficient data were not available on fish < 150 mm or TL2 organisms. The FCMs are only used for a few species where a California TLR could not be used, including: river otter, southern sea otter, California Ridgeway's rail and light-footed Ridgeway's rail. Additionally, when possible, targets from site-specific projects and from site-specific data were included in Table K-3, such as for river otter. A range of values form various California projects, as well as targets derived from national values are included in Table K-3, to show some of the uncertainly in these values. However, this does not include all the uncertainly in these targets (see section K.9).

K.4.2 River Otter (Food Chain Multiplier Approach)

For river otter, the USFWS suggested the use of a food chain multiplier since prey comes from mainly TL3 less than 150 mm, and otters also catch larger TL4 fish, so there would be a predator-prey relationship between the two categories of fish. Site-specific data were used to derive a food chain multiplier of 5 for Cache Creek, and a food chain multiplier of 8.1 for the Sacramento-San Joaquin Delta. These food chain multipliers were used to calculate the protective target for river otter (shown in Table K-3). For this analysis, the U.S. EPA national food chain multiplier of 4 was also used to calculate targets for river otter (Table K-3).

K.4.3 Southern Sea Otter, California Ridgeway's Rail and Light-Footed Ridgeway's Rail (Food Chain Multiplier Approach)

For the small threatened and endangered species that eat from TL2 and TL3 the food chain multiplier approach was also used. These species were southern sea otter, California Ridgeway's rail, and light-footed Ridgeway's rail. The USFWS used the U.S. EPA food chain multiplier of 5.7 for TL2 to TL3 (FCM2/3), since California data were not available to calculate a California specific value. The same food chain multiplier of 5.7 was used for this analysis. The targets for each trophic level are shown in Table K-3.

K.4.4 Osprey (Trophic Level Ratio Approach)

Ospreys (and bald eagles) prey on fish from TL3 and TL4, and the fish preyed on from the two trophic levels are likely to be similarly sized fish, mostly above 150 mm. The USFWS 2005 had a more detailed account of the size of fish eaten by ospreys and recommended the target for osprey be applied to fish in the size range of 150 – 350 mm, although it was noted that ospreys will occasionally take larger and smaller fish. Bald eagles generally consume fish over 300mm, however some are over 500 mm (USFWS 2003). Following the rational from the USFWS, a trophic level ratio is more appropriate for calculating methylmercury concentrations in the prey of these species.

There were no existing national or statewide trophic level ratios. The trophic level ratios used in previous analyses were calculated based on site-specific data (for Cache Creek, the Sacramento-San Joaquin Delta and Clear Lake), and these trophic level ratios (relating TL3 to TL4) ranged from 1.7 to 3. The resulting protective targets calculated with these site-specific trophic level ratios are shown in Table K-3. These can be used as a range of possible conditions in California. However, the trophic level ratios are all based on data from one geographic area of California, the California Central Valley. Different areas of Northern California outside the Central Valley are not well represented and no Southern California areas are represented.

As part of this analysis, a statewide trophic level ratio for California was calculated (see Appendix L for calculation). The goal was to collect data from all over the state, but the available data were again mostly from the Central Valley (see map in Figure L-1 and Figure L-2 in Appendix L). The data used to calculate the ratios were collected from 35 locations throughout the state, including 17 rivers, 11 sloughs, and 7 lakes and reservoirs and 4 other water bodies (see Appendix L). This 'statewide' data set likely included more recent data not included in past analyses. The trophic level ratio for TL4 fish 150 – 350 mm to TL3 fish 150 – 350 mm was 2.1.

An example calculation of osprey targets using equation 5 (above) with the statewide trophic level ratio is shown below, and the resulting values are also shown in Table K-3. Since osprey do not eat from TL2 the equation can be reduced, and solved for [Hg]TL3:

$$[Hg]TL3 = WV / [(\%TL3) + (\%TL4 \times TLR4/3)]$$
$$[Hg]TL3 = 0.105 \text{ mg/kg} / [(0.9) + (0.1 \times 2.1)]$$
$$[Hg]TL3 = 0.09545 = \mathbf{0.09 \text{ mg/kg}}$$

The target for [Hg] TL3 can then be used to find the osprey target for [Hg] TL4:

$$[Hg]TL4 = [Hg]TL3 \times TLR4/3$$
$$[Hg]TL4 = 0.09545 \times 2.1 = 0.1909 = \mathbf{0.20 \text{ mg/kg}}$$

K.5 Calculation of Targets for Species that Eat Fish and Piscivorous Birds

K.5.1 Peregrine Falcon

Developing wildlife targets for the two remaining species of concern, bald eagle and peregrine falcon, required further modifications to the approach used above because both eagles and falcons can consume a wide variety of avian prey. Avian prey that is aquatic-dependent, may be omnivorous or piscivorous. Methylmercury biomagnification from the aquatic food web into these prey birds can be a significant source of dietary exposure for eagles and falcons, and must be incorporated into the equations to calculate protective targets. Non aquatic-dependent avian prey is considered as part of "other foods" which USFWS assumed to have insignificant levels of mercury (Section K.3). To include the aquatic-dependent avian prey, Equation 2 must be modified with additional terms, presented below as Equation 7 (equation 7 from USFWS 2004):

$$WV = (\%TL3 \times [Hg]TL3) + (\%TL4 \times [Hg]TL4) + (\%OB \times [Hg]OB) + (\%PB \times [Hg]PB) \quad (7)$$

where,
%OB = percent of omnivorous birds (TL2-consumers) in diet
%PB = percent of piscivorous birds (TL3 fish-consumers) in diet
[Hg]OB = methylmercury concentration in omnivorous bird prey
[Hg]PB = methylmercury concentration in piscivorous bird prey

And:
[Hg]OB = [Hg]TL2 × MOB
[Hg]PB = [Hg]TL2 × FCM3/2× MPB

where,
MOB = biomagnification factor representing biomagnification into omnivorous bird prey
MPB = biomagnification factor representing biomagnification into piscivorous bird prey

Substituting in the new terms and solving for [Hg]TL2:

$$[Hg]TL2 = WV / [(\%TL3 \times FCM3/2) + (\%TL4 \times FCM3/2\times TLR4/3) + (\%OB \times MOB) + (\%PB \times FCM3/2 \times MPB)] \quad (8)$$

FCM3 = 5.7 from the U.S. EPA national BAF (used in USFWS 2003, Cache Creek targets (Central Valley Water Board 2005, USFWS 2004), and the Sacramento-San Joaquin Delta targets (Central Valley Water Board: 2010))
TLR = 1.7 from Cache Creek (USFWS 2004), 3 for the Sacramento-San Joaquin Delta (Central Valley Water Board 2010), 2.1 for California (Appendix L)
MOB = 10 (USFWS 2003)
MPB = 12.5 (USFWS 2003)

For peregrine falcon, the resulting targets in the previously published wildlife target reports were all the same (Table K-3). A value for the food chain multiplier is needed, but a value for the trophic level ratio is not needed, since this species does not eat fish from TL4 (see equation 7). The food chain multiplier used in the USFWS and Central Valley Regional Water Board analyses was the U.S. EPA national food chain multiplier since the habitat of the birds that the falcon preys upon is most likely larger than a single water body (unlike prey fish, which are confined to a water body). This species has a lower risk compared to others since it consumes a fair amount of omnivorous birds.

Calculation of peregrine falcon targets using equation 8 is shown below:

$$[Hg]TL2 = WV / [(\%TL3 \times FCM3/2) + (\%TL4 \times FCM3/2 \times TLR4/3) + (\%OB \times MOB) + (\%PB \times FCM3/2 \times MPB)]$$

A majority (85%) of the diet of the peregrine falcon is "other foods", including terrestrial avian prey (Table K-2), and USFWS assumed terrestrial avian prey to be an insignificant source of mercury (Section K.3) and is, therefore, not included in the equation. The calculation (below) includes the other portion of the peregrine falcon's diet, which is 10% ominous bird and 0.5 % piscivorous birds). Peregrine falcon does not eat from TL3 or TL4, so the equation reduces to:

$[Hg]TL2 = 0.139 \text{ mg/kg} / [(0.10 \times 10) + (0.05 \times 5.7 \times 12.5)]$
$[Hg]TL2 = 0.03047 \text{ mg/kg}$

$[Hg]TL3 = [Hg]TL2 \times FCM3/2$
$[Hg]TL3 = 0.03047 \times 5.7 = 0.1737 =$ **0.17 mg/kg**

$[Hg]TL4 = [Hg]TL3 \times TLR4/3$
$[Hg]TL4 = 0.1737 \times 2.0 = 0.3473 =$ **0.35 mg/kg**

$[Hg]OB = [Hg]TL2 \times MOB$
$[Hg]OB = 0.03047 \times 10 = 0.3047 =$ **0.30 mg/kg**

$[Hg]PB = [Hg]TL2 \times FCM3/2 \times MPB$
$[Hg]PB = 0.03047 \times 5.7 \times 12.5 = 2.171 =$ **2.17 mg/kg**

K.5.2 Bald Eagle

For bald eagle, the USFWS 2004 and Central Valley Regional Water Board analyses used the U.S. EPA national food chain multiplier to translate between TL2 and TL3, and site-specific trophic level ratios to translate from TL3 to TL4, ranging from 1.7 to 3 (the same as used for the osprey analyses). The resulting targets calculated for bald eagle with the different trophic level ratios are shown in Table K-3 along with targets calculated using the statewide trophic level ratio of 2.1 calculated in Appendix L.

An example calculation of bald eagle targets using equation 8 and the statewide trophic level ratio is shown below:

[Hg]TL2 = WV / [(%TL3 × FCM3/2) + (%TL4 × FCM3/2 × TLR4/3) + (%OB × MOB) + (%PB × FCM3/2 × MPB)]

[Hg]TL2 = 0.195 mg/kg / [(0.58 × 5.7) + (0.13 × 5.7 × 2.0) + (0.13 × 10) + (0.05 × 5.7 × 12.5)]
[Hg]TL2 = 0.02021 mg/kg

[Hg]TL3 = [Hg]TL2 × FCM3/2
[Hg]TL3 = 0.02021 × 5.7 = 0.1152 = **0.11 mg/kg**

[Hg]TL4 = [Hg]TL3 × TLR4/3
[Hg]TL4 = 0.1152 × 2.0 = 0.2303 = **0.24 mg/kg**

[Hg]OB = [Hg]TL2 × MOB
[Hg]OB = 0.02021 × 10 = 0.2021 = **0.20 mg/kg**

[Hg]PB = [Hg]TL2 × FCM3/2× MPB
[Hg]PB = 0.02021 × 5.7 ×12.5 = 1.440 =**1.43 mg/kg**

Table K-3. Protective Wildlife Targets (in mg/kg, wet weight) in Various Trophic Levels (TL), Omnivorous Birds (OB) or Piscivorous Birds (PB), and the Most Sensitive Species in Each TL Category (Shaded Gray)

Species	TL2	TL2/3 < 50 mm	TL3 < 150 mm	TL3 150 – 500 mm	TL4 150 – 500 mm	OB	PB
Mink			0.077 [a,b]				
River Otter			0.04 [a] 0.059 [b] 0.067 [g]		0.30 [b] 0.36 [a] 0.27 [g]		
Belted Kingfisher			0.046 [a,b,c]				
Common Merganser				0.085 [a,b] 0.099 [c] (150 – 300 mm)			
Western Grebe				0.084 [a,b,] (150 – 300 mm)			
Double-crested Cormorant			0.094 [a,b]				
Osprey				0.09 [a, d,g] 0.10 [b, c, e]	0.26 [a] 0.17 [b] 0.20 [c, g] 0.19 [d] 0.18 [e]		
Bald Eagle				0.11 [a, g] 0.12 [b, e] 0.09 [d] 0.08 [f]	0.31 [a] 0.20 [b] 0.22 [d] 0.23 [e,] 0.28 [f] 0.24 [g]	0.19 [a] 0.21 [b] 0.20 [g]	1.35 [a] 1.50 [b] 1.29 [d] 1.43 [g]
Peregrine Falcon				(0.17) [a, b, e]		0.30 [a,b,e]	2.17 [a,b,e]
Southern sea otter [FT]	0.028 [f]		0.16 [f]				
California least tern [FE]		0.03 [b]					
California Ridgeway's rail [FE]	0.037 [f]		0.21 [f]				
Light-footed Ridgeway's rail [FE]	0.022 [f]		0.12 [f]				
Yuma Ridgeway's rail [FE]	0.009 [f]		0.050 [f]				
Western snowy plover [FT]	0.104 [f]						
Great blue heron			0.12 [c]				
Forster's tern		0.047 [c]					
Common loon				0.11 [d]			

[a] from Sacramento-San Joaquin Delta targets (Table 4.3, Central Valley Water Board 2010)
[b] from the Cache Creek targets (USFWS 2004, Table 5 and Table 6)
[c] from Guadalupe River Watershed targets (Table 5, USFWS 2005)
[d] from Clear Lake analysis (Table C-3,C-4 Central Valley Water Board 2002).
[e] from Cache Creek targets (Central Valley Water Board 2005)
[f] calculated from information in the USFWS evaluation of the human heath criterion (USFWS 2003)
[g] calculated as part of this report for California, see text above.
[FT/ FE] on federal list of threated or endangered species

K.6 Suggested protective targets

K.6.1 Approach to Determine Targets to Use as Water Quality Objectives

Table K-3 shows protective targets for each species. Multiple values are shown, including values derived for this analysis and values derived from previously published analyses, as indicated in the table. It would be ideal to have only one water quality objective to protect wildlife and human health, as opposed to setting multiple water quality objectives for each fish trophic level and size category shown in Table K-3. One objective would be much easier to implement and monitor. Past monitoring has been directed at TL4 fish to assess common sport fish and the worst case scenario for human consumers. The final recommended human health water quality objective will most likely be applied to TL4 fish 150 – 500 mm, thus the goal was to derive the final wildlife target in terms of the TL4 fish 150 – 500 mm.

A reasonable approach for deriving a target to protect all wildlife species would be to identify the species with the lowest target and use that target to protect all wildlife. However, it is not obvious which species is the most sensitive from Table K-3. The targets in Table K-3 apply to different categories of fish, so they are not directly comparable to one another as they are shown. All targets must be converted to the same trophic level and size of fish for comparison.

In the following section, one final target for TL4 150 – 500 mm fish was derived by first identifying the lowest target (most sensitive species) in each trophic level and size category. These targets are highlighted in gray in Table K-3. Then, estimates of the corresponding TL4 concentration are made using ratios (trophic level ratio or food chain multiplier) or other information. The resulting lowest estimated TL4 concentration should protect all species. The final recommendations are rounded to one significant figure since the mercury water quality objective(s) will be expressed with one significant figure (based on U.S. EPA 2001).

Top predator birds like bald eagle could be most at risk because methylmercury bioaccumulates up the food chain. However, this analysis suggests that some species that feed lower on the food chain such as the terns and rails may need a higher degree of protection because of their small body size and their complete dependence on aquatic prey. No targets are recommended for avian prey species, although Table K-3 includes values for avian species. This is because the USFWS concluded that meeting the appropriate targets in fish tissue would adequately reduce methylmercury levels in the avian prey species that eat fish or invertebrates from these watersheds.

K.6.2 Target for Wildlife That Prey on TL4 Fish, 150 – 500 mm Long

Osprey had the lowest targets in the TL4 category with values ranging from 0.17 to 0.26 mg/kg (Table K-3). For bald eagle, targets were a little higher ranging from 0.20 to 0.31 mg/kg. The osprey targets apply to fish 150 – 350, while bald eagle targets apply to larger fish (150 – 500)

which will have higher methylmercury concentrations. Since bald eagle prey is already categorized as TL4 150 – 500 mm this target does not need converting.

To determine the concentration in 150 – 500 mm TL4 fish that would provide concentrations in 150 – 350 mm TL4 fish to protect osprey, a ratio of methylmercury in fish tissue for TL4 150 – 500 mm to TL4 150 – 350 mm was calculated in Appendix L. The ratio of 1.2 was used to estimate from the concentration in larger TL4 fish to smaller TL4 fish: (0.3 mg/kg)/(1.2) = 0.25 mg/kg. From this estimation it seems that 0.3 mg/kg in TL4 Fish 150 – 500 mm is not clearly protective for osprey, because it may equate to 0.25 mg/kg in TL4 150 – 350 mm, but it is close to achieving the targets for osprey which are 0.20 mg/kg on average. **A target of 0.2 mg/kg TL4 fish 150 – 500 mm (total length) is recommended to protect bald eagle and osprey.**

K.6.3 Target for Wildlife That Prey on TL3 Fish, 150 – 500 mm Long

Common merganser and western grebe have the lowest targets in the TL3 150 – 500 mm category. The targets actually apply to smaller TL3 fish that are 150 – 300 mm (see Table K-3). To protect these species, **TL3 fish between 150 – 300 mm (total length) should have methylmercury concentrations no greater than 0.08 mg/kg, wet weight**.

To relate this concentration in TL3 150 – 300 mm fish back to a methylmercury concentration in TL4 150 – 500 mm fish, a ratio of 2.5 for TL4 150 – 500 mm vs. TL3 150 – 350 mm fish was used (Appendix L). The corresponding TL4 concentration is: 2.5 * 0.08 mg/kg = 0.20 mg/kg. **To maintain 0.08 mg/kg in TL3 150 – 350 mm (total length) fish, mercury concentrations in TL4 fish 150 – 500 mm should not be higher than 0.2 mg/kg.**

K.6.4 Target for Wildlife That Prey on TL3 Fish, Less Than 150 mm Long

The most sensitive wildlife species for the TL3 less than 150 mm category are the river otter with values of 0.04 and 0.06 mg/kg, and 0.05 mg/kg for belted kingfisher (Table K-3). To protect these species, TL3 fish less than 150 mm should have methylmercury concentrations no greater than 0.05 mg/kg, wet weight.

To relate the target concentration in TL3 less than 150 mm fish back to TL4 150 – 500 mm fish, information in the USFWS analysis can be used. The USFWS concluded that **attainment of the 0.08 mg/kg in TL3 150 – 300 mm fish is likely to result in attainment of 0.05 mg/kg target in TL3 less than 150 mm fish** (USFWS 2003)**.** And to achieve 0.08 mg/kg in TL3 fish 150 – 350 mm, as described above, **0.2 mg/kg in TL4** is recommended.

An alternative way to relate the concentration back to TL4 is by using a food chain multiplier. A food chain multiplier can be used because there can be a predatory prey relationship between these two fish classifications (TL3 less than 150 mm and TL4 150 – 500 mm). Three food chain multiplies were found. The USFWS used the U.S. EPA national food chain multiplier of 4 in their 2003 analysis. For Cache Creek, the USFWS recommended a food chain multiplier of 5 for the

relationship between TL4 fish larger than 180 mm and TL2/TL3 fish less than 105 mm. For the Sacramento-San Joaquin Delta a food chain multiplier of 8 was derived for TL3 50 – 150 mm fish to TL4 150 – 350 mm fish. The results using these three food chain multipliers were 0.16, 0.20 and 0.32 mg/kg in TL4 fish. Since there is a fair bit of uncertainty as to which food chain multiplier is more appropriate and the resulting estimates have a fair range, the average is recommended (0.23 mg/kg). (There was not a good data set available to calculate a state wide ratio of fish less than 150 mm and TL4 fish 150 – 500 mm. See Appendix L.) **To achieve the targets in TL3 less than 150 mm (total length), mercury concentrations in TL4 fish 150 – 500 mm should not be higher than 0.2 mg/kg.**

K.6.5 Target for Wildlife that Prey on TL3 Fish, 0 – 500 mm

Yuma Ridgeway's rail has the lowest values in this category of small and large TL3 fish. This size range of TL3 fish can be related back to TL4 fish with the U.S. EPA national food chain multiplier of 4, giving: 0.05 mg/kg x 4 = 0.2 mg/kg in TL4 fish. A food chain multiplier (instead of a trophic level ratio) can be used because there is a predatory-prey relationship between these two fish classifications: Yuma Ridgway's rail prey on crayfish, and bass will eat crayfish. **To maintain 0.05 mg/kg in TL3 fish 0 – 500 mm, mercury concentrations in TL4 fish 150 – 500 mm should not be higher than 0.2 mg/kg.**

K.6.6 Target for Wildlife that Prey on TL3 Fish, Less Than 50 mm

To protect California least tern, fish less than 50 mm (total length) should have methylmercury concentrations no greater than 0.03 mg/kg (Table K-3). This target was the most difficult to relate back to TL4 concentrations, because of a lack of data to derive a ratio. Also maintaining this target is very important because the California least tern is an endangered species. Therefore, for this target is recommended as a separate site-specific water quality objective.

This target is probably not that inconsistent with the other targets, given the trend of decreasing mercury with decreasing fish length and trophic level, and given the decreasing mercury concentrations for the targets for each successive smaller fish size/ trophic level category that are consistent with achieving 0. 2 mg/kg in TL4 fish (0.08 mg/kg in TL3 fish 150 – 300 mm, and 0.05 mg/kg in TL3 fish less than 150 mm).

K.6.7 Target for Wildlife That Prey on TL2 Fish

All of the TL2 targets should be met if the TL3 targets are met. This is because the three lowest TL2 targets (Table K-3) were calculated directly from the TL3 targets by dividing by the national food chain multiplier of 5.7. The corresponding TL3 targets (southern sea otter, California Ridgeway's rail and light-footed Ridgeway's rail) are all higher than the lowest target in the TL3 150 – 500 mm category (0.08 mg/kg). **The TL2 target should be met if the TL3 150 – 500**

mm target is met (0.08 mg/kg)**, which according to rational above, should be met if the TL4 150 – 500 mm target of 0.2 mg/kg is met.**

K.7 Comparison of Suggested Targets to Recent Information

K.7.1 Grebe in California

A further comparison of the wildlife targets was made to Ackerman et al.'s. recent study on mercury concentrations in grebe blood. This study also characterized the relationship between mercury in prey fish and mercury in sport fish. The comparison suggests that the 0.2 mg/kg sport fish target correlates to about 1 mg/kg wet weight in grebe blood (Ackerman et al. 2015a,b). The concentration of 1 mg/kg mercury in blood is the boundary concentration from low risk to moderate risk category in a study of loons (Evers et al. 2004).

Ackerman et al. suggested that the State Water Resources Control Board could consider lowering this target value of 0.2 mg/kg in sport fish to ensure protection of all individual grebes, but did not suggest a specific target (Ackerman et al. 2015a). However, while the 1 mg/kg in blood is associated with some risk, the authors who derived that threshold, Evers et al., did not derive a "no risk" threshold (the "low risk" category was 0 – 1 mg/kg mercury in blood), making the value of 1 mg/kg the lowest threshold (other than 0). Also, the same researchers, Evers et al., used the benchmark that defined the threshold for their "high risk" category of 3 mg/kg mercury in blood as their adverse effects threshold (Evers et al. 2004, pg 56, Evers et al. 2008b). Evers et al. did not assert the 3 ppm threshold or the 1 ppm threshold should be a protective criterion for loon (Evers et al. 2008), although it was clear that a protective criterion should be no higher than 3 ppm in blood.

Ackerman et al. did not derive a threshold for prey fish that would be protective of grebes. But data in Ackerman et al.' report suggests that the concentration of 1 mg/kg in grebe blood correlates to about 0.048 mg/kg in prey fish 10 – 123 mm (weight wet, Ackerman et al. 2015a). This is similar to our recommended target for fish smaller than 150 mm, which is 0.05 mg/kg. For this comparison, mercury on a wet weight basis (HgWw) was calculated from the value 0.2 mg/kg mercury dry weight (HgDw, 1 mg/kg in grebe blood corresponded to 0.2 mg/kg in prey fish dry weight in Figure 5, Ackerman et al. 2015a) using 76% moisture for prey fish (Ackerman et al. 2015a) and the equation:

HgWw = HgDw*(1 - proportion moisture)

K.7.2 Common Loon

Recent studies in the common loon have made them one of the most well studied species in regards to the effects of methylmercury in birds. Common loons are widely distributed geographically and long lived. They feed preferentially on small fish (100–150 mm in size) from lakes within established territories (Depew et al. 2012). Several thresholds for loon are shown in Tables J-1 (Appendix J), which are close to the wildlife targets and are discussed below.

Burgess and Meyer measured mercury concentrations in small fish, blood mercury levels in adult male, female and juvenile common loons, lake pH, and loon productivity from 120 lakes in Wisconsin, USA and New Brunswick and Nova Scotia, Canada (Burgess and Meyer 2008). The fish sampled for the study were small fish (76–127 mm in length) typically consumed as prey by loons (supported by Barr 1996). Quantile regression analysis indicated that maximum observed loon productivity dropped 50% when fish mercury levels were 0.21 mg/kg (wet weight), and failed completely when fish mercury concentrations were 0.41 mg/kg. The authors did not determine a no effect threshold. The target for fish 50 – 150 mm (the same size as loon prey fish) is 0.05 mg/kg, which is four times lower than the threshold from Burgess and Meyer. Given that the threshold was a 50% effect threshold on reproduction, the target may not seem protective enough. However, the authors explain that this threshold is not well suited to deriving regulatory thresholds: "The relationships between measures of loon mercury exposure and reproduction presented in this paper are correlative. Empirical dose–response studies will further define toxicity thresholds" (Burgess and Meyer 2008).

Kenow et al. conducted controlled laboratory studies with common loon chicks (Kenow et al. 2007, 2010). The authors note the importance of controlled laboratory studies since quantifying the impact of contaminant exposure on wild populations is complicated by the confounding effects of other environmental stressors (Kenow 2010). No effects to the chicks behavior were found at 0.08 mg/kg in the diet (Kenow 2007, 2010), which is above the target of 0.05 mg/kg for fish 50 – 150 mm (comparable to loon prey fish).

In another subsequent study on loons, screening benchmarks for use in ecological risk assessment were derived (Depew et al. 2012b). The results from Burgess and Meyer 2008 were incorporated into Depew et al. benchmarks, which were derived from a larger compilation of toxicity data. The lowest screening benchmark derived was 0.1 mg/kg (fish tissue, wet weight) for adult behavioral abnormalities, which was the midpoint of range for adverse adult behavior lowest effect level (0.05 – 0.15 mg/kg). The significant reproductive impairment threshold was 0.18 mg/kg, which included impacts to productivity and hatch success. The third threshold was for reproductive failure: 0.40 mg/kg. All these thresholds are above the target of 0.05 mg/kg for fish 50 – 150 mm (comparable to the size of loon prey fish).

Of the three thresholds derived by Depew et al., the lowest threshold of 0.1 mg/kg (fish tissue, wet weight, Depew et al. 2012) may be the best threshold to compare to the targets. However, the authors noted: "Importantly, the degree to which these adult behavioral changes will affect adult or chick survival in the wild or population dynamics is presently unknown; therefore, the suitability of this benchmark for ecological risk assessment remains limited." On the other hand, the remaining screening benchmarks (0.18 mg/kg and 0.4 mg/kg , wet wt) are proposed to be indicative of significant impairment. They were not meant to be protective criteria. Unfortunately, a no effect level was not derived for survival, growth, or reproduction. As stated above, the target of 0.05 mg/kg for the prey fish (the same size as loon prey on), appears

protective of loon since it is lower than the lowest benchmark of 0.1 mg/kg from the study (Depew et al. 2012).

K.7.3 Ibis

The lowest mercury toxicity threshold for wildlife found in the literature was for white ibis (Table J-1 in Appendix J). White ibis (*Eudocimus albus*) do not have habitat in California, although another species within the same family, the white faced ibis do (*Plegadis chihi*) (Cornell Lab of Ornithology 2016). This threshold was 0.05 mg/kg in the diet which was the LOAEL (Lowest Observed Adverse Effect Level) for effects on breeding behavior, which came from a 3 year experiment. The results of this experiment were described in multiple papers that are summarized here briefly. White ibises were exposed to environmentally relevant dietary methylmercury concentrations (0.05 – 0.3 mg/kg wet weight) over 3 years in captivity. The lowest effect level for a breeding behavior in white ibises was 0.05 mg/kg (wet weight). The effects were increases in male–male pairing behavior and dose-related reductions in key courtship behaviors for female-male paring. Also females exposed to 0.3 mg/kg fledged 34 % fewer young per female than control females, but the difference was not statistically significant (Frederick and Jayasena 2010). There was no effect on survival (Frederick et al. 2011). A specific threshold for toxicity was not suggested. Since the data that would mostly clearly demonstrate a detrimental effect on reproduction (vs. behavior) were not statically significant, this study does not provide a strong value for deriving a water quality objective. The endpoints of survival, growth or reproduction were the focus of USFWS evaluation (USFWS 2003) and the Great Lakes Initiative (U.S. EPA 1995).

Nevertheless, the LOAEL of 0.05 mg/kg for white ibis (based on behavior, Frederick and Jayasena 2010), can be compared to the suggested targets derived in this Appendix. To approximate a no effect level for ibis, the ibis LOAEL of 0.05 mg/kg was divided by 2 (as done in Zhang et al. 2013 and U.S. EPA 1995) resulting in a no effect dietary threshold of 0.025 mg/kg for ibis. Ibis have a mixed diet of TL2 and TL3 organisms (see Section K.10). If the ibis is assumed to eat 40% TL3 fish, equation 2 can be used to estimate the resulting mercury concentration in TL3 prey fish (with U.S. EPA's FCM of 5.7, as shown below). The result is 0.05 mg/kg in fish, which is equivalent to the target of 0.05 mg/kg in prey fish (50 – 150mm). This suggests ibis could eat up to 40% TL3 fish and be protected. This estimate may be conservative since ibis may actually eat more insects and invertebrates and little fish.

$[Hg]TL2 = WV / [(\%TL2) + (\%TL3 \times FCM3/2)$
$[Hg]TL2 = 0.025 \text{ mg/kg} / [(0.6) + (0.4 \times 5.7)]$
$[Hg]TL2 = 0.00868 \text{ mg/kg}$

$[Hg]TL3 = [Hg]TL2 \times FCM3/2$
$[Hg]TL3 = 0.00868 \times 5.7 = 0.04947 =$ **0.05 mg/kg in TL3 fish**

K.8 Recommended Targets for Use as Water Quality Objectives

After reviewing all of the information for each size and trophic level classification, 0.2 mg/kg was the best choice for a target in TL4 fish that is consistent with all the other targets. **Therefore, based on all the information together, 0.2 mg/kg in TL4 150 – 500 mm (total length) fish is recommended as the water quality objective to provide protection for most species.**

It is hardest to judge the relationship between the methylmercury concentration in TL4 fish and the methylmercury concentration in lowest trophic level prey fish (either TL2 fish or TL2/3 fish less than 50 mm). Several of the threatened or endangered species eat in these lower tropic levels. The USFWS has previously recommended a target for fish less than 50 mm (total length) to protect the California least tern, one of the sensitive endangered species. This target of 0.03 mg/kg in fish less than 50 mm has been adopted by the Water Boards as a site-specific objective in San Francisco Bay and the Sacramento-San Joaquin Delta. It is therefore recommended to set a second water quality objective for fish less than 50 mm to ensure the protection of this species. Since the California least tern lives only in select geographical areas (Figure K-1) this objective could be applied only to the water bodies in which this species feeds. Generally, California least tern inhabit San Francisco Bay down along the coast to the California border with Mexico. **The objective of 0.03 mg/kg (in fish less than 50 mm) should apply to specific water bodies listed in Section K.11, Table K-5**. The geographic areas where the California least tern live are also inhabited by other endangered species: the California Ridgeway's rail and light-footed Ridgeway's rail. This target would offer these species added protection as well. The California Ridgeway's rail is believed to be adversely affected, at least in part due to methylmercury (Schwarzbach et al. 2006).

Further analysis indicated a third water quality objective is needed to ensure protection of all wildlife. California has warm waters that support species of black bass and cold waters that are trout dominated, generally speaking (see Figure K-3). Bass are a TL4 species that accumulates higher concentrations of mercury than trout[21], which are mostly TL3 species. In waters that lack TL4 fish, the objective of 0.2 mg/kg would be applied to the TL3 fish. In these waters TL3 fish are the top of the food web in that water body, so this is protective of species that eat from the top of the food web (humans and some wildlife species such as eagles), but ultimately the application of the objective is less stringent, since TL3 accumulate less mercury. Therefore, this situation needs to be carefully considered to ensure protection of all wildlife.

Examples of water bodies that have no TL4 fish species include trout dominated waters of the Sierra Nevada Mountains and the northern most parts of California (Figure K-3). Also, the Salton Sea does not support TL4 species because of the high salinity. Tilapia, which is a TL3 fish, is the dominant species in the Salton Sea.

[21] Although, the USFWS analyses categorized trout as TL4 fish in the bald eagle diet (USFWS 2003, USFWS 2004, USFWS 2005). Either way, the objective is protective of bald eagle, because bald eagle are protected by 0.2 mg/kg in the overall diet.

Applying the objective of 0.2 mg/kg to TL3 fish in waters where TL4 fish are absent cannot ensure protection for some wildlife. This because the mercury level in TL3 fish (0.2 mg/kg) would exceed the targets for merganser, grebe and belted king fisher and osprey in TL3 fish (0.05 – 0.1 mg/kg). Merganser, grebe and belted king fisher and osprey have habitat that overlaps with trout dominated waters, which lack TL4 fish (see maps in Section K.13, especially Figure K-4). Additionally, some trout are recently planted hatchery fish, which are poor indicators of the water quality and the resulting methylmercury concentrations in lower trophic level resident fish.

The recommended solution to address waters that lack TL4 fish is to establish an additional objective based on the targets in Table K-3. For example, an objective could be established of 0.08 mg/kg in fish 150 – 300 mm to protect grebe and merganser based on the targets in Table K-3. Alternatively, since belted kingfisher are more ubiquitous, **an objective could be established of 0.05 mg/kg in TL3 fish 50 – 150 mm based on the targets (Table K-3) for kingfisher.** This objective should be consistent with achieving 0.08 mg/kg in 150 – 300 mm TL3 fish (see Section K.6). Narrowing the size range from 0 – 150 mm to 50 – 150 mm will distinguish this objective from the California Least Tern Prey Fish Objective, which applies to fish 0 – 50 mm long. The more narrow size range is also more protective, since larger fish have higher mercury concentration.

This objective could be applied *only* to waters that lack TL4 fish, to save monitoring resources. Alternatively, if the objective is applied statewide, in order to save monitoring resources, monitoring could be prioritized for waters that lack TL4 fish, especially those with fish from hatcheries. Also, where data on sport fish (either TL3 or TL4) indicates that a water body is impaired, monitoring prey fish would be unnecessary to show that the water body is indeed impaired. However, data from prey fish would be needed to show that the water body is no longer impaired. Also where prey fish less than 50 mm long are monitored, it would be unnecessary to also monitor prey fish that are 50 – 150 mm long.

Another endangered species that appears to be more sensitive to methylmercury is the Yuma Ridgeway's Rail, which inhabits the Salton Sea, and the Colorado River according to the USFWS draft recovery plan (USFWS 2009, see also Figure K-1). There are no TL4 fish in the Salton Sea and so the objective of 0.2 mg/kg would be applied to TL3 fish which is less stringent. Therefore, a **second objective should also be applied to the Salton Sea and the Colorado River to ensure protection for the Yuma Ridgeway's rail.** This could be accomplished one of several ways: 1) if the objective of 0.05 in fish 50 – 150 mm is adopted statewide (recommended); 2) propose the objective of 0.03 in fish less than 50 mm apply to the Salton Sea and Colorado River; 3) propose an objective of 0.04 mg/kg in crayfish, which is the prey for Yuma Ridgeway's rail (Table K-2 and text in Section K.2).

Regional Water Boards may adopt site-specific objectives for mercury and may modify the application of the objective of 0.2 mg/kg in TL4 fish based on site-specific human consumption

pattern. If the Regional Water Board does this, the Regional Water Board must also ensure protection for wildlife species. If a Regional Water Board is considering a site-specific objective or is concerned for sensitive wildlife and there are no TL4 fish species, monitoring of the target of 0.05 mg/kg in TL3 fish 50 – 150 mm could be used to ensure wildlife are protected. If the species of concern is the California least tern, then the target of 0.03 mg/kg in fish less than 50 mm should be used instead. Other targets or objectives may be developed for the particular species that feed in the affected water body.

The final objective for TL4 fish should be applied to the fillet to protect human health because most humans eat the fillet of TL4 fish. Also, monitoring programs typically measure mercury in the fillet. Mercury concentrations are slightly higher in the fillet than in the whole fish, so this provides some extra protection for wildlife and humans who eat the whole fish. On the other hand, it is recommended that the two objectives for prey fish (the objective for TL2/3 fish less than 50 mm and the objective for TL3 fish less than 150 mm) be applied to whole fish, since this objective is meant to protect wildlife only, which will likely consume the fish whole.

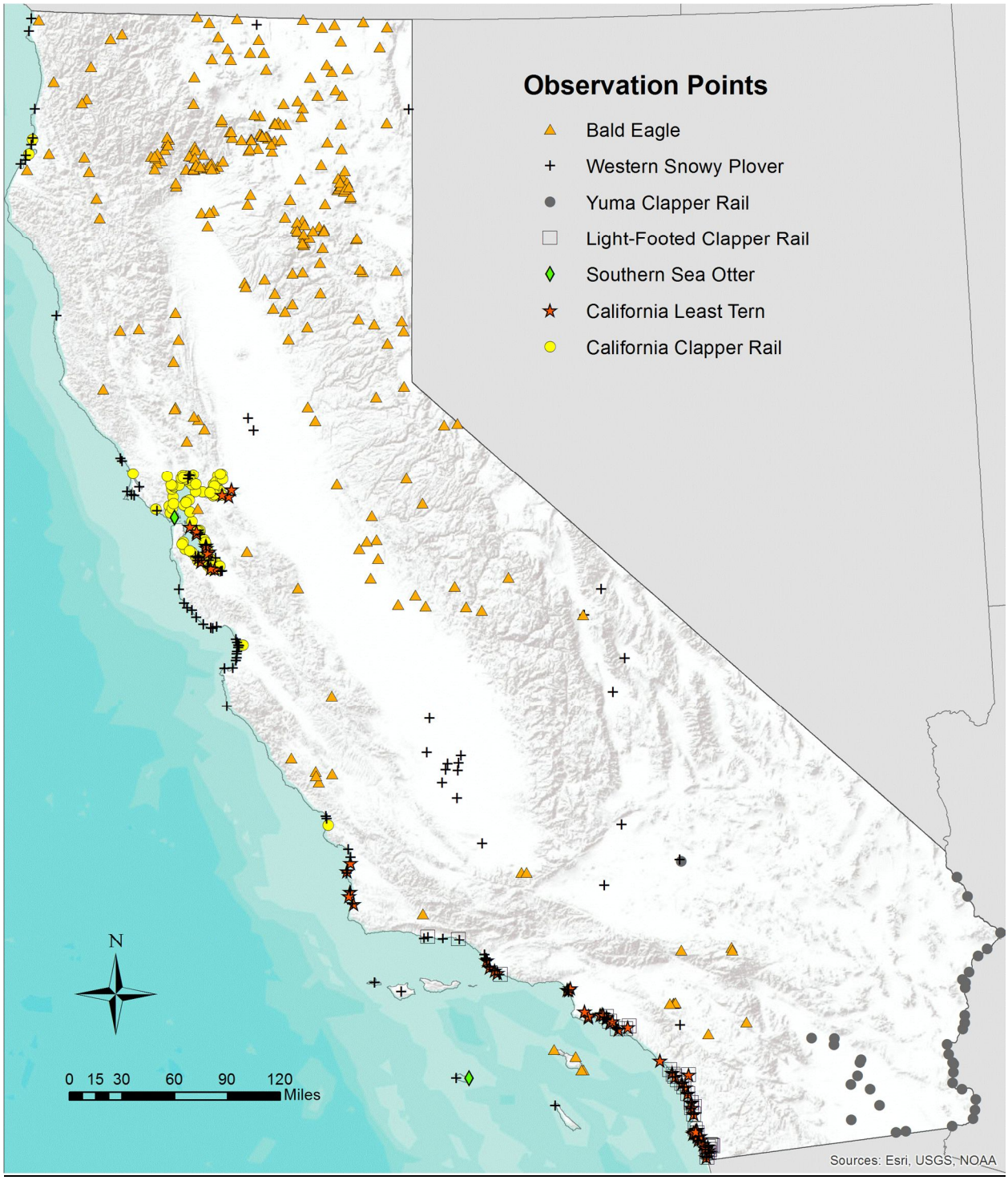


Figure K-1. Observation locations of threatened or endangered species included in this analysis and bald eagle (recently delisted).

The recommended objective for TL4 fish is shown in Table K-4 in comparison to other site-specific objectives that have been adopted by California Water Boards.

Table K-4. Comparison of Adopted Site-specific TL4 Water Quality Objectives to the Sport Fish Water Quality Objective

Geographic Area	Objective	Applicable TL4 Fish Size (mm)	Other Water Quality Objectives?	Wildlife Equally or More Sensitive Than Human Health (Human Fish Consumption Rate Used)?
Clear Lake (Central Valley Water Board 2002)	0.19	300 – 400	TL3 (no size specified)	Yes (17.5 g/day)
San Francisco Bay (San Francisco Bay Water Board 2006)	0.2	Varies by species 250 – 1350	Fish < 50 mm	No (32 g/day), only California least tern
Cache Creek (Central Valley Water Board 2005)	0.23	250 – 350	TL3 fish 250 – 350 mm	Yes (17.5 g/day)
Sacramento-San Joaquin Delta (Central Valley Water Board 2010)	0.24	150 – 500	TL3 fish 150 – 500 mm, and fish < 50 mm	No (32 g/day), only California least tern
Provisions	0.2	200 – 500	Fish < 50 mm, and TL 3 fish 50 - 150 mm	Wildlife targets require similar stringency as used for recreational fishing (32 g/day) in warm waters with black bass. However, measuring mercury in TL4 fish may not ensure objectives are met in TL3 and TL2 fish, especially in trout dominated waters (see text in Section K.8).

K.9 Limitations and Sources of Uncertainty in this Analysis

K.9.1 General Points of Uncertainty

This section reviews some of the assumptions and sources of uncertainty in these calculations. This section is broken down into two parts 1) factors that seem to suggest these calculations are conservative, and 2) factors that suggested these calculations may not be conservative enough. A few points of uncertainly that were not obviously in either category are discussed first.

The food chain multipliers (FCMs) and trophic level ratios (TLRs) are estimates that add to the uncertainty in these calculations. Some are site-specific while some were derived from national data. These values may not accurately represent all of California's waters, but a more accurate alternative is not available. More specially, FCMs could not be calculated, since sufficient data were not available for fish < 150 mm or TL2 organisms. California's statewide monitoring program has collected a great deal of data on large TL4 and TL3 fish, but much less data on fish <150 mm or TL2 organisms. While there was a large data set for large TL4 and TL3 fish, the data that could be used to derive the TLRs provided poor geographic representation of the California (see Appendix L). Since the TLRs were limited and a California FCM was not possible to calculate, values form various California projects, as well as targets derived from national values are all included in Table K-3 to provide and idea of the uncertainly in these values. However, this will not capture all of the uncertainly. If minimum and maximum values for the FMCs and TLRs were used the variation in the targets would be larger. The actual amount of mercury in fish in various waters will vary by the food web in a particular water body and other waterbody specific factors. The variation in mercury concentrations in prey fish vs. sport fish in a particular water body is exemplified in the recent USGS grebe study (Ackerman et al. 2015, Figure 5, see also Section K.7.1). Only average FCM and TLR values were used in this analysis to provide estimates for the whole state. These estimates may be either over protective or under protective for a particular water body

There are a couple of points of uncertainty associate with each wildlife value. These include the lack of long term studies for mammals, lack of a no adverse effect level for birds, and extrapolation from one species to another. More specifically, all avian wildlife values are based on one study by Heinz et al. (1979) in mallard ducks. Since then, no appropriate type of controlled dose-response study has been done on more relevant wildlife species. An uncertainty factor of three was used to derive a concentration that should cause no adverse effects in ducks, because the methylmercury concentration used in the study caused adverse effects in the ducks (a decrease in ducklings, compared to control). It is very difficult to determine how accurately the resulting wildlife values represent the wildlife species of concern.

Some conservative estimates were used by the USFWS to derive the diet for each species, but these diet estimates were revised in subsequent analyses. For example, California supports wintering and resident bald eagles with a variety of suitable foraging habitat. Because of this variation in habitat, eagle diets likely span a wide range of possible food types and trophic level combinations. To account for this variation, the USFWS used a conservative approach to establish a diet based on the highest trophic level

compositions that were reasonably likely to occur (USFWS 2003). Subsequent analyses, though, revised the proportion of TL4 fish in the diet, reducing it to 13% of the diet. However, Jackman et al. observed that 55% of the prey that bald eagles brought back to their nests was bass at Shasta Lake (Jackman et al. 2007). The estimated diets may be non-conservative for some areas, such as Shasta Lake, or the estimated diets may be conservative for other areas.

The lack of available data precludes evaluating exposure to insectivorous wildlife that consume the terrestrial stages of aquatic insects and may be exposed to relatively high concentrations of methylmercury. High concentrations of methylmercury (1.66 ppm) have been measured in the blood of riparian song sparrows downstream of New Almaden, the site of a large mercury mine (Robinson et al. 2011, Section K.10.2). These concentrations were similar to those that were associated with a 25% to 30% reduction in nest success of Carolina Wrens along two mercury-contaminated rivers in Virginia (Jackson et al. 2011). Additional studies will be required to determine the relationship between mercury concentrations in prey fish and sport fish and those of aquatic insects that inhabit the same water bodies.

K.9.2 Points of Uncertainty That Suggest a Less Stringent Objective

Wildlife likely consume whole fish, while many humans often only eat the fillet of the fish. The mercury concentration in the fillet is higher than in the whole fish. Therefore, wildlife targets applied to fillet will a have some level of extra protection. The mercury concentration in the fillet can be converted to the mercury concentration in the whole-body with the formula (Peterson et al. 2007):

$$[\log(\text{fillet biopsy Hg}) = 0.2545 + 1.0623 \log(\text{whole-fish Hg})]$$

If the fillet has 0.3 mg/kg mercury then the corresponding whole fish concentration will be 0.185 mg/kg mercury. It is not recommended that this conversion be applied to the targets since the final objective will be applied to the fillet. It will then be difficult to ensure that targets in whole fish will be achieved. Doing so will add additional layers of uncertainty. In general, this information suggests that the water quality objective for TL 4 fish should be conservative for wildlife. Although, for the two prey fish objectives (fish less than 50 mm and TL3 fish 50 – 150 mm), the objective is recommended for whole fish, since these are only meant for wildlife.

The osprey seems to be a more sensitive species from this analysis and from the results of the Heinz et al. comparative study (Heinz et al. 2009). However, no adverse effects on reproduction in osprey have been observed near Clear Lake, California, which has highly elevated fish methylmercury concentrations from mercury mining (Cahill et al. 1998, Anderson et al. 2008). These results suggest that the targets in this analysis may be conservative because the targets are much lower than the concentrations observed in these studies.

K.9.3 Points of Uncertainty That Suggest a More Stringent Objective

Studies in grebe, loon and ibis contain some suggestions that toxic effect could occur near the mercury water quality objectives. However, evidence was not found that clearly indicated a lower water quality objective is needed. These studies are discussed in detail in Section K.7.

The wildlife values for all avian species were based on a reference dose for mallard ducks. Heinz et al. investigated the relative toxicity to methylmercury using 23 avian species to determine if other species are more or less sensitive than mallard ducks. They found that mallards were one of the least sensitive species, which indicates that the wildlife values calculated here are likely non-conservative. However, it is very difficult to determine more appropriate wildlife values at this time with the available information. The most sensitive of the species in the study were American kestrel (*Falco sparverius*), osprey (*Pandion haliaetus*), white ibis (*Eudocimus albus*), snowy egret (*Egretta thula*), and tri-colored heron (*Egretta tricolor*). The least sensitive species were mallards (*Anas platyrhynchos*), hooded merganser (*Lophodytes cucullatus*), lesser scaup (*Aythya affinis*), Canada goose (*Branta canadensis*), double-crested cormorant (*Phalacrocorax auritus*), and laughing gull (*Leucophaeus atricilla*). Species categorized as having medium sensitivity were the Ridgeway's rail (*Rallus longirostris*), sandhill crane (*Grus canadensis*), ring-necked pheasant (*Phasianus colchicus*), chicken (*Gallus gallus*), common grackle (*Quiscalus quiscula*), tree swallow (*Tachycineta bicolor*), herring gull (*Larus argentatus*), common tern (*Sterna hirundo*), royal tern (*Sterna maxima*), Caspian tern (*Sterna caspia*), great egret (*Ardea alba*), brown pelican (*Pelecanus occidentalis*), and anhinga (*Anhinga anhinga,* Heinz et al. 2009).

The USFWS also considered another reference dose (used to calculated wildlife values) that was three times lower; 0.007 mg/kg/day for California Ridgeway's rail, light-footed Ridgeway's rail, Yuma Ridgeway's rail and western snowy plover (USFWS 2003). This reference dose was calculated with an additional uncertainty factor to account for greater susceptibility of rail as indicated by egg injection studies, which were not final at the time of writing the USFWS analysis (USFWS 2003). The results of the egg injection studies were later published as Heinz et al. 2009. Since then, there has been no additional information on the sensitivity of rails. USFWS did not use this information to unequivocally recommend the lower reference dose for rails (0.007 mg/kg/day vs. 0.021 mg/kg/day). USFWS stated "The diet-to-egg transfer efficiency can vary widely between different species, as evidenced by the controlled feeding studies with mallards (Heinz, 1979) and pheasants (Fimreite, 1971). It would be imprudent to assume that similar sensitivities to egg concentrations between the clapper rail and the pheasant would necessarily be caused by the same dietary concentration" (see p 20 – 21of USFWS 2003). A non-conservative choice was made not to include this information in the calculations because there was little other evidence to support that rails have a significantly higher risk in the environment. Rails exposure to mercury is generally low since they eat food lower on the food chain, which puts them at lower risk of mercury toxicity.

A couple subsequent studies tried to gather more information on rails, but these two studies do not suggest a threshold for effects. On one study, the body condition of California clapper rails

was negatively related to mercury concentrations within tidal marsh habitats of San Francisco Bay, California. Model averaged estimates indicated a potential decrease in body mass of 20 – 22 g (5 – 7%) over the observed range of mercury concentrations (Ackerman et al. 2012).

Later in another study in the same area, total mercury was measured in six macroinvertebrates and one fish species, representing Clapper Rail diets. The average mercury concentrations in all species was above 0.05 mg/kg (roughly 0.05 – 0.1 mg/kg wet weight for all except the eastern mudsnail, Casazza et al. 2014). Mercury concentrations in the eastern mudsnail were about 4 times higher than the other species: Baltic clam, soft-shell clam, ragworm, ribbed horse mussel, mud crab, staghorn sculpin. These organisms are TL2 and TL3. The sculpin were the only finfish included and they were 30 – 60 mm long, so the most comparable mercury water quality objective is 0.03 mg/kg in fish less than 50 mm long. This water quality objective (0.30 mg/kg in fish < 50 mm) has already been adopted as site-specific objective in San Francisco Bay. San Francisco Bay is known to be heavily impacted by mercury and is listed as impaired due to mercury. Therefore, the fact that Ackerman et al. 2012 found a small effect on body condition is not in conflict with the mercury water quality objectives. This information is not detailed enough to suggest whether or not a lower threshold is needed to protect rails.

If birds migrate or have a large feeding range, that behavior could make them less vulnerable to mercury hot spots. However, some species, including rails which are a sensitive species, are year round residents. More importantly, the exposure during breeding or nesting season may be the most significant, and movement during those times tends to be limited. Ackerman et al. noted grebes become flightless after they arrive at their summer locations. They lose feathers and wings atrophy (Ackerman et al. 2015). Terns, avocets and stilts were found to stay relatively close to their capture site in San Francisco Bay and mercury concentrations in the blood of the birds varied by location, showing that mercury hotspots can have an impact on locally breeding birds (Ackerman et al. 2007, Ackerman et al. 2008). Additionally, the assumption that “other foods” (see Section K.3) have no mercury is a non-conservative assumption.

A final point of uncertainty that is very difficult to incorporate is the combined effect of methylmercury with other contaminants and habitat loss. For example Heniz and Hoffman (1998) found that the combined treatment with selenium and methylmercury reduced survival of ducklings and produced more embryo deformities than in either treatment alone. Many areas of California also have high levels of selenium.

K.10 Other species Considered, but for Which Wildlife Values and Targets were not Calculated

K.10.1 California Brown Pelican

The California Brown Pelican was delisted from state and federal endangered status in 2009. The brown pelican feeds in the open ocean off the southern California coast, but also in the Salton Sea. Contamination of food supply by DDT and other chlorinated hydrocarbons reduced

nesting productivity in California nearly to zero in 1969-71, from eggshell thinning and altered parental behavior. Since then, contamination has been reduced and productivity has increased (CDFW 1990). A separate analysis for the brown pelican is not included because most areas the pelicans inhabit are outside the geographic scope of the Provisions, except the Salton Sea. Also, pelicans should be protected by the targets for osprey. Brown pelicans primarily consume fish (vs. other types of food) and in this analysis osprey were considered to eat 100% fish. The brown pelican is probably less sensitive than ospreys based on the equations provided by the USFWS (equation 1) because brown pelicans are larger (2.75 – 5.5 kg) than ospreys (1.75 kg), although pelicans could eat more TL4 fish which would have higher mercury levels.

K.10.2 Sparrows

A recent study of riparian songbirds (song sparrows) in streams in the San Francisco Bay area found blood mercury concentrations high enough to cause reduced reproductive success (Robinson et al., 2011). Blood methylmercury concentrations were highest (1.66 ppm) downstream of New Almaden. These birds are insectivorous, not piscivorous. Song Sparrows are very small, smaller than the California least tern. Song sparrows weigh about 32 g, which according to equation 1, would make songs sparrows a more sensitive species to methylmercury toxicity. To drive a protective wildlife value for this species, a food intake rate would need to be calculated. Forster's terns were also captured in a site downstream of the New Almaden mining district. These terns had slightly higher blood mercury concentrations (averaging 2 ppm), than the sparrows (Ackerman et al. 2008). This comparison would suggest that an objective that protects Forster's tern should also protect the sparrows.

K.10.3 Marbled Murrelet

The marbled murrelet is listed by the USFWS as threatened. It is a coastal species, similar to the California least tern, but the marbled murrelet inhabits the northern California coast instead of the southern California coast. The USFWS did not have sufficient information about this species when writing their Biological Opinion to develop a suggested criterion, but stated that the criteria for the California least tern would be applicable for protection of the marbled murrelet. This species was not included in the USFWS's later evaluation (USFWS 2003). The marbled murrelet feeds in the open ocean, which is beyond the geographic scope of this objective. It feeds closer to shore during breading season, in water less than 95 ft. deep and it nests inland (CDFW 1990).

K.10.4 Ibis

White Ibis were one of the most sensitive species reported by Heinz et al. 2009 and a wildlife value for this species was lacking for this analysis. White ibis (*Eudocimus albus*) do not inhabit California (Cornell Lab of Ornithology 2016), while the white-faced Ibis (*Plegadis chihi*) do inhabit California (CDFW 1990). The white-faced ibis was a California Species of Special Concern, but is no longer on the list (Shuford and Gardali, 2008). The white-faced ibis eats

earthworms, insects, crustaceans, amphibians, small fishes, and miscellaneous invertebrates (CDFW 1990). Other authorities on ibis report that white faced ibis eats mainly insects (Cornell Lab of Ornithology 2016). A threshold for ibis was the lowest found in the literature compared to thresholds found for other species (Table J-1 in Appendix J), which is discussed in Section K.7.

K.11 Locations where the Objective to Protect the California Least Tern Should be Applied

A list of water bodies where the objective of 0.03 mg/kg in fish less than 50 mm should apply is given in Table K-5, which is based on management areas defined by the USFWS (USFWS 2006). Additionally, this objective may be applied to a few other waters as described in Section K.8 to ensure protection for the Yuma Ridgeway's rail, unless another objective is adopted to protect the Yuma Ridgeway's rail (e.g. 0.05 mg/kg in fish 50 – 150mm). Other waters should be added by the appropriate Regional Water Boards based on local knowledge or as information becomes available. The applicable water bodies include only inland surface waters, enclosed bays, and estuaries. The open ocean is not part of the geographic scope of the Provisions.

Since 1970, California least tern nesting sites have been recorded from San Francisco Bay to Baja California. The nesting range in California has always been widely discontinuous, with the majority of birds nesting in southern California, from Santa Barbara County down through San Diego County. On the other hand, between the city of Santa Barbara and Monterey Bay, there are few known regularly used breeding sites (USFWS 1985).

The California least tern obtains most of its food from shallow estuaries and lagoons, and nearshore ocean waters. Feeding activity at the few sites that have been studied occurs mostly within 3.2 km (2 miles) of breeding colonies, and at many sites foraging is primarily in nearshore ocean waters less than 18.3 m (60 feet) deep. Colonies located near productive estuarine habitats appear to utilize such areas heavily, but data regarding the relative value of estuaries to feeding least terns are scarce. The increased use of freshwater marsh systems, lakes, lagoons, and estuarine areas during post-breeding dispersal suggests the special importance of such habitats during the breeding cycle, when juveniles are learning to fish for themselves (USFWS 1985).

Table K-5. Waters for the Least Tern Prey Fish Water Quality Objective and the Corresponding Regional Water Board

RB	Mgt.[1] Area	County	USFWS Site Name	Applicable inland surface water, enclosed bay[2] or estuary[3]	RARE Designation In Regional Water Quality Control Plan (Basin Plan)?
2	A	Alameda	Alameda Naval Air Station	An objective that is protective of the California Least tern has already been adopted for Lower San Francisco Bay	Yes: San Francisco Bay Region
		Alameda	Alvarado Salt Ponds		
		Alameda	Oakland Airport		
		San Mateo	Bair Island	Bair Island Marsh	Yes: San Francisco Bay Region
3	B	San Luis Obispo	Pismo Beach	Pismo Creek Estuary, Pismo Creek, Arroyo Grande Estuary, Arroyo Grande Creek, downstream (Oceano Lagoon, Meadow Creek, Pismo Marsh (Lake), Los Berros Creek), Big Pocket Lakes (Dune Lakes)	Yes: Central Coast Region
		San Luis Obispo	Oso Flaco Lake	Oso Flaco Lake, Oso Flaco Creek	Yes: Central Coast Region
3	C	Santa Barbara	Santa Maria River	Santa Maria Estuary, Santa Maria River (except Corralitos Canyon Creek, Sisquoc River, downstream), Orcutt Creek	Yes: Central Coast Region
3	D	Santa Barbara	San Antonio Creek	San Antonio Creek, San Antonio Creek Estuary	Yes: Central Coast Region
		Santa Barbara	Purisima Point (North, South)	None – (coast/open ocean)	Yes: Central Coast Region
		Santa Barbara	Santa Ynez River	Santa Ynez River Estuary, Santa Ynez River, downstream	Yes: Central Coast Region
4	E	Ventura	Santa Clara River	Santa Clara River Estuary, Santa Clara River Reach 1	Yes: Los Angeles Region
4	F	Ventura	Ormond Beach	Ormond Beach Wetlands	Yes: Los Angeles Region
		Ventura	Mugu Lagoon	Calleguags Creek Reach 1 (also called Mugu Lagoon)	Yes: Los Angeles Region
4	G	Los Angeles	Venice Beach	Ballona lagoon, Marina Del Rey (except Harbor),	Yes: Los Angeles Region
		Los Angeles	Playa del Rey	Ballona Wetlands, Ballona Creek Estuary	Yes: Los Angeles Region
4	H	Los Angeles	Terminal Island	Los Angeles/Long Beach Inner Harbor, Los Angeles/Long Beach Outer Harbor	Yes: Los Angeles Region
		Los Angeles	San Gabriel River	Alamitos Bay: Los Cerritos Wetlands, San Gabriel Estuary, Los Cerritos Channel Estuary, Long Beach Marina	Yes: Los Angeles Region
4	I	Los Angeles	Cerritos Lagoon		
		Los Angeles	Costa Del Sol		

Table K-5. Waters for the Least Tern Prey Fish Water Quality Objective and the Corresponding Regional Water Board

RB	Mgt.[1] Area	County	USFWS Site Name	Applicable inland surface water, enclosed bay[2] or estuary[3]	RARE Designation In Regional Water Quality Control Plan (Basin Plan)?
8	J	Orange	Anaheim Bay	Anaheim Bay	Yes: Santa Anna Region
		Orange	Surfside Beach	Anaheim Bay	Yes: Santa Anna Region
8	K	Orange	Bolsa Chica (North, South)	Bolsa Bay, Bolsa Chica Ecological Reserve	Yes: Santa Anna Region
8	L	Orange	Huntington Beach	Santa Ana River Salt Marsh, Tidal Prism of Santa Ana River (to within 1000' of Victoria Street) and Newport Slough	Yes: Santa Anna Region
8	M	Orange	Upper Newport Bay	Upper Newport Bay	Yes: Santa Anna Region
9	N	San Diego	San Mateo Creek	San Mateo Creek Mouth	Yes: San Diego Region
		San Diego	Aliso Creek	Aliso Canyon (in San Onofre Creek Watershed. Not in Orange County)	Yes: San Diego Region
		San Diego	Santa Margarita River	Santa Margarita Lagoon	Yes: San Diego Region
9	O	San Diego	Buena Vista Lagoon	Buena Vista Creek	Yes: San Diego Region
9	P	San Diego	Agua Hedionda Lagoon	Agua Hedionda Lagoon	Yes: San Diego Region
9	Q	San Diego	Batiquitos Lagoon	Batiquitos Lagoon	Yes: San Diego Region
9	R	San Diego	San Elijo Lagoon	San Elijo Lagoon	Yes: San Diego Region
9	S	San Diego	San Dieguito Lagoon	San Dieguito Lagoon	Yes: San Diego Region
		San Diego	Whispering Palms Encinitas	None[4]	None: San Diego Region
9	T	San Diego	Los Penasquitos Lagoon	Los Penasquitos Lagoon	Yes: San Diego Region
9	U	San Diego	FAA Island	Mission Bay	Yes: San Diego Region
		San Diego	North Fiesta Island	Mission Bay	Yes: San Diego Region
		San Diego	Stony Point	Mission Bay	Yes: San Diego Region
		San Diego	South Sea World Drive	Mission Bay	Yes: San Diego Region
		San Diego	Clover Leaf	Mission Bay	Yes: San Diego Region

Table K-5. Waters for the Least Tern Prey Fish Water Quality Objective and the Corresponding Regional Water Board

RB	Mgt.[1] Area	County	USFWS Site Name	Applicable inland surface water, enclosed bay[2] or estuary[3]	RARE Designation In Regional Water Quality Control Plan (Basin Plan)?
9	V	San Diego	Naval Training Center	San Diego Bay	Yes: San Diego Region
		San Diego	San Diego Int. Airport	San Diego Bay	Yes: San Diego Region
		San Diego	Chula Vista Wildlife Reserve	San Diego Bay	Yes: San Diego Region
		San Diego	Sweetwater River	Sweetwater River, Hydrologic Unit Basin Number 9.21	Yes: San Diego Region
		San Diego	North Island	San Diego Bay	Yes: San Diego Region
		San Diego	Delta Beach	San Diego Bay	Yes: San Diego Region
		San Diego	Coronado Cays	San Diego Bay	Yes: San Diego Region
		San Diego	Saltworks	San Diego Bay	Yes: San Diego Region
9	W	San Diego	Tijuana River Mouth	Tijuana River Estuary	Yes: San Diego Region

[1]Based on the Californian least tern coastal management areas and sites from the USFWS (USFWS 2006).

[2]"Enclosed Bays" means indentations along the coast that enclose an area of oceanic water within distinct headlands or harbor works. Enclosed bays include all bays where the narrowest distance between the headlands or outermost harbor works is less than 75 percent of the greatest dimension of the enclosed portion of the bay. Enclosed bays include, but are not limited to, Humboldt Bay, Bodega Harbor, Tomales Bay, Drake's Estero, San Francisco Bay, Morro Bay, Los Angeles-Long Beach Harbor, Upper and Lower Newport Bay, Mission Bay, and San Diego Bay. Enclosed bays do not include inland surface waters or ocean waters (State Water Board 2005).

[3]"Estuaries" means waters, including coastal lagoons, located at the mouths of streams that serve as areas of mixing for fresh and ocean waters. Coastal lagoons and mouths of streams that are temporarily separated from the ocean by sandbars shall be considered estuaries. Estuarine waters shall be considered to extend from a bay or the open ocean to a point upstream where there is no significant mixing of fresh water and seawater. Estuarine waters included, but are not limited to, the Sacramento-San Joaquin Delta, as defined in Water Code Section 12220, Suisun Bay, Carquinez Strait downstream to the Carquinez Bridge, and appropriate areas of the Smith, Mad, Eel, Noyo, Russian, Klamath, San Diego, and Otay rivers. Estuaries do not include inland surface waters or ocean waters (State Water Board 2005).

[4]In the USFWS list of management areas (USFWS 2006) Whispering Palms, San Diego Country, is labelled with an asterisk rather than identified as a numbered management area since it only had nesting one year and the location was developed by the following season. Therefore it is no longer a suitable site. A single least tern's nest was found on the site in 1979 on the levees of the old County sanitation ponds off of Via de la Valle. Prior to the 1980 season, the site was bulldozed and developed into the Whispering Palms Golf Course.

K.12 Considerations for Monitoring and Assessment

For monitoring and assessment of prey of the Californian Least tern, there is a long list of water bodies to which the objective should apply (Table K-5). However, certain sites could be prioritized for monitoring to save resources. The 2012 annual monitoring report reported that 74% of the breeding pairs were found at six locations: Naval Base Coronado, Point Mugu, Batiquitos Lagoon Ecological Reserve, Camp Pendleton, Huntington State Beach, and Alameda Point (Frost 2013).

The tern feeds primarily in shallow estuaries or lagoons where small fish are abundant. The tern hovers, and then plunges for fish near the surface, without submerging completely. Therefore, the relevant monitoring species are any that swim near the surface, not bottom dwelling fish. Prey in California includes anchovy (Engraulis sp.), silversides (Atherinops sp.) and shiner surfperch (*Cymatogaster aggregata*). Considerable feeding also takes place near shore in the open ocean, especially where lagoons are nearby, or at mouths of bays (CDFG 1990).

Fish tissue monitoring studies have found that fish mercury concentrations can vary by season and also suggests spring is the best time for monitoring. Eagles-Smith and Ackerman measured mercury in small fish, which are typical prey for Forester's tern in the San Francisco Bay Estuary (Eagles-Smith and Ackerman 2009). Fish mercury concentrations varied substantially over time, increasing 40% in spring (March – May) then decreasing 40% in early summer (May – July). This peak in mercury concentrations coincides with breeding. The increase in mercury concentrations may be due to seasonal changes in water quality that affect methylmercury production or changes in food web dynamics.

Fish tissue monitoring should be done during the breading season because impacts of mercury on reproduction have been frequently observed (Scheuhammer et al. 2007). The California least tern nesting season extends from approximately mid-April into early August, with the majority of nests completed by mid-June. Incubation usually lasts from 20 to 25 days. Flight stage is reached at approximately 20 days of age, but the young birds do not become fully proficient fishers until after they migrate from the breeding grounds. A second wave of nesting occurs from mid-June to early August. These are mainly re-nests after initial failures and second year birds nesting for the first time. Most authorities agree that least terns are capable of successfully raising only one brood per pair in a season (USFWS 1985).

Ackerman et al. found that the risk of mercury toxicity for waters birds is highest at hatching and fledging (Ackerman et al. 2011). Researchers examined total mercury and methyl-mercury concentrations in blood, liver, kidney, muscle, and feathers of Forster's tern (*Sterna forsteri*), black-necked stilt (*Himantopus mexicanus*) and American avocet (*Recurvirostra americana*) chicks as they aged from hatching through postfledging in San Francisco Bay. Mercury concentrations in internal tissues were highest immediately after hatching, due to maternally deposited mercury in eggs. Concentrations then rapidly declined as chicks aged and diluted their mercury concentrations through growth in size and as mercury is transferred into growing feathers. Mercury concentrations then increased during fledging when tissue growth and feather growth slowed, while chicks continued to

acquire mercury through their diet. Springtime monitoring in fish should be representative of mercury in the eggs at hatching. Most chicks hatch in May or June, except in the northern sites near San Francisco they tend to hatch in June or July (Frost 2013).

Some birds have a fairly small range during breeding, which is import to consider when designing monitoring and assessment procedures. Ackerman et al. radio-marked and tracked 72 Forster's terns (*Sterna forsteri*) in San Francisco Bay to determine locations of dietary mercury uptake. The radiotelemetry data revealed that Forster's terns generally remained near their site of capture and foraged in nearby waters. On average, tern locations were 2.2 km to 7.7 km from their capture site, and mercury concentrations in blood differed among capture sites. Breeding terns are likely to be even more at risk because blood mercury concentrations more than tripled during the 45-day pre-breeding time period (Ackerman et al. 2008). In another study in San Francisco Bay, radio telemetry data for American avocets (*Recurvirostra americana*) and black-necked stilts (*Himantopus mexicanus*) showed these species had stronger site fidelity. The areas that avocets and stilts occupied half the time were 1 – 4 km^2 and the area they occupied 95% of the time was 8 – 25 km^2. Species differences in habitat use and foraging strategies may increase mercury exposure in stilts more than avocets (Ackerman et al. 2007). The fact that movement during breeding or nesting season tends to be limited is also discussed in Section K.9 on points of uncertainty.

For monitoring grebe prey, Ackerman et al. recommend sampling at least 20 individual prey fish from a minimum of two different species from each water body and analyzing total mercury concentrations on an individual, rather than a composite, basis. Prey fish should be sampled during the breeding season ("approximately April – July") when wildlife are at greatest risk to potential mercury-induced impairment (Ackerman et al. 2015). Sampling date should be standardized for annual monitoring programs because seasonal variation in prey fish mercury concentrations can be substantial (Eagles-Smith and Ackerman, 2009).

Information on relevant wildlife breeding periods was compiled in Table K-6. This information was used to recommend the averaging periods for the water quality objectives for wildlife. The recommended averaging period for the objective that applies to TL3 fish 50 – 150 mm is February 1 – July 31. The recommended averaging period for the objective that applies to fish less than 50 mm long for the California Least Tern is April 1 – August 31. Averaging periods are used in evaluating whether the water quality objective is achieved. The State Water Board's assessment policy allows for the use of different averaging periods as specified by particular water quality objectives (State Water Board 2004). All data collected within the same averaging period will be combined into a single resultant value (see section 6.1.5.6 of State Water Board 2004). Data collected during another averaging period (for example, in this case, the breeding season of the next year) would be combined into separate additional values. The values are then evaluated to determine if the water quality objective is being exceeded according to State Water Board's assessment policy (State Water Board 2004).

Table K-6 Wildlife Breeding Period for Prey Fish Collection Time

Aquatic-dependent Wildlife Species	Typical Breeding or Gestation Period	Citation
Bald eagle	February – July (a)	CDFW 1990
River otter	January – May (b)	CDFW 1990
Osprey	March – September (a)	CDFW 1990
Common merganser	Mid-April – August	Mallory and Metz 1999
Western grebe	April – September	Ackerman et al. 2015
Great blue heron	Mid-February – July	CDFW 1990
Double-crested cormorant	January – August	CDFW 1990
Mink	Late-January – May	CDFW 1990
Belted kingfisher	April – Mid-August	CDFW 1990
Forster's tern	April – Mid-August	Ackerman et al. 2014
California least tern	April – August	USFWS 1985
Western snowy plover, Pacific Coast population	March – Mid-September	USFWS 2007
Yuma Ridgeway's rail	March – July	USFWS 2009
California Ridgeway's rail	Late March – August	USFWS 2010
Light-footed Ridgeway's rail	Mid-February – Mid-July	Zembal et al. 2014

a) Timing of egg laying varies with latitude
b) Reproductive cycle of river otters is extended and includes peak breeding season of avian species of concern. Otter mating typically occurs December through April and reproductive cycle may include delay of implantation of the fertilized embryo up to eight months. Kits typically born in March and April after two months gestation (CDFW 1990).

K.13 Habitat Range Maps

The following maps are provided to support protections for wildlife, discussed in Section K.8 of this appendix. In Table K-3, some values showing the most sensitive species for each trophic level category are shaded gray. For these species, California Wildlife Habitat Relationship System range maps are shown below, as well as maps for some similarly sensitive species. More range maps can be found on the California Department of Fish and Game website (as well as downloadable GIS data http://www.dfg.ca.gov/biogeodata/cwhr/). Maps are also provided in Figure K-3 and Figure K-4 to show the general location of trout dominated waters, because the water quality objectives may be applied differently in trout dominated waters (see end of Section K.8), which could impact the level of protection for species that inhabit those waters. These maps support the discussion on the recommended water quality objectives in Section K.8.

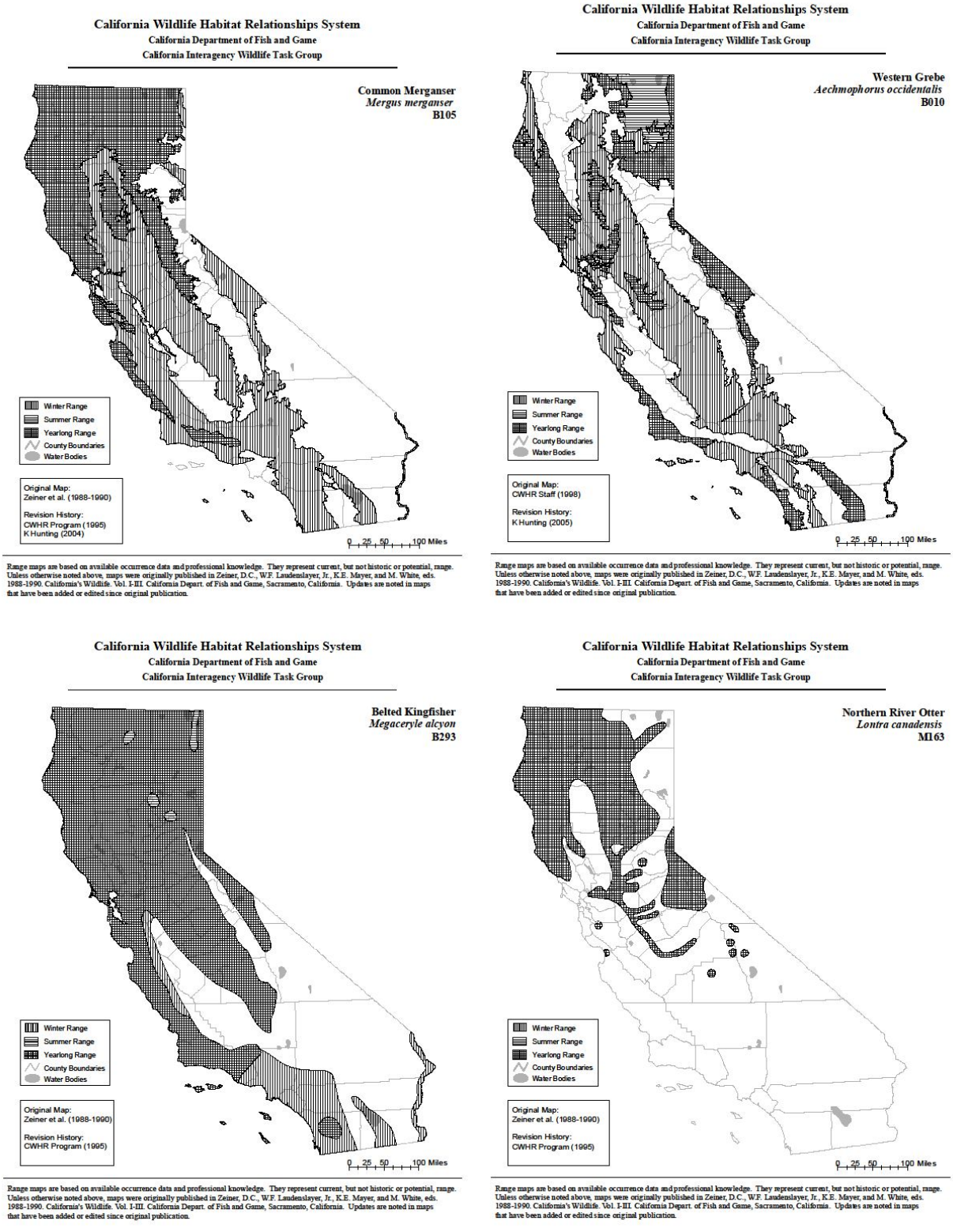
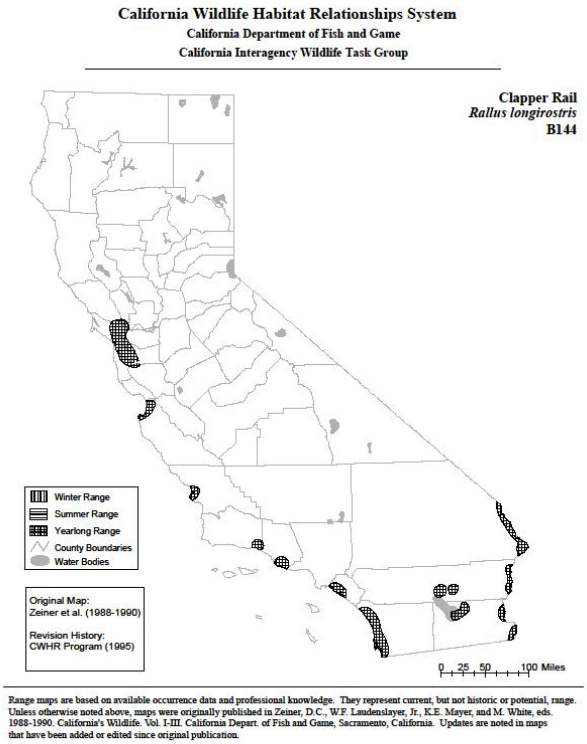
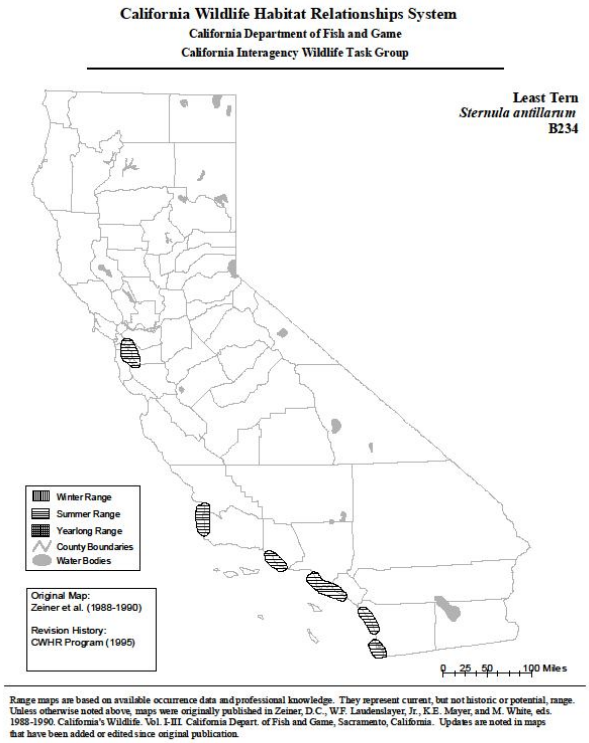
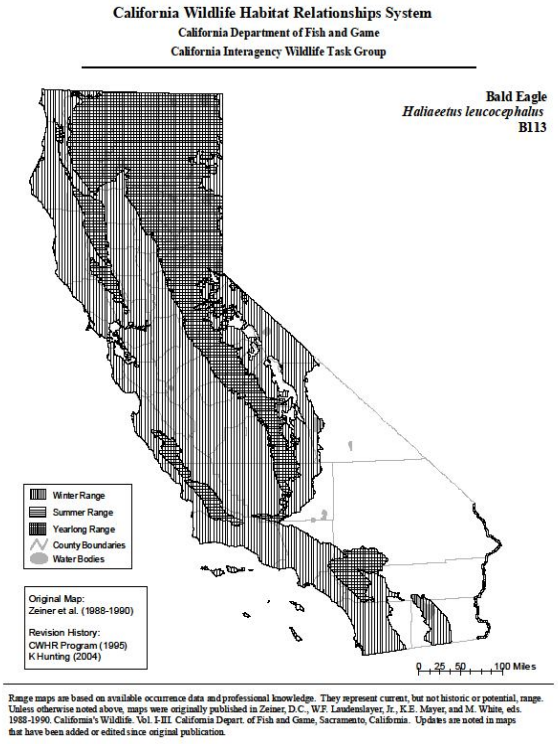


Figure K-2. California Wildlife Habitat Relationship System range maps for select wildlife species.







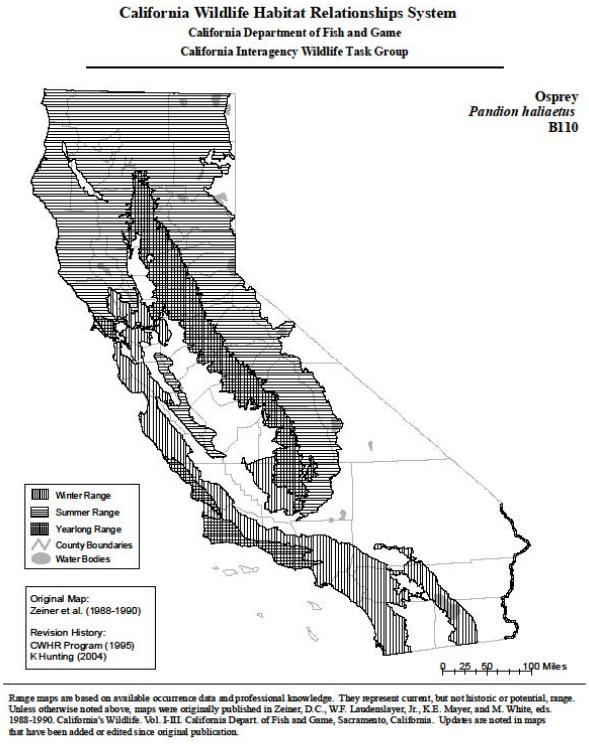


Figure K-2 (continued). California Wildlife Habitat Relationship System range maps for select wildlife species.

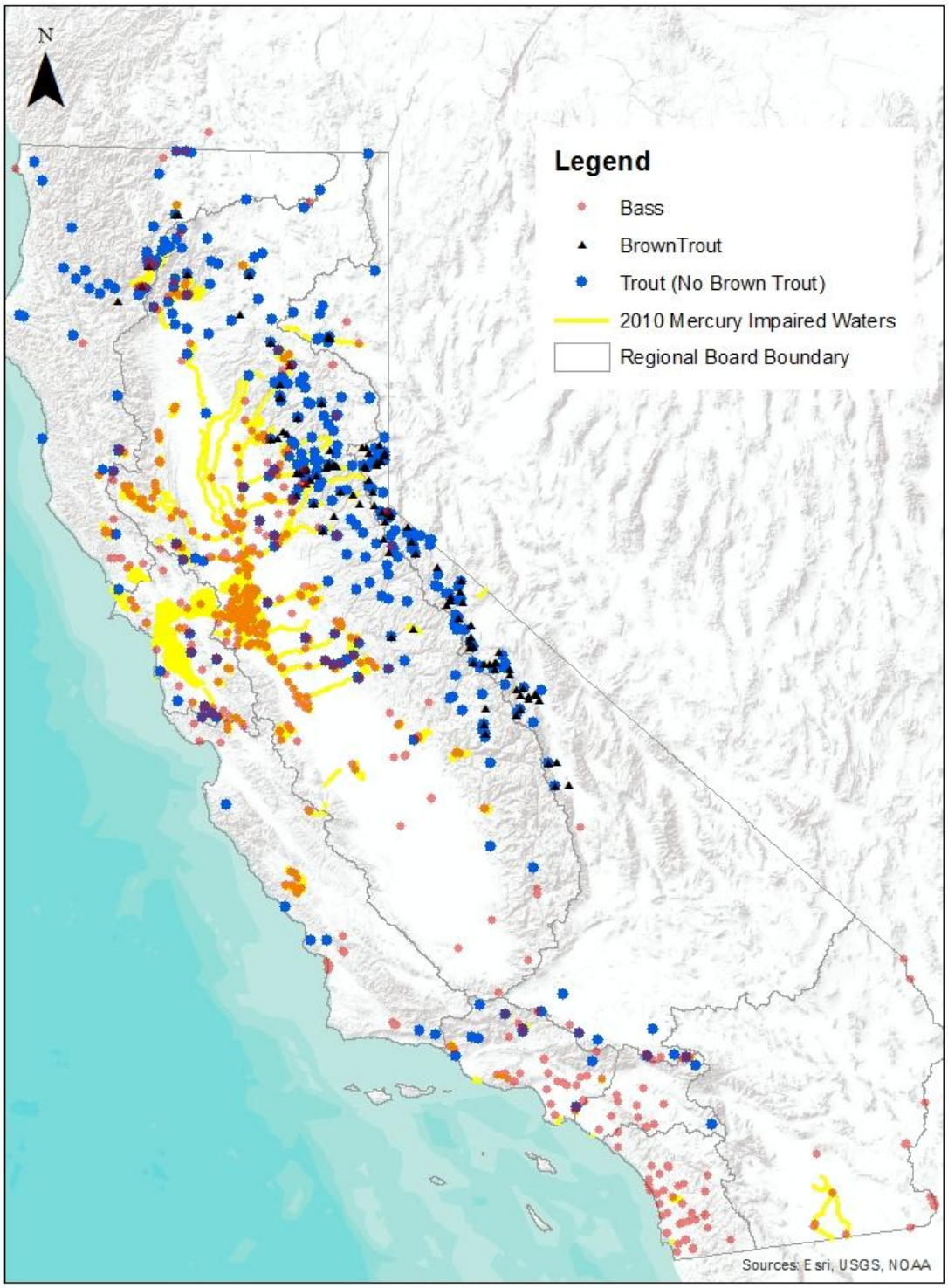


Figure K-3. Locations where Water Boards related monitoring programs have caught bass (largemouth bass, smallmouth bass and spotted bass), trout (rainbow trout, brook trout, lake trout, eagle lake trout), and brown trout. Data obtained from the California Environmental Data Exchange Network (CEDEN, www.ceden.org/).

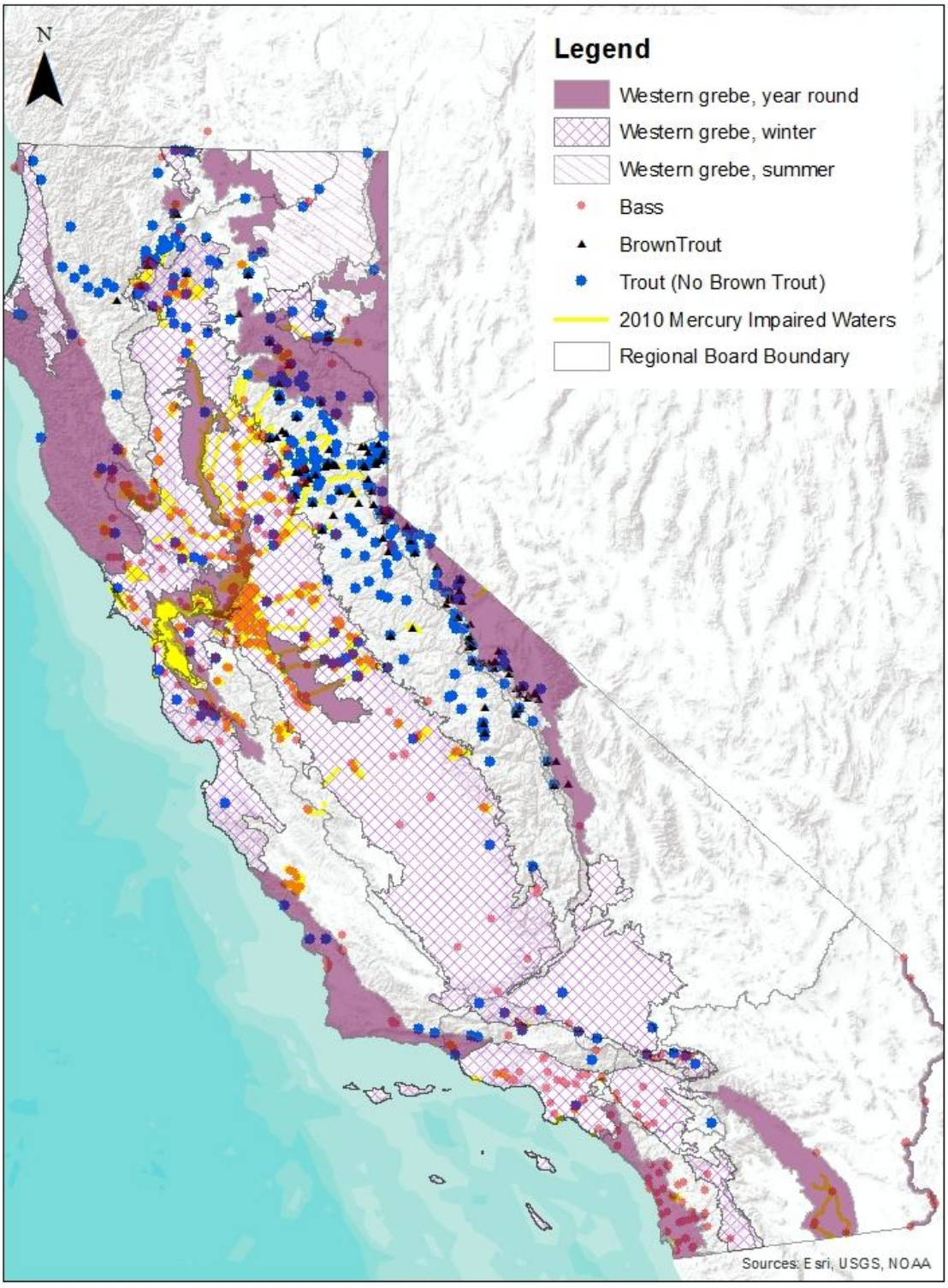


Figure K-4. Sensitive species habitat ranges that may overlap with trout dominated waters (see Figure K-3). Habitat ranges from California Wildlife Habitat Relationships (GIS shapefiles from www.dfg.ca.gov/biogeodata/cwhr/).

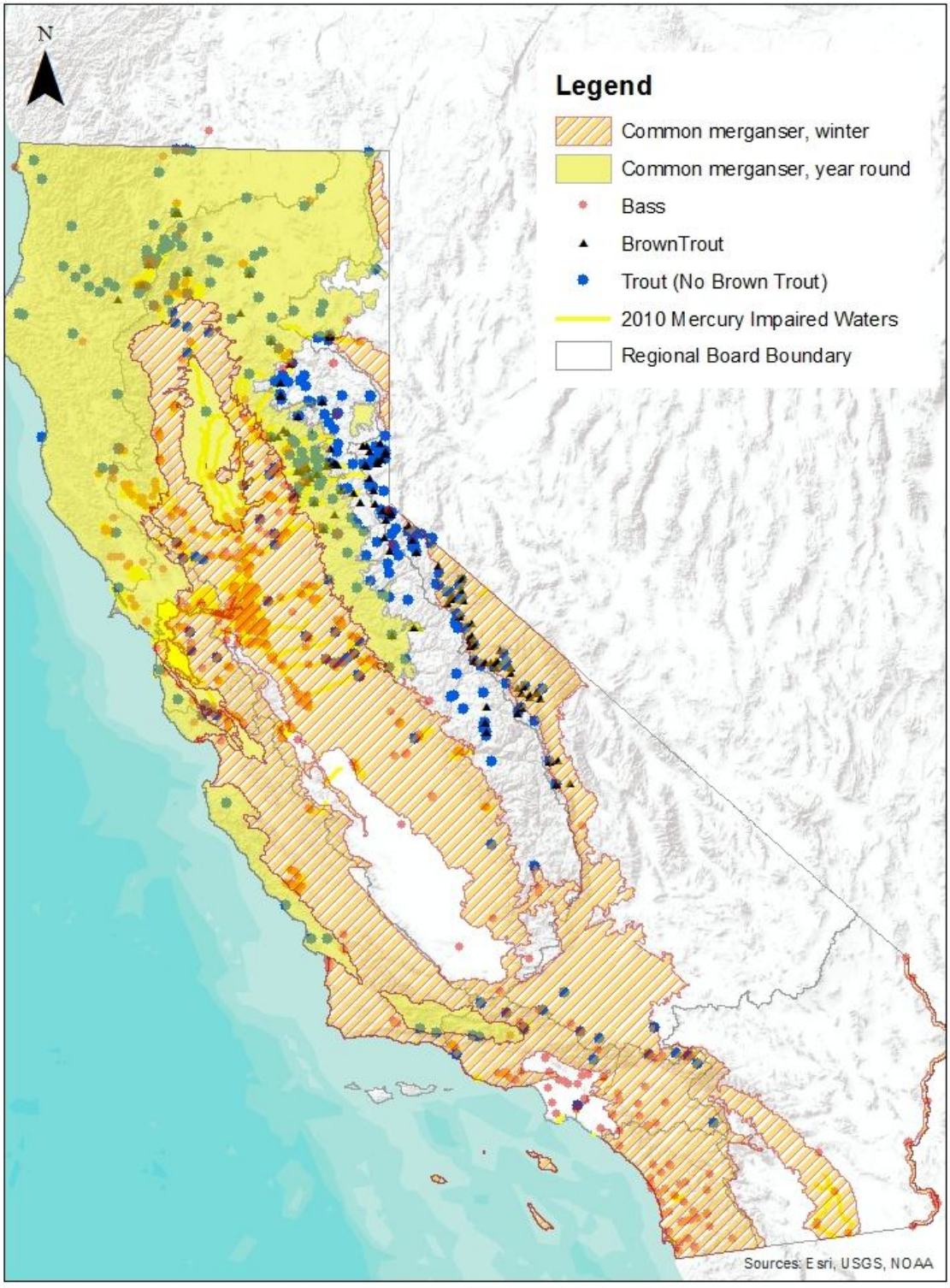


Figure K-4 (continued). Sensitive species habitat ranges that may overlap with trout dominated waters (see Figure K-3). Habitat ranges from California Wildlife Habitat Relationships (GIS shapefiles from www.dfg.ca.gov/biogeodata/cwhr/).

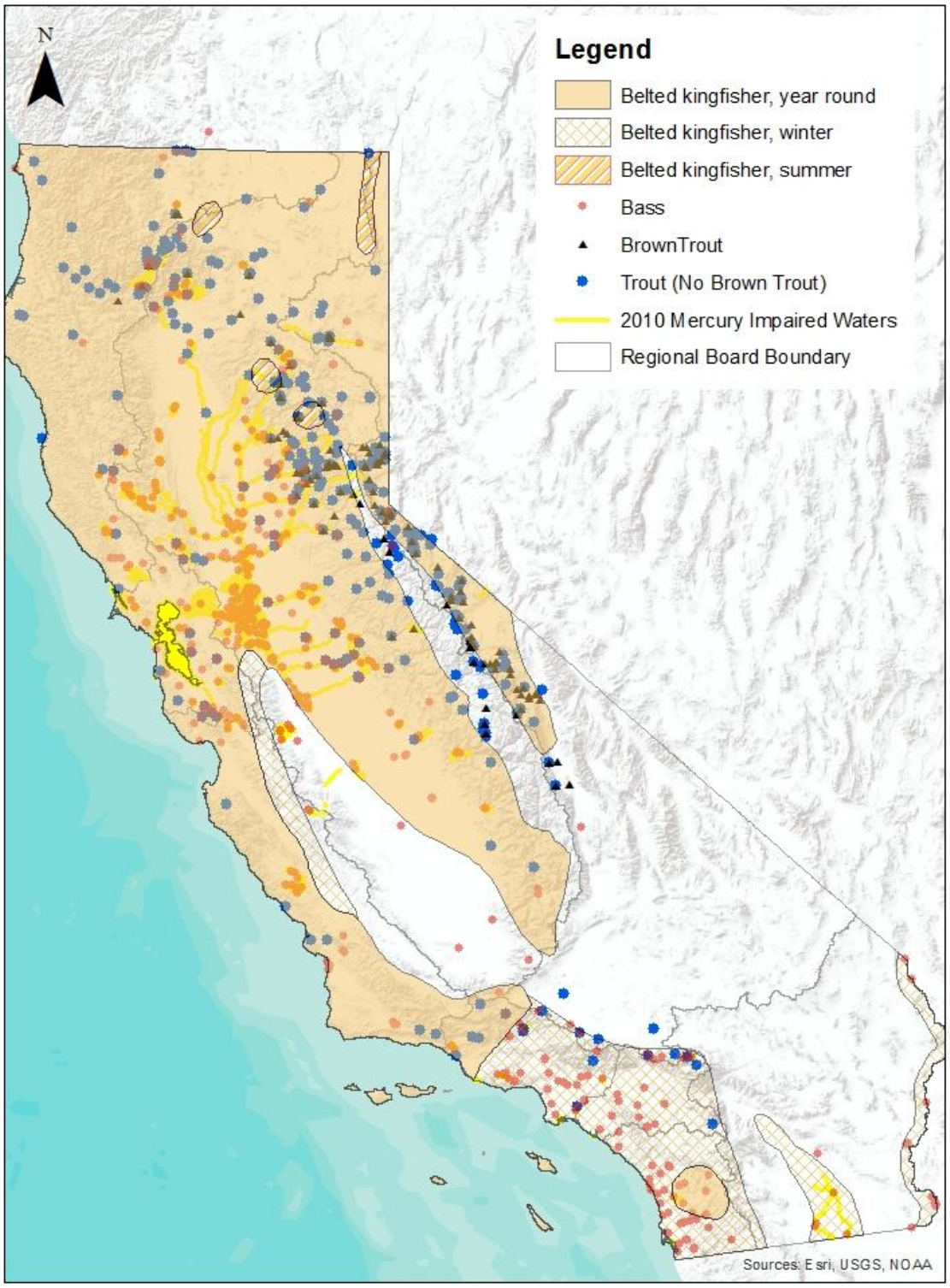


Figure K-4 (continued). Sensitive species habitat ranges that may overlap with trout dominated waters (see Figure K-3). Habitat ranges from California Wildlife Habitat Relationships (GIS shapefiles from www.dfg.ca.gov/biogeodata/cwhr/).

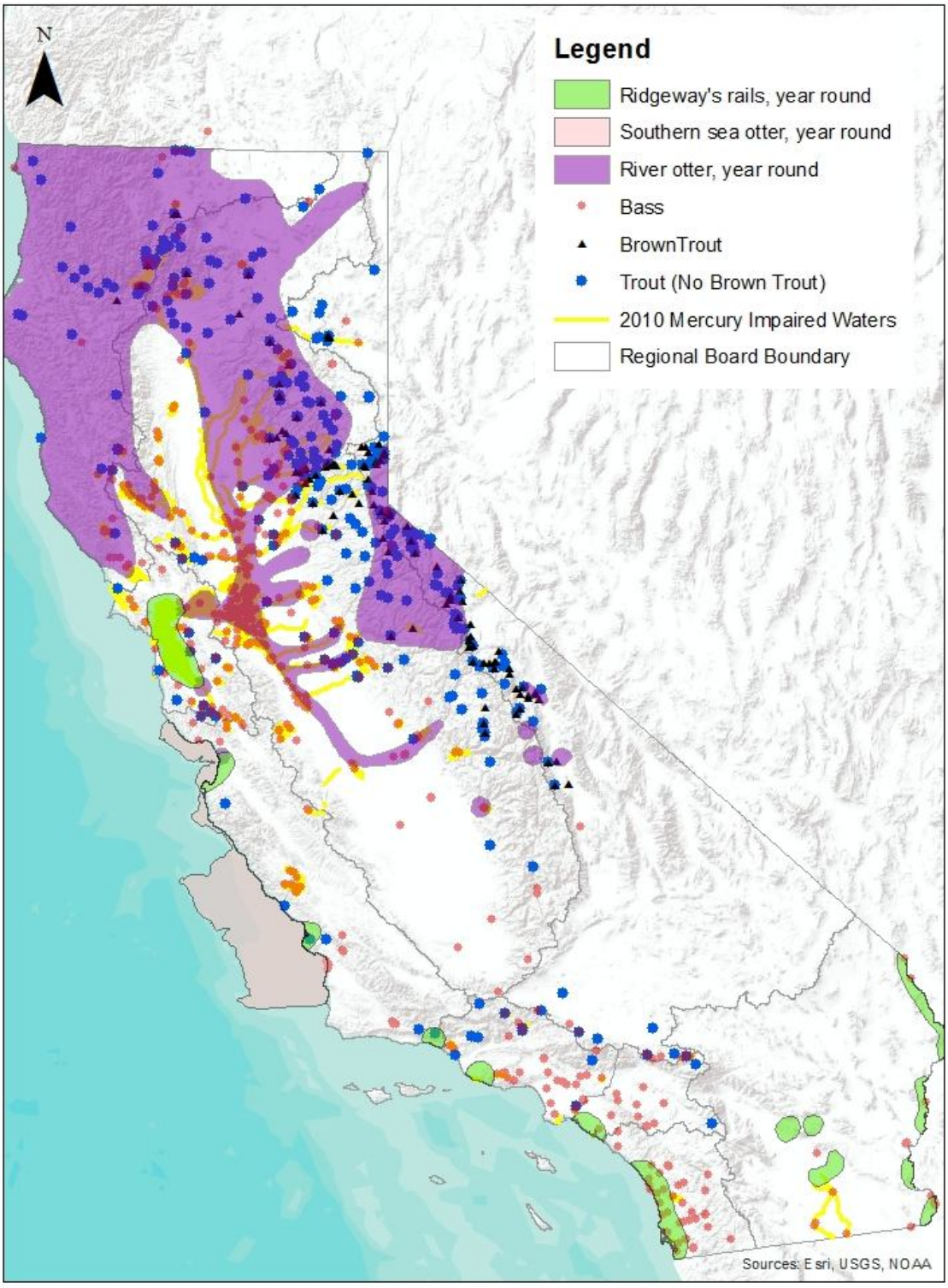


Figure K-4 (continued). Sensitive species habitat ranges that may overlap with trout dominated waters (see Figure K-3). Habitat ranges from California Wildlife Habitat Relationships (GIS shapefiles from www.dfg.ca.gov/biogeodata/cwhr/).

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RESEARCH ARTICLE

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Phylogenetic analysis of the Lancinae (Gastropoda, Lymnaeidae) with a description of the U.S. federally endangered Banbury Springs lanx

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Abstract

We examined the patelliform snails of the subfamily Lancinae, endemic to northwestern North America, to test whether morphological variation correlated with genetic and anatomical differences. Molecular analyses using *cox1*, 16S, calmodulin intron, and 28S rDNA partial sequences and anatomical data supported recognition of four species in three genera. The relationships of lancines within Lymnaeidae are not yet well-resolved. The federally endangered Banbury Springs lanx is described as a new genus and species, *Idaholanx fresti*, confirming its distinctiveness and narrow endemicity.

Keywords

Lanx, Fisherola, Basommatophora, anatomy, molecular

Introduction

The lancines are relatively large freshwater limpets (up to 20 mm in length), found from the upper Sacramento and Pit Rivers of northern California, north to the Columbia River system in the states of Idaho, Oregon, Washington and Montana in the United States and the province of British Columbia, Canada. Some freshwater limpets in related families have been shown to have high morphological variation within relatively few, widespread species (Walther et al. 2006a, b), but no previous study has analyzed the lancines in detail.

Because of their larger size and color pattern, Tryon (1870) incorrectly suspected that some lancines were mislabeled marine forms. Despite the differences, lancines were generally classified along with other freshwater limpets in Ancylinae until Pilsbry (1925) and H. B. Baker (1925) examined the anatomy and showed that they were lymnaeids. Further studies (Morrison 1955, Walter 1969) have confirmed the lymnaeid anatomy. Although several lymnaeids tend towards few whorls and wide apertures, these are the only truly patelliform members extant in the family. Within the Lancinae, three generic names have been proposed: *Lanx* Clessin, 1880, *Fisherola* Hannibal, 1912, and *Walkerola* Hannibal 1912, but whether they should be recognized as genera, subgenera, or synonyms has varied between authors. Current classification typically recognizes *Lanx* and *Fisherola* but treats *Walkerola* as a subgenus or synonym of *Lanx* (Burch & Tottenham, 1980). Nine names (plus one unpublished name cited in the literature) have been proposed for extant species (Table 1). However, there is little agreement in the literature as to whether the variation in shell shape, height, color, and anatomy between populations provide an adequate basis for recognizing all of these taxa (Morrison 1955).

Of particular importance are the questions relating to the status of the Banbury Springs lanx. Banbury Springs lanx was discovered by Terry Frest in 1988 and thought to be a new, undescribed species within the genus *Lanx*. It is listed as federally endangered in the United States (U.S. Fish and Wildlife Service 1992). Although the small size and different shape distinguish it from other lancines, normal *Fisherola* occur nearby in the Snake River, raising the possibility that it is just a local ecomorph. However, no populations of *Fisherola* are known from any other springs (U.S. Fish and Wildlife Service 2006).

The primary objective of this study was to determine the taxonomic status of the United States federally endangered Banbury Springs lanx. We describe it as a new genus and species based on molecular and anatomical data. Secondly, we examine the phylogenetic relationships of the Lancinae using mitochondrial and nuclear gene regions.

Materials and methods

We sampled populations from throughout the geographic range of *Lanx* and *Fisherola*, emphasizing morphologically or geographically distinct populations (Table 2). A few additional lymnaeids were sampled as outgroups. Specimens were preserved in ethanol

Table 1. Nominal Recent species names in Lancinae.

Species name	Type locality	Assignment in present study
Ancylus altus Tryon, 1865	Klamath River	*Lanx alta* (Tryon, 1865)
Ancylus crassus Haldeman, 1844	Columbia drainage	*Fisherola nuttallii* (Haldeman, 1841)
Lanx hannai Walker, 1925	upper Sacramento River	*Lanx patelloides* (Lea, 1856)
Lanx (*Walkerola*) *klamathensis* Hannibal, 1912	Klamath River	*Lanx alta* (Tryon, 1865)
Ancylus kootaniensis Baird, 1863 [*kootenaiensis* is an invalid emendation]	Kootenai River (restricted by Morrison 1955)	probably *Fisherola nuttallii* (Haldeman, 1841) but not directly sampled
Fisherola lancides Hannibal, 1912	Snake River	*Fisherola nuttallii* (Haldeman, 1841)
Ancylus newberryi Lea, 1858	upper Sacramento (correction by Pilsbry 1925)	*Lanx patelloides* (Lea, 1856)
Ancylus (*Velletea*) *nuttallii* Haldeman, 1841	Columbia drainage	*Fisherola nuttallii* (Haldeman,1841)
Ancylus patelloides Lea, 1856	upper Sacramento River	*Lanx patelloides* (Lea, 1856)
Ancylus praeclarus Stimpson ms. cited in Lea, 1867	unstated	not validly proposed; Lea stated that *newberryi* differs from it in several ways but never directly said anything about *praeclarus*
Ancylus subrotundatus Tryon, 1865	Umpqua River	*Lanx alta* (Tryon, 1865)

in the field. Dissections were carried out using a stereomicroscope fitted with a camera lucida. Typically at least two specimens per population were dissected; in some cases only one specimen was available. DNA extraction used digestion in CTAB overnight at 37°C, followed by chloroform-isoamyl alcohol separation, isopropanol precipitation, and washing with 70% ethanol before drying and dissolving in TE (Campbell et al. 2005). PCR amplification was often difficult, so several genes were attempted in an effort to find genes with suitable variation that amplified consistently. ITS failed to amplify. 16S (using the primers from Krebs et al. 2003) amplified for few populations. *Cox1* (using primers LCO1490 from Folmer et al. 1994 and the external primer from Carpenter and Wheeler 1999) amplified for several but not all samples. The best amplification was obtained for 28S (primers 2/3F and 6R from Park and Ó Foighil 2000) and calmodulin intron (primers from Schilthuizen et al. 1999 and new primers ATGAAGTGGATGCTGAYGG and ATTCTGGGAARTCTATYG). However, as observed for other gastropods (Simpson et al. 2005), multiple highly divergent calmodulin intron alleles were obtained, suggesting that multiple copies of calmodulin exist in basommatophorans. The sequence length variation was sufficient to make selection of a single copy straightforward using gel extraction (QIAquick gel extraction kit, Qiagen). The band of about 420 bp (including primers) was selected because it consistently amplified strongly. Because the key variable region in 18S is in the first part of the gene, we used the 1F-4R primers (Giribet et al. 1996) to amplify that portion of the gene. PCR cycles used were 95°C, 3 min; 5 cycles at 92°C for 30 sec, 40°C for 30 sec,

Table 2. Populations sequenced. Species names under "Morphospecies" were assigned based on shell form. Designation is the name assigned based on the present results and used in the trees. A single individual from the Rogue system yielded two distinct calmodulin intron sequences and unique sequences for 28S and *cox1*.

Designation	Morphospecies	Locality	Drainage	Accession number
Idaholanx fresti	Banbury lanx	Banbury Springs, Idaho	Snake	calmodulin HM230326, 28S HM230308, *cox1* HM230356, 16S KT267273
Idaholanx fresti	Banbury lanx	Box Canyon Springs, Idaho	Snake	calmodulin HM230327, 28S HM230309, *cox1* HM230357, 16S KT267273
Idaholanx fresti	Banbury lanx	Briggs Spring, Idaho	Snake	28S HM230310
Idaholanx fresti	Banbury lanx	Thousand Springs, Idaho	Snake	calmodulin HM230328, 28S HM230311
Fisherola nuttallii	*F. lancides*	off Bancroft Springs, Snake River, Idaho	Snake	calmodulin HM230330, 28S HM230315, *cox1* HM230359, 16S HM230355
Fisherola nuttallii	*F. nuttallii*	Deschutes River, RM 6.3, Oregon	Columbia	calmodulin HM230329, 28S HM230314, 16S KT267274
Fisherola nuttallii	*F. nuttallii*	Owyhee River, Whistling Bird Rapids, Oregon	Snake	calmodulin HM230331, 18S HM230306, 28S HM230316, *cox1* HM230360
Lanx alta	*L. alta*	Klamath River at Collier Rest Area, California	Klamath	calmodulin HM230336, 18S HM230307
Lanx alta	*L. klamathensis*	Barclay Spring, Hagelstein Park, Upper Klamath Lake, Oregon	Klamath	calmodulin HM230335, 28S HM230319
Lanx alta	*L. klamathensis*	Link River at Hwy bridge, Klamath Falls, Oregon	Klamath	calmodulin HM230337
Lanx alta	*L.* species	Smith River National Recreation Area, California	Smith	calmodulin HM230341, 28S HM230321
Lanx alta	*L.* species	Smith River National Recreation Area, California	Smith	calmodulin HM230342
Lanx alta	*L.* species cf. *L. alta*	Rogue River at Gold Nugget Recreation area (BLM), Oregon	Rogue	calmodulin HM230338, HM230340 (identical sequence from two specimens)
Lanx alta	*L.* species cf. *L. alta*	Rogue River at Gold Nugget Recreation area (BLM), Oregon	Rogue	calmodulin HM230339, 28S HM230320, *cox1* HM230362
Lanx alta	*L. subrotundata*	Amacher City Park, Roseburg, Umpqua River, Oregon	Umpqua	calmodulin HM230334, 28S HM230318, *cox1* HM230361
Lanx patelloides	*L. hannai*	McCloud River S. of Ah-Di-Na Camp Ground, California	Sacramento	calmodulin HM230346, 28S HM230322, *cox1* HM230363

Designation	Morphospecies	Locality	Drainage	Accession number
Lanx patelloides	*L. patelloides*	Battle Creek, Sacramento River, California	Sacramento	calmodulin HM230343
Lanx patelloides	*L. patelloides*	Pit River at CA Hwy 299 bridge, California	Sacramento	calmodulin HM230347
Lanx patelloides	*L. patelloides*	Sucker Springs lower spring channel, California	Pit	calmodulin HM230348, 28S HM230323
Lanx patelloides	*L.* species	Lava Creek Lodge, Eastman Lake, Fall River, California	Pit	calmodulin HM230344, HM230349(long), 16S KT267276
Lanx patelloides	*L.* species	Lost Creek source spring	Pit	calmodulin HM230345

65°C for 2 min; and 40 cycles with at 92°C for 30 sec, x°C for 30 sec, 65°C for 2 min, where x is about 2°C below the lower primer annealing temperature; finishing with 10 min at 72°C before cooling to 4°C. In some cases with weak amplification, nested PCR for calmodulin intron using the Schilthuizen et al. (1999) primers followed by the new primers was used. PCR products were purified using DyeEx 2.0 kits (Qiagen). Sequencing used ABI BigDye 3.1 with cycle sequencing reactions of 4 minutes at 96°C, followed by 40 cycles with 15 sec at 96°C, 15 sec at about 2°C below the lower primer annealing temperature, and 4 min at 65°C, followed by 10 min at 72°C before cooling to 4°C. Sequences were aligned in BioEdit 7.0.5.3 (Hall 1999). Preliminary alignments made use of CLUSTAL W (Larkin et al. 2007), followed by manual editing to eliminate unnecessary gaps, inconsistent alignment of identical sequences, and other problems. Outgroups were selected based on the availability of 28S sequence data and at least one of the other included genes. To obtain more complete genetic coverage, three outgroups (*Carinifex* sp., *Polyrhytis emarginata s.l.*, and *Galba modicella s.l.*) combined sequences from more than one nominal species, but the species in question are closely related and have sometimes been synonymized.

DNA data were analyzed in PAUP* 4.0a152 (Swofford 1998), TNT (Goloboff et al. 2008) and MrBayes3.2 (Ronquist et al. 2011). Duplicate sequences were eliminated from the phylogenetic analyses. Partition-homogeneity tests (P_{ILD} of Dowton and Austin 2002) were run in PAUP*4.0a152 with 100 replicates of 10 random addition replicates each. This test is sensitive to other factors, such as partition size and evolutionary model, besides data compatibility (Dowton and Austin 2002), but may provide a rough idea of agreement between data sets. Despite the problems of the ILD type of tests, no better alternative has gained wide acceptance. The test requires data for each included taxon and partition, so pairwise comparisons were made between all genes. The only significantly incompatible gene was 16S data, so it was analyzed separately, but the others were concatenated. Indels were coded as missing data. Parsimony analyses in PAUP* used 500 replicates of TBR swapping, with random taxon addition sequence and holding 10 trees at each addition step. Parsimony bootstrapping used 500 replicates, each replicate being a random-addition heuristic search with 10 random replicates. MrModeltest 2.2 (Nylander 2004) was used to select a maximum likelihood model for the nucleic acid sequences that was then input into MrBayes. Bayesian analyses used 2,000,000 generations and 8 chains, with revmat, shape, pinvar, and statefreq unlinked, and the concatenated sequence had the genes identified as partitions. Duplicate sequences were excluded.

Abbreviations

FMNH Field Museum of Natural History, Chicago, Illinois, U.S.A.

SAC Invertebrate Identification's invertebrate reference collection, Chicago, Illinois, U.S.A.

DCS Deixis Consultants mollusc reference collection, Seattle, Washington, U.S.A.

Table 3. Outgroup sequences analyzed. Source gives locality for new specimens and literature citation for published sequences. * indicates newly generated sequences.

Taxon	Gene	Accessions	Sources
Acroloxus lacustris (Linnaeus, 1758)	16S	AY577462	Jorgensen et al. 2004
Acroloxus lacustris (Linnaeus, 1758)	28S	DQ328296	Walther et al. 2006b
Acroloxus lacustris (Linnaeus, 1758)	*cox1*	DQ328271	Walther et al. 2006b
Ancylus fluviatilis Müller, 1774	16S	AY577466	Jorgensen et al. 2004
Ancylus fluviatilis Müller, 1774	28S	DQ328295	Walther et al. 2006b
Ancylus fluviatilis Müller, 1774	*cox1*	DQ328270	Walther et al. 2006b
Austropeplea tomentosa (L. Pfeiffer, 1855)	16S	EU556238	Puslednik et al. 2009
Austropeplea tomentosa (L. Pfeiffer, 1855)	28S	HQ156217	Holznagel et al. 2010
Austropeplea tomentosa (L. Pfeiffer, 1855)	*cox1*	AY227365	Remigio and Hebert 2003
Carinifex newberryi (Lea, 1858)	28S	*HM230312	Lava Creek, 1st spring pool N. of Hanna Boathouse, CA
Carinifex ponsonbyi Smith, 1876	16S	*HM230354	Hagelstein Park, mid channel E. side center, Klamath River, OR
Carinifex ponsonbyi Smith, 1876	*cox1*	*HM230358	Hagelstein Park, mid channel E. side center, Klamath River, OR
Dilatata dilatata (Gould, 1841)	28S	*HM230313	Sipsey River near Benevola, Greene Co. AL
Dilatata dilatata (Gould, 1841)	*cox1*	EF012173	Albrecht et al. 2007
Galba modicella (Say, 1825)	*cox1*	KM612000	Dewaard et al. 2015
Galba obrussa (Say, 1825)	16S	AF485658	Remigio 2002
Galba obrussa (Say, 1825)	28S	*HM230317	Sipsey River near Benevola, Greene Co. AL
Galba obrussa (Say, 1825)	cam	*HM230332	Sipsey River near Benevola, Greene Co. AL
Lymnaea stagnalis (Linnaeus, 1758)	16S	AF485661	Remigio 2002
Lymnaea stagnalis (Linnaeus, 1758)	28S	AY427490	Vonnemann et al. 2005
Lymnaea stagnalis (Linnaeus, 1758)	*cox1*	KT831385	Gordy et al. 2016
Orientogalba ollula (Gould, 1859)	16S	U82067	Remigio and Blair 1997
Orientogalba ollula (Gould, 1859)	28S	AY465065	Jung et al., unpublished
Orientogalba ollula (Gould, 1859)	*cox1*	KC135900	Park et al. 2012
Physa acuta (Draparnaud, 1805)	16S	JQ390525	Nolan et al. 2014
Physa acuta (Draparnaud, 1805)	28S	DQ256738	Holznagel et al. 2010
Physa acuta (Draparnaud, 1805)	*cox1*	JQ390525	Nolan et al. 2014
Planorbella trivolvis (Say, 1817)	16S	AY030234	DeJong et al. 2001
Planorbella trivolvis (Say, 1817)	28S	AF435688	Morgan et al. 2002
Planorbella trivolvis (Say, 1817)	*cox1*	KM612028	Dewaard et al. 2015
Polyrhytis emarginata (Say, 1821)	28S	DQ328299	Walther et al. 2006b
Polyrhytis elodes (Say, 1821)	16S	AF485652	Remigio 2002
Polyrhytis exilis (Lea, 1834)	*cox1*	*HM230364	Ditch along the Stump Lake access road, Jersey Co., IL
Radix auricularia (Linnaeus, 1758)	16S	JN794284	von Oheimb et al. 2011
Radix auricularia (Linnaeus, 1758)	28S	AY465067	Jung et al., unpublished
Radix auricularia (Linnaeus, 1758)	*cox1*	KP242340	Patel et al. 2015
Radix balthica (Linnaeus, 1758)	16S	HQ330989	Feldmeyer et al. 2010
Radix balthica (Linnaeus, 1758)	28S	EF417136	Sonnenberg et al. 2007
Radix balthica (Linnaeus, 1758)	*cox1*	KP098541	Feldmeyer et al. 2015

Results

Amplification of 28S and calmodulin intron were most successful, but representatives of each species (as recognized herein) also amplified for *cox1*. Within Lancinae, interspecies and intergenus percent variation was lowest for 28S and highest for *cox1*. However, the calmodulin intron sequence for lancines was more divergent from *Galba obrussa* than the maximum variation between lymnaeids for *cox1* (26-30% versus 22%) (Table 4). Calmodulin sequences for planorbids generated in ongoing study on *Vorticifex* were apparently homologous based on the beginning and end of the intron sequence, but the middle of the intron was too divergent in sequence and length to obtain a meaningful alignment between the planorbids and lymnaeids. One calmodulin intron paralog of significantly different length was sequenced, but no homology with the chosen paralog was evident (GenBank accession number HM230349).

Several populations yielded identical or nearly identical sequences. These are enumerated in Table 2. No indels were found in *cox1* within the sampled species, though other Hygrophila do have insertions (pers. obs.). 28S, 16S, and calmodulin intron all had several small indels. MrModeltest (Nylander 2004) favored a HKY model for calmodulin intron and GTR+I+G for 28S, 16S, and *cox1*. Figures 1–2 show the results of phylogenetic analyses.

Parameters for the trees from these analyses are in Table 5. All Bayesian analyses had a final average standard deviation of split frequencies below 0.6%. Roughly 70% bootstrap support or 95% Bayesian posterior probability are thought to reflect significant support, though these empirical estimates are affected by several data and tree characteristics.

As 18S typically shows little resolution at the species level, it was only sequenced for two species from different lancine genera, and those sequences were identical. Table 6 gives the E10-1 variable region for lymnaeids (present results and published data). The sequences are sufficiently variable to make alignment uncertain. Parsimony analyses using different alignments gave substantially different phylogenetic patterns, so we did

Table 4. Range of percent differences in DNA sequence (raw data, gaps treated as missing).

Gene	Lymnaeidae	lancine genera	Lanx species	lancine intraspecies
28S	up to 7.6%	1.2–2.8%	0.79–1.2%	0.00–0.40%
CAM intron	up to 30.1%	4.8–8.0%	1.3–2.6%	0.00–1.87%
cox1	up to 21.1%	12.9–21.1%	7.9–8.6%	0.15–1.0%
16S	up to 21.3%	12.8–16.6	no data	0.00–2.5%

Table 5. Tree statistics.

Gene	Parsimony		Bayesian		
	# trees	length	burnin	maximum ln likelihood	mean ln likelihood
28S, CAM intron, and *cox1*	18	1670	165000	-9578.885	-9602.83
16S	2	719	65000	-3414.11	-3427.56

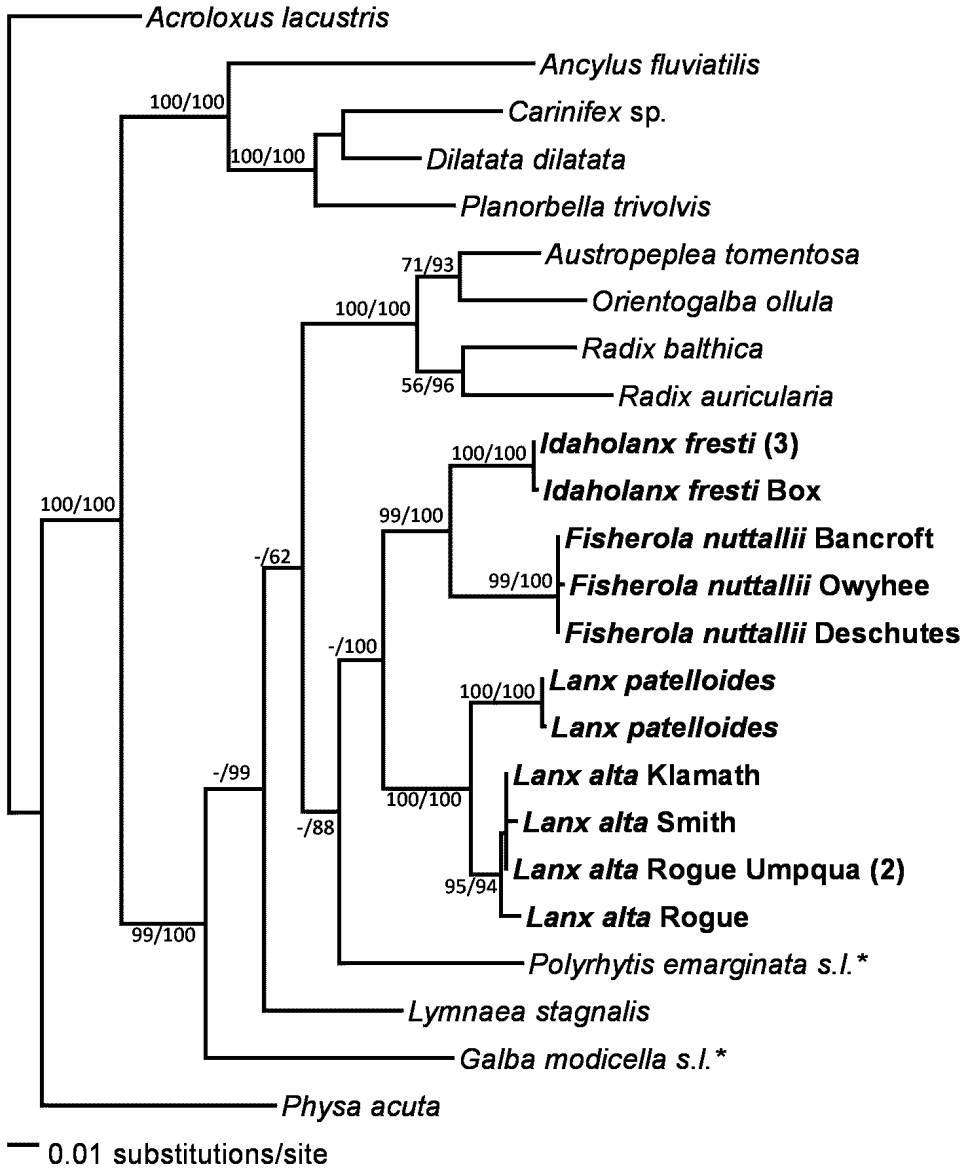

Figure 1. Phylogram of the Bayesian majority-rule consensus tree for 28S, *cox1*, and calmodulin intron sequence data. Numbers on branches are bootstrap percentages before the slash, then Bayesian posterior probabilities. - indicates a value under 50% or 0.5 when the other method gave higher values. Taxon names in bold are lancines; starred taxa are Acellinae.

not use them. The alignment in the table is to facilitate comparison and may not reflect actual homology. However, several groups of species have closely similar or identical sequences, supporting a close relationship within these groups.

Table 6. Hypervariable portion of the E10 region of 18S genes for lymnaeids. * indicates newly generated data. The alignment is meant to facilitate comparison between the different species. Differences between the more divergent sequences are too great for confident homologizing.

Species	Accession number	Sequence
Aenigmomphiscola europaea, A. kazakhstanica, Lymnaea stagnalis, Omphiscola glabra, Stagnicola palustris	AY577484, FR797819-FR797829, JN614363, JN614364, HQ659966, JN614368, JN614367	CCGCG------TGC-GG--GGCGACTCGT-GCGCGGCG
Fisherola nuttallii	HM230306*	CCGT-CGC-GCGGGGCGTCAAACCCTCGCCG-GCGGCG
Galba cousini	FN598151, JN614345, JN614344	CCGT-------CGCGGCGCAAGCCGAG-----GCGGCG
Galba cubensis	Z83831, JN614326-JN614331, JN614334	CCGTGTCGTGCCGCGGTGCAAGCCGTGGTCGCGCGGCG
Galba humilis	FN182190	CCGT-------CGCGGCGCAGGCCGAG-----GCGGCG
Galba schirazensis	FR772291, JN614335-JN614343	CCGGC----CATTCATTCACTTGCGTGG----TCGGCG
Galba truncatula	Y09019, Z73985, EU152270, EU728668, HQ659965, JN614346-JN614354, FR797815, FR797816	CCGT-------CCT-TTC----GCGAGG----GCGGTG
Galba viator	AF239912	CCGTGTGCCTCCGTGGTGCAAGCCGTGGTCGCGCGGCG
Galba viator	AM412222, AY057088, AY057089, JN614332, JN614333	CCGTGTGCCTCCGCGGTGCAAGCCGTGGTCGCGCGGCG
Lanx alta	HM230307*	CCGT-CGC-GCGGGGCGTCAAACCCTCGCCG-GCGGCG
Lymnaea stagnalis	EF489345	CCG----------CGGCG
Lymnaea stagnalis, Omphiscola glabra, Stagnicola palustris	Y09018, Z73984, AY427525,Y09015, Z73982, JN614365, JN614366, Y09016, Z73983	CCGCG------TGCCGG--GGCGACTCGT-GCGCGGCG
Pectinidens diaphana	EU241865, JF909497, JN614361, JN614362	CCGC-------CGC-GG--CTCGCGCCGT-G-GCGGCG
Pseudosuccinea columella	FN598152, JN614358-JN614360	CCGT-------CGGTCC--CGCGAGGGGCCG-GCGGTG
Pseudosuccinea columella	EU241866	CCGTT------CGGTCC--CGCGAGGGGCCG-GCGGTG
Radix auricularia, Radix peregra	Z73980, Y09017, Z73981, FR797817, FR797818, JN614356, JN614357	CCGCG------TGCTC---TTCGCGGGGT-GCGCGGTG
Radix natalensis	AF192272, EU152269	CCGCG------TGCTC---CTCACGGGGT-GCGCGGTG
Radix natalensis	AF192273	CCGCG------TGCTC---CTCACGGGGT-GCGTGGTG

Species	Accession number	Sequence
Radix natalensis	AF192274	CCGCG------TGCTC---CTCCCGGGGT-GCGCGGTG
Radix natalensis	JN614355	CCGCG------TGCTC---CTCGCGGGGT-GCGCGGTG

Sources: Bargues and Mas-Coma 1997 (Z73980-5); Bargues et al. 1997 (Z83831); Bargues et al. 2007 (AM412222); Bargues et al. 2009 (FN182190); Bargues et al. 2011a (FR772291); Bargues et al. 2011b (FN598151-2); Bargues et al. 2012 (JF909497); Correa et al. 2011 (JN614326-68); Dayrat et al. 2011 (HQ659965-6); Duffy et al. 2009 (AF239912, AY057088-9, EU241865-6, EU728668); Jorgensen et al. 2004 (AY577484); Klamath River at Collier Rest Area, California (HM230307*); Klussmann-Kolb et al. 2008 (EF489345) (Note: their analyses excluded variable regions, so perhaps the region was excised from the published sequence rather than originally absent); Marquez, unpublished (Y09015-9); Owyhee River, Whistling Bird Rapids, Oregon (HM230306*); Stothard et al. 2000 (AF192272-4); Vinarski et al. 2011 (FR797815-29) Vonnemann et al. 2005 (AY427525); Walker et al. 2008 (EU152269, EU152270). Only the E10 region is considered above, so there may be differences in other parts of the sequence for ones that are grouped in the table.

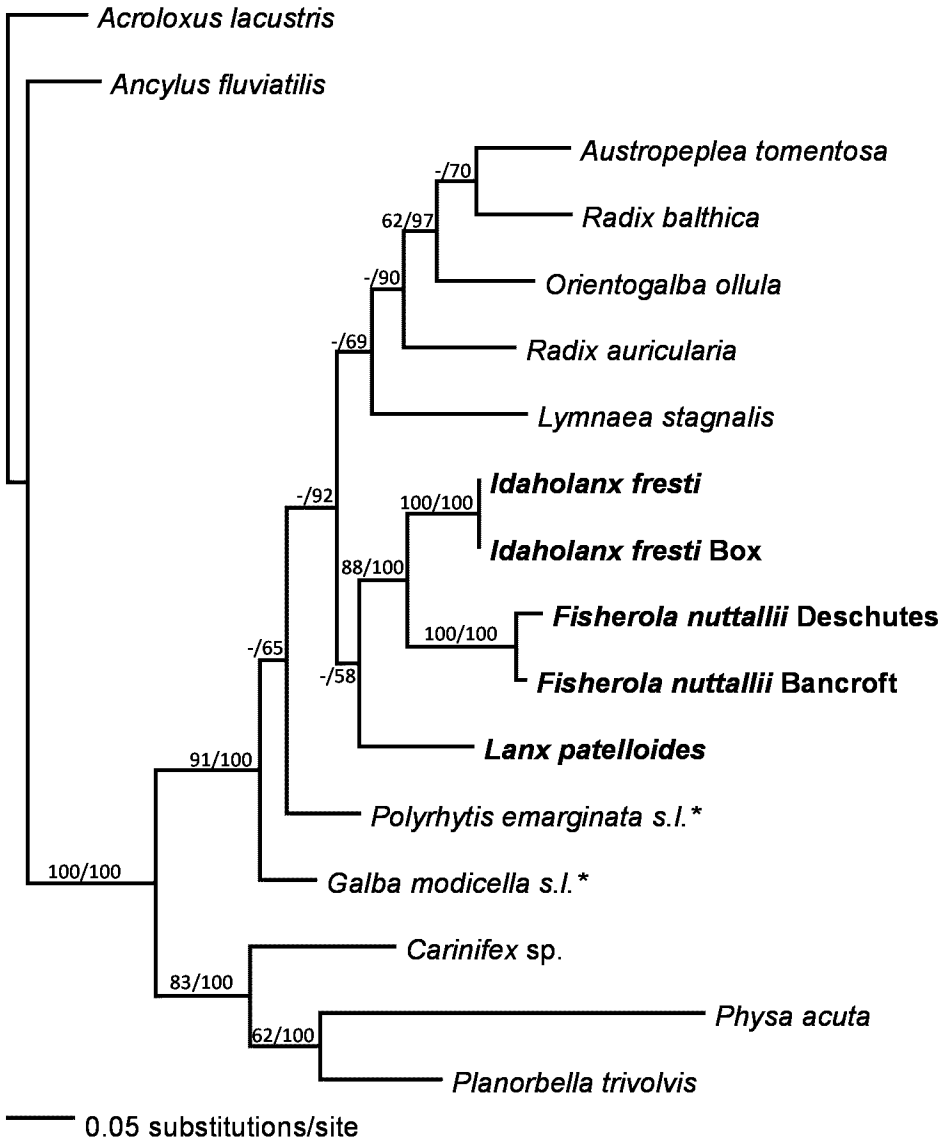

Figure 2. Phylogram of the Bayesian majority-rule consensus tree for 16S sequence data. Numbers on branches are bootstrap percentages before the slash, then Bayesian posterior probabilities. - indicates a value under 50% or 0.5 when the other method gave higher values. Taxon names in bold are lancines; starred taxa are Acellinae.

Discussion

In agreement with the anatomical data, molecular data give strong support for placing Lancinae in Lymnaeidae, which favors treating lancines as a subfamily rather than as a separate family. The relationships of lancines to other lymnaeids are not yet well-

resolved. Anatomy (Walter 1969) supports an affinity between Lancinae and the predominantly New World "advanced stagnicoline" group (subfamily Acellinae). Amphipepleinae (*Radix, Austropeplea,* and *Orientogalba*) was consistently supported as monophyletic, but the relationships between Amphipepleinae, Lancinae, and the remaining lymnaeids were not well-resolved, probably a function of the limited number of taxa. Sampling of additional lymnaeids, as well as additional genetic data (especially 28S) should greatly improve resolution of the relationships in this diverse and important but taxonomically problematic family.

The Lancinae appear supported as a monophyletic group, relatively divergent from other lymnaeids. Most of the analyses, the 18S sequence similarity, and several morphological features all support Lancinae. Morphological synapomorphies include the fully patelliform shell, shape of the penial complex and C-shaped to circular columellar muscle (Baker 1925, this work). Patelliform lymnaeids evolved convergently multiple times in the Miocene Paratethys lakes of southeastern Europe (Harzhauser and Mandic 2008), so the molecular data provides a useful test of the morphological similarities. However, the monophyly of Lancinae received low bootstrap support and, in the 16S analysis, low Bayesian posterior probabilities. Within the Lancinae, the present analyses had *Idaholanx* more closely related to *Fisherola* than to *Lanx*. Some single-gene analyses (not shown) had other patterns of intergeneric relationships in Lancinae. The weak resolution may reflect the limited number of available outgroups with 28S data. Additionally, variation in the *cox1* gene may be approaching saturation within Lancinae, as the maximum percent difference between lancines, the maximum difference between any two lymnaeids, and the differences between lymnaeids and other basommatophorans were all about 20%. As a result, convergent effects of multiple mutations in the variable sites probably obscure higher-level relationships in this data set. MacNeil (1939) reported Cretaceous lancines, so the subfamily has had enough time to develop significant genetic variation.

The genetic data consistently support recognition of three major groups within Lancinae. Two correspond to the presently recognized genera *Lanx* and *Fisherola*, while the third includes only the Banbury lanx. These results suggest that the Banbury lanx deserves recognition as a distinct genus and species (see description below). Each lancine genus was strongly supported as monophyletic. Genetic variation within *Fisherola* and *Idaholanx* was minimal. Within *Lanx*, there was one clear division and one ambiguous division between populations. The Sacramento-Pit system populations of *Lanx* (*L. patelloides*) consistently differed from those from farther west and north. These western and northern *Lanx* populations include *L. alta* in the Klamath and Umpqua systems and genetically more variable populations from the Smith and Rogue River systems. The difference between the Smith and Rogue forms and standard *L. alta* was less than the difference between *L. alta* and *L. patelloides* (in the case of 28S, only a few bases) but greater than the variation within other drainages. One specimen from the Rogue River system had both the standard *L. alta* allele and the Smith River allele for calmodulin intron, and the two calmodulin intron alleles obtained for Smith River specimens appear paraphyletic relative to the standard *L. alta* allele. The

variation within the Rogue and Smith systems therefore appears infraspecific, and the populations are assigned to *L. alta*. However, the genetic variation may be evolutionarily significant for the conservation of this species. H. B. Baker (1925) and Morrison (1955) noted that the Rogue River population did not exactly match described species from other drainages. *Lanx alta*, as defined herein, is very plastic in shell shape, so this may not be significant.

The relatively high genetic differences between lancine species contrasts with many other lymnaeids. The present results suggest that only one lancine species is present in each river system, with the exception of *Idaholanx fresti* in a few springs and *Fisherola nuttallii* in the main rivers, both in the Columbia-Snake system. The recognition of only two species in *Lanx* contrasts with most previous classifications. In particular, the widely recognized *L. subrotunda* and *L. klamathensis* are synonymized herein with *L. alta.* Previous tentative synonymization of *L. hannai* with *L. patelloides* and *F. lancides* with *F. nuttallii* are also supported (Morrison 1955, Burch 1982). Although specific populations assigned to *F. kootaniensis* and *L. newberryi* were not sampled in this study, the observed lack of variation within river systems supports previous synonymization with *F. nuttallii* and *L. patelloides*, respectively (Pilsbry 1925). Pilsbry (1925) also pointed out that *F. crassus* is an objective synonym of *F. nuttallii*, Haldeman having apparently renamed the same specimen. These synonymies suggest that lancines are relatively variable in shell shape and color pattern, as suspected by Morrison (1955). Similar results from Walther et al. (2006a, b) for the ancylids *Ferrissia* and *Laevapex* suggests that limpet-shaped Hygrophila have been taxonomically oversplit due to ecomorphic variation. Effects of environmental parameters correlate with shell shape in limpets (Basch 1963, McMahon and Whitehead 1987, Tanaka et al. 2002), and there is also extensive unexplained variation within populations (McMahon 2004). Additionally, limpet shape may be affected by the available substrate (Ridgway et al. 1999). Albrecht et al. (2004) discuss several factors potentially influencing shell shape in freshwater limpets and suggest that waves or currents and predators are the most likely selective pressures. Denny (2000) found that marine intertidal limpets are not optimized to resist wave-produced forces, presumably because the grasping force of a stationary marine limpet typically greatly exceeds observed wave forces. However, the smaller size and thin shells of freshwater limpets and the different environmental parameters for a stream with continual flow versus unpredictably directed waves during tide changes may result in different environmental pressures. Evolutionary pressures and convergent evolution relating to the limpet shape are reviewed in Vermeij (2016), including discussion of the lymnaeids.

The potential for self-fertilization in Hygrophila may account for high genetic divergence. Self-fertilization varies from rare to common in different species (Njiouku et al. 1993, Dillon et al. 2005, Puurtinen et al. 2007). The ultimate population bottleneck of a single individual would produce extreme founder effects and genetic drift, while also producing a genetically uniform founding population, thus accounting for high divergence between taxa and low variation within. Bolotov et al. (2016) found evidence for high divergence due to founder effect in the postglacial invasion of Iceland by lymnaeids. Although the long geologic history of lancines would allow for plenty

of time to accumulate changes, if the modern genera diverged fairly early, the lancines are unusually divergent in *cox1* protein sequence relative to the other lymnaeids, suggesting additional factors at work. Variation between populations within a river system was quite low. The largest difference between any two alleles within a river system was 9 to 10 bases between calmodulin intron alleles in the Smith and Rogue River populations. Outside of those, there was one individual of *L. alta* from the Klamath River with a single deletion of 6 bases in the calmodulin intron.

The low species diversity of lancines (four species from the entire Pacific Northwest region) contrasts with freshwater caenogastropods such as *Juga* and *Fluminicola* in the same river systems, which show high local endemicity within drainages (Hershler et al. 2007, Campbell et al. 2016). The habitat preferences of lancines resemble those of the associated caenogastropods, primarily in cool, flowing, well-oxygenated water, often in springs or spring-influenced areas. The potential for a single hermaphroditic individual to found a new population facilitates dispersal in Hygrophila, in contrast to the gonochoristic caenogastropods. However, unlike many lymnaeids, lancines have a poorly developed lung and are not known to survive out of water for extended periods of time, limiting their potential for dispersal by birds or other overland travel. Dispersal therefore likely occurs primarily within drainages, yet somehow lancines maintain high genetic homogeneity across much larger distances than *Juga* and *Fluminicola*, despite apparently similar ecology.

Thus, the present data supports recognition of the Banbury Springs lanx as a distinct genus and species. However, variation within *Fisherola* and *Lanx* seems to be largely ecophenotypic, giving a total of only four extant species in the subfamily Lancinae.

Systematic descriptions

Family Lymnaeidae Rafinesque, 1815

Idaholanx Clark, Campbell & Lydeard, gen. n.

http://zoobank.org/5E7508F1-1AF1-4051-AFD3-E7733DEF094F

Type species. *Idaholanx fresti* Clark, Campbell & Lydeard sp. n.

Description. *Shell* (Figs 3, 5A). Patelliform, 2.0–3.9 mm in height and 4.0–6.7 mm in length and 3.0–5.4 mm in width. Aperture elliptical. Protoconch smooth, apex positioned posteriorly. Teleoconch sculpture of concentric growth lines. Shell pale to dark reddish brown. Internal columellar muscle scar C-shaped.

Non-genital anatomy. Columnar muscle C-shaped (Fig. 5B), gap on right side, roughly central. Digestive gland, kidney and lung typical of Lymnaeidae and that seen for *Lanx* and *Fisherola* (Baker 1925, SAC personal observations). Animal colour dark grey to black.

Genitalia anatomy (Fig. 4): The distinction between the praeputium and penial sheath is not clearly defined, the praeputium and the penial sheath are both about half

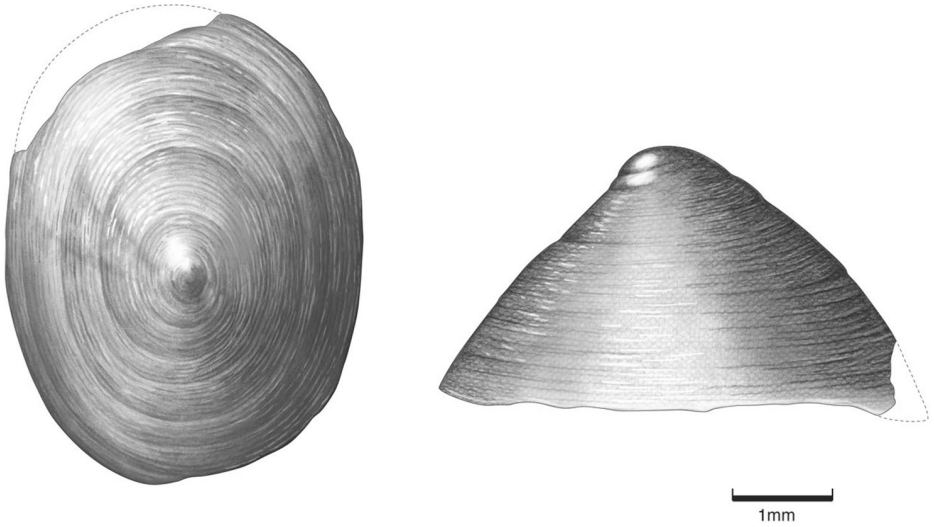

Figure 3. Shell, holotype of *Idaholanx fresti* sp. n.

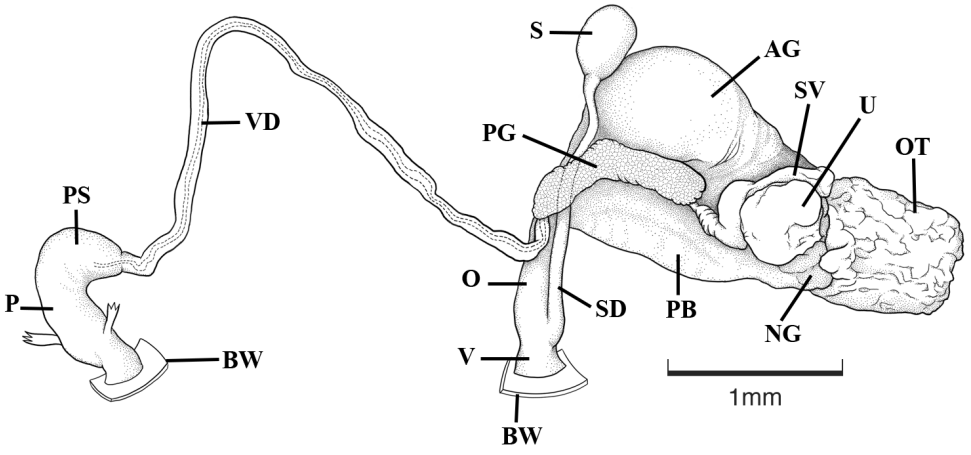

Figure 4. Reproductive anatomy, holotype of *Idaholanx fresti* sp. n. **AG** albumen gland **BW** body wall **NG** nidamental gland **O** oviduct **OT** ovotestis **P** penis **PB** pyriform body **PG** prostate gland **PS** penial sheath **S** spermatheca **SD** spermathecal duct **SV** seminal vesicle **U** uterus **V** vagina **VD** vas deferens.

the length of the penial complex. Penis is short and thick. The prostate is elongate and tube like, with the vas deferens entering apically. The uterus is strongly folded, and is surrounded by a large albumen gland. The uterus connects to the proximal part of the oviduct (oviduct I) by a short tubular duct. A roundish nidamental gland joins here. The oviduct widens into the pyriform body which is relatively large, with the anterior portion slightly more swollen than the distal portion. The short oviduct II terminates with a small vagina. The spermatheca is of moderate size and ovate. The spermathecal duct is long and widens at its opening to the vagina.

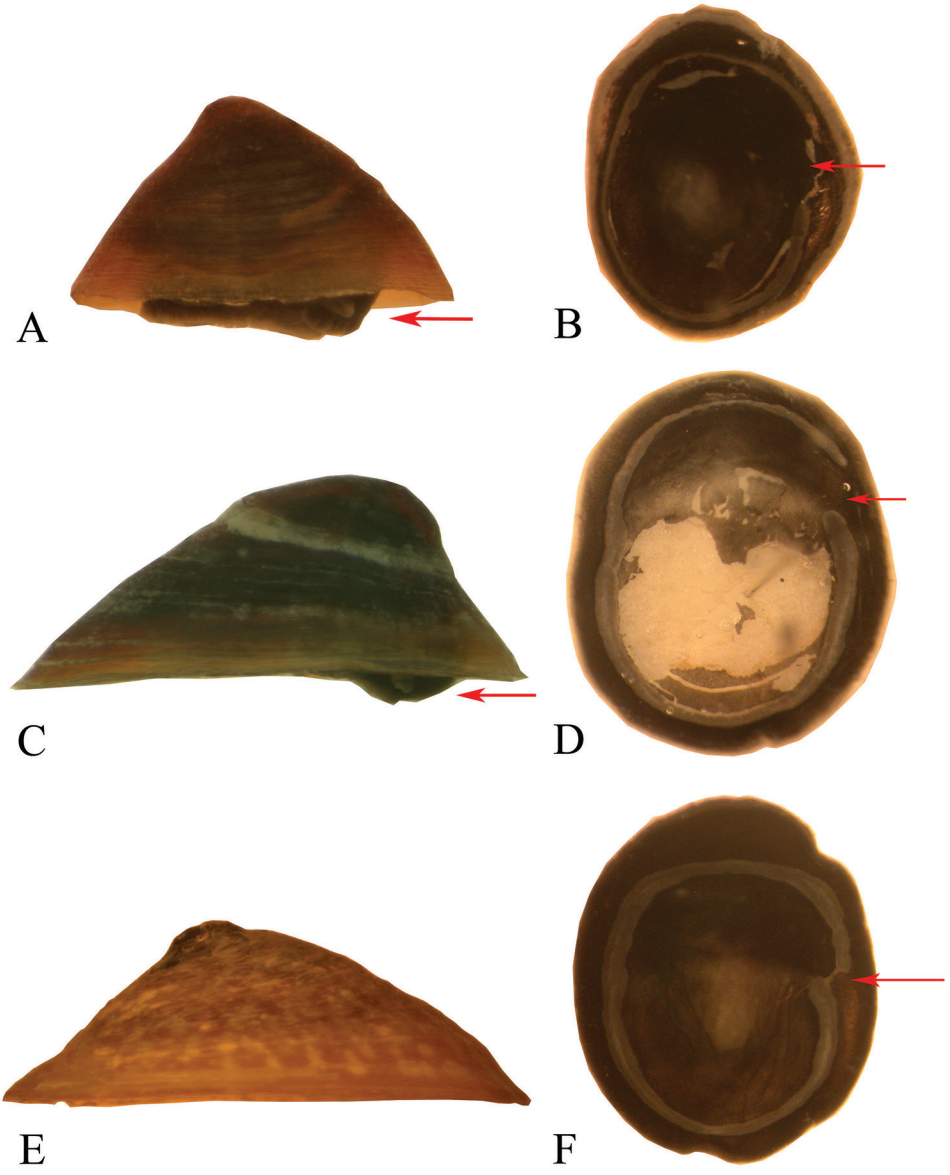

Figure 5. Comparison of shells and animals of *Idaholanx* n. gen., *Fisherola* and *Lanx*. The shells are oriented with the head of the animal facing right, while the whole animals without shells are dorsal views with the head up. *Idaholanx fresti* sp. n. **A** shell **B** whole animal. *Fisherola nuttalli*: **C** shell **D** whole animal. *Lanx patelloides*. **E** shell **F** whole animal. The red arrows indicate the position of the head in **A, C**; the position of the gap in the columella muscle in **B, D** and the narrow connection in **F**. Images not to scale.

Distribution. *Idaholanx*, as currently recognised, is known from four isolated cold water springs (Thousand, Banbury, Briggs and Box Canyon Springs) that flow into eastern side of an 8 km section of the Snake River, in Gooding County, Idaho.

Remarks. *Idaholanx* gen. n. differs from *Fisherola* by having a smaller, taller shell with its apex located towards the middle of the shell and not posteriorly. It differs from *Lanx* by being smaller and taller and having an open C-shaped columellar muscle and not a closed circular columellar muscle (Fig. 5C–F).

Etymology. A combination of Idaho, the only state the genus is known to occur in and *Lanx*, the genus it has been historically referred to and which is currently only known from northern California and southern Oregon.

Idaholanx fresti Clark, Campbell & Lydeard, sp. n.

http://zoobank.org/9B243DB3-ABD2-40CC-B9A0-BC4DD1778971

Type locality. 21–24th runs of the lower outflow of Banbury Springs, Gooding County, Idaho, U.S.A. 42°41'20.5"N, 114°49'18"W, 879m, 4 Sept 2003. Coll: T. Frest & E. Johannes.

Type material. Holotype Field Museum of Natural History (FMNH) 342894 (dissected), paratypes FMNH 342895, DCS, SAC S.26084; FMNH 342896, DCS, SAC S.26085 (shell), 13–15th runs of the lower outflow of Banbury Springs, about middle of spring complex along trail with wooden bridges, 42°41'21"N, 114°49'18"W, 21 Sept 1989; FMNH 342901, lower outflow of Banbury Springs, 42°41'21.8"N, 114°49'19.4"W, 11 Jan 2006; FMNH 342904, SAC S.23967 (shell), lower outflow of Banbury Springs, 42°41'21"N, 114°49'18"W, 6 Aug 2006; FMNH 342897 (shells), SAC S.25699 (shell), lower outflow of Banbury Springs, 42°41'21.8"N, 114°49'18.5"W, 25 May 2016.

Additional material examined. Idaho. *Gooding County*. FMNH 342905 (shells), SAC S.25842 (shell) lower outflow of Box Canyon Spring, about 110m below diversion dam, 42°42'26.5"N, 114°49'02"W, 24 May 2016; FMNH 342898 (shells) lower outflow of Box Canyon Spring, about 160m below diversion dam, 42°42'27"N, 114°49'04"W, Apr 2016; FMNH 342899 (1 dissected), FMNH 342900 (shell) lower outflow of Box Canyon Spring, about 400m below diversion dam, 42°42'27.5"N, 114°49'14.5"W, 11 Jan 2006; FMNH 342902 (1 dissected) outflow of Briggs Spring just below road crossing, 42°40'26.3"N, 114°48'33.4"W, 24 Jan 2006; FMNH 342906 (shells), SAC S.25707 (shell) outflow of Briggs Spring about 15m below diversion dam, 42°40'26.9"N, 114°48'39.2"W, 24 May 2016; FMNH 342903 (1 dissected), outflow of Thousand Springs, 42°44'51.7"N, 114°50'42.3"W, 24 Jan 2006.

Description. Shell and anatomical description as for genus. Holotype 2.8 mm in height, 4.8 mm in length and 3.6 mm in width.

Etymology. Named for the late Dr Terrence J. Frest, for his significant contribution to the knowledge of land and freshwater molluscs of North America, especially of the western states and who was also a colleague and friend.

Ecology. This species is found under and on the sides of stones in cold flowing water in the range of 12.2–16.7 °C. It is not known exactly when egg laying occurs or how many eggs are laided at a time. It could be similar to the closely related species

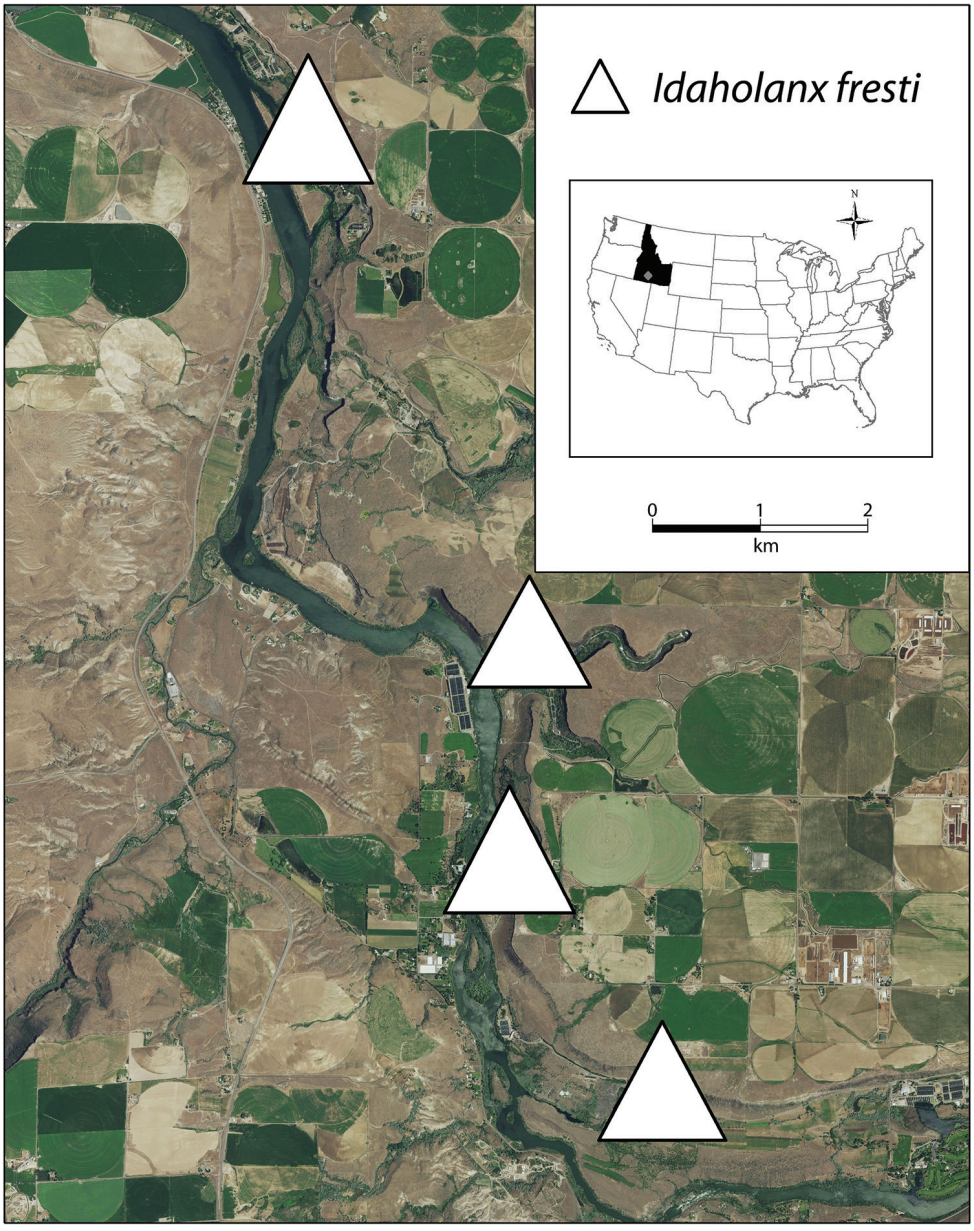

Figure 6. Distribution of *Idaholanx fresti*. Insets show location of Idaho in the US and of the springs in Idaho.

Fisherola nuttallii (Haldeman, 1841) which occurs in the Snake River and other major tributaries of, as well as the main stem of the Columbia River. Coutant and Becker (1970) observed *Fisherola nuttallii* laying transparent, suboval gelatinous egg masses containing between 1–12 eggs laid from April to June in the Washington, U.S.A. portion of the Columbia River. They noted that growth rates increased as the availability

of food and temperature increased and that the life span was about a year, with adult mortality increasing rapidly after egg laying and after the temperatures increased above 17.3°C.

Distribution. Currently known from four small to large isolated spring complexes along an eight kilometer stretch of the Snake River in Gooding County, Idaho (Fig. 6).

Conservation status. Listed as endangered under the U.S. Endangered Species Act of 1973, under the name Banbury Springs lanx, *Lanx* sp.

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Dave Hopper (U.S. Fish & Wildlife Service, Boise, Idaho) and Steve Lysne (formerly at the U.S. Fish & Wildlife Service, Boise now at the College of Western Idaho, Boise, Idaho) helped with collecting specimens, guiding one of us (SAC) to three of the four known locations of *Idaholanx* and providing access to habitat and ecological data they have collected. Nicolas Hardy, Idaho BLM, Boise, Idaho generated the map. Juna Kurihara did the illustrations of the shell and reproductive anatomy of *Idaholanx fresti*. Ed Johannes and the late Terry Frest collected specimens and provided copies of their reports. The ABI 3100 automated sequencer was funded by a NSF equipment grant to C. Lydeard, R. Mayden, M. Powell, and P. Harris (DBI-0070351). John Tucker collected the *Polyrhytis exilis* specimens. Andrew Campbell helped collect the new *Hinkleyia caperata* specimen. The TNT program is available with the sponsorship of the Willi Hennig Society.

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Chlorpyrifos

Chlorpyrifos is an organophosphate insecticide, acaricide and miticide used primarily to control foliage and soil-borne insect pests.

On November 2, 2023, the U.S. Court of Appeals for the Eighth Circuit issued a ruling vacating EPA's final rule revoking all food tolerances of chlorpyrifos and remanding the matter to EPA for further proceedings. As a result of this decision, all food tolerances for chlorpyrifos that existed prior to the issuance of the final rule revoking these tolerances were reinstated once the court's mandate was issued on December 28, 2023. On February 5, 2024, EPA issued a Federal Register notice to amend the Code of Federal Regulations to reflect the court's reinstatement of those tolerances.

The Eighth Circuit's decision stated that EPA should have considered modification of tolerances in addition to complete revocation and noted that the Agency had "identified 11 specific candidates" of food and feed crop uses in a Proposed Interim Registration Review Decision (PID) for chlorpyrifos that EPA issued in 2020. Consequently, the Agency expects to expeditiously propose a new rule to revoke the tolerances associated with all but the 11 uses referenced by the court. EPA is also engaged in discussions with the registrants to further reduce exposures associated with the 11 uses of chlorpyrifos that were referenced by the Eighth Circuit.

EPA will continue to work to protect farmworkers, endangered species and their habitats, and the nation's most vulnerable populations (including children) through its ongoing registration review and ESA processes for chlorpyrifos uses.

At this time, final cancelations orders, including their terms for existing stocks of products subject to those cancelation orders, and related return programs for chlorpyrifos products, remain in place, unless and until amended by EPA.

On this page:

Basic Information

Chlorpyrifos has been used as a pesticide since 1965 in both agricultural and non-agricultural areas.

On August 20, 2021, EPA issued a final rule revoking all chlorpyrifos tolerances and setting an expiration date for those tolerances of February 28, 2022. Applications of chlorpyrifos to food commodities after February 28, 2022 resulted in food being considered adulterated; distribution of adulterated food in interstate commerce is unlawful under the FFDCA. On

November 2, 2023, the U.S. Court of Appeals for the Eighth Circuit issued a ruling vacating EPA's final rule revoking all food tolerances of chlorpyrifos and remanding the matter to EPA for further proceedings. Those tolerances were reinstated on December 28, 2023 when the Eighth Circuit issued its mandate of its November 2023 decision. EPA also issued a Federal Register notice to amend the Code of Federal Regulations to reflect the court's reinstatement of those tolerances.

Non-agricultural, non-food uses were unaffected and will be considered as EPA completes its registration review of this chemical.

Non-food products are sold as liquids, granules, water-dispersible granules, wettable powders, and water-soluble packets, and may be applied by ground equipment.

Using Chlorpyrifos Products Safely

In accordance with the Federal Insecticide, Fungicide, Rodenticide Act (FIFRA), EPA only registers a pesticide when it determines that it will not cause unreasonable adverse effects on humans or the environment, while considering the economic, social, and environmental costs and benefits of the use of the pesticide. EPA reviews and approves label directions to ensure that pesticides can be used without posing unreasonable adverse effects to the environment, including ensuring that the use will not result in dietary risk inconsistent with the FFDCA safety standard.

The key to ensuring that the pesticide will not cause unreasonable adverse effects is for all users to read and closely follow the label directions.

The current chlorpyrifos labels require workers handling and applying chlorpyrifos to wear additional personal protective equipment (chemical resistant gloves, coveralls, respirators).

EPA Actions and Regulatory History

Since its first registration in 1965, chlorpyrifos has been reviewed several times by EPA for tolerance reassessment, reregistration, and most recently, as part of its ongoing registration review <https://epa.gov/pesticide-reevaluation/registration-review-process>. The following timeline summarizes the work EPA has done to ensure that, as science and technology evolve, registered chlorpyrifos products remain safe for use.

2000 – Voluntary Agreement to Eliminate, Phase Out and Modify Certain Uses

In 1996, the Food Quality Protection Act (FQPA) set a more stringent safety standard to be especially protective of children. After finalizing the chlorpyrifos risk assessments for reregistration, EPA identified the need to modify certain chlorpyrifos uses to meet the revised standard of safety, and to address health and environmental risks from chlorpyrifos exposure. In 2000, the registrants of chlorpyrifos voluntarily entered into an agreement with EPA to eliminate, phase out, and modify certain uses. Some examples of the voluntary cancellations and modifications in the agreement include:

- Eliminating most homeowner uses, except ant and roach baits in child resistant packaging and fire ant mound treatments, and phasing out all termiticide uses.
- Discontinuing all uses of chlorpyrifos products in the United States on tomatoes, restricting use on apples to pre-bloom and dormant application, and lowering the grape tolerance (maximum residue level) to reflect the labeled dormant application.

2002 – Label Changes to Ensure Environmental and Worker Safety

In 2002, EPA made a number of changes to the required safety measures that improved safety for the environment and for those applying this pesticide including:

- Use of buffer zones to protect water quality, fish and wildlife;

- Reductions in application rates per season on a variety of crops including citrus and corn; and
- Increase in amount of personal protective equipment <https://epa.gov/emergency-response/personal-protective-equipment> to mitigate risk to agricultural workers.

Read the 2006 Registration Eligibility Decision (RED) for chlorpyrifos, which finalized the 2002 Interim RED, and includes an overview of the chlorpyrifos human health risk assessment for reregistration <https://www3.epa.gov/pesticides/chem_search/reg_actions/reregistration/red_pc-059101_1-jul-06.pdf>.

2011 – Preliminary Human Health Risk Assessment

In 2011, as part of the registration review process, EPA completed a comprehensive preliminary human health risk assessment for all chlorpyrifos uses. This assessment included the results of extensive new research and the findings of a number of new studies that had become available since the Agency's last human health risk assessment for chlorpyrifos, completed in June 2000.

Read the 2011 human health risk assessment for chlorpyrifos.

2012 – Spray Drift Mitigation and Changes to Application Rates

In 2012, EPA significantly lowered the aerial pesticide application rates and created "no-spray" buffer zones for ground, airblast and aerial application methods around public spaces, including recreational areas, schools, homes and other sensitive areas to be protective of children and other bystanders.

Read the 2012 Spray Drift Mitigation Decision for chlorpyrifos.

2014 – Revised Human Health Risk Assessment

In 2014, as part of the registration review process, EPA completed a revised human health risk assessment for all chlorpyrifos uses. The assessment updated the June 2011 preliminary human health risk assessment based on new information received, including public comments. EPA factored in exposures from multiple sources including from the exposures from food and water, from inhaling the pesticide and through the skin. EPA considered all populations including infants, children, and women of child-bearing age. EPA incorporated information from a 2012 assessment of spray drift exposure and as well as new restrictions put into place to limit spray drift.

Read the 2014 human health risk assessment for chlorpyrifos.

2016 – Revised Human Health Risk Assessment

After receiving public comments on the 2014 risk assessment and feedback from the FIFRA Scientific Advisory Panel (SAP), EPA revised its human health risk assessment for chlorpyrifos in 2016, which was published subsequent to the issuance of the proposed rule, and retained the 10X FQPA Safety Factor.

Read the 2016 human health risk assessment for chlorpyrifos.

2020 – Draft Ecological Risk Assessment and Revised Human Health Risk Assessment

In Sept. 2020, EPA issued the following assessments: *Chlorpyrifos: Draft Ecological Risk Assessment for Registration Review,* <https://www.regulations.gov/document/epa-hq-opp-2008-0850-0940> the *Chlorpyrifos: Third Revised Human Health Risk Assessment for Registration Review* *<https://www.regulations.gov/document/epa-hq-opp-2008-0850-0944>, and the Updated Chlorpyrifos Refined Drinking Water Assessment for Registration Review*.

The draft ecological risk assessment describes the ecological risks posed by the uses of chlorpyrifos in the context of FIFRA, by providing a range of screening risk quotients. In the 2020 Third Revised Human Health Risk Assessment, EPA utilized the same

endpoint and points of departure as those used in the 2014 human health risk assessment. This was done because the Agency concluded that the science addressing neurodevelopmental effects remained unresolved and further evaluation of the science during the remaining time for completion of registration review was warranted.

While in the 2020 revised human health risk assessment the Agency determined that risks from exposures to chlorpyrifos residues in food were not of concern, drinking water exposures significantly add to those risks. When considering the drinking water contribution from all registered uses, the Agency's levels of concern were exceeded when combined with food and residential exposures.

Due to the large number of files in support of the Updated Chlorpyrifos Refined Drinking Water Assessment for Registration Review, instructions to access to those attachments are provided below. **Download and Unzip Instructions**:

1. Hover over the file name, right-click the file link.
2. Save file to a local directory following displayed instructions.
3. To unzip all the contents of the zipped folder, right-click the zip file, select Extract All, and then follow the instructions.
4. When accessing additional zip files within the subfolders, step 3 will need to be repeated.

Attachments

- Attachment 1 - Master Use Summary (PDF) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-1.pdf>(14 pp, 640 K)
- Attachment 2 - Usage Files (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-2.zip>(1 pg, 2.5 MB)
- Attachment 3 - (Modeling Input and Output Files) PCA Analysis (XLSX) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3.xlsx>(1 pg, 12.9 MB)
- Attachment 3 - (Modeling Input and Output Files) PCA-PCT Aggregate Analysis, Upper Bound HUC04 (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-ubhuc04.zip>(1 pg, 198.9 MB)
- Attachment 3 - (Modeling Input and Output Files) PCA-PCT Aggregate Analysis, Upper Bound HUC07a (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-ubhuc07a.zip>(1 pg, 198.9 MB)
- Attachment 3 - (Modeling Input and Output Files) PCA-PCT Aggregate Analysis, Upper Bound HUC07b (1 of 2) (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-ubhuc07b-results-a.zip>(1 pg, 615 MB)
- Attachment 3 - Modeling Input and Output Files) PCA-PCT Aggregate Analysis, Upper Bound HUC07b (2 of 2) (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-ubhuc07b-results-b.zip>(1 pg, 541.8 MB)
- Attachment 3 - (Modeling Input and Output Files) PCA-PCT Aggregate Analysis, Upper Bound HUC09 (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-ubhuc09.zip>(1 pg, 138.6 MB)
- Attachment 3 - (Modeling Input and Output Files) Chlorpyrifos SIAB Use and Usage Matrix (XLSX) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-usagematrix.xlsx>(1 pg, 143 K)
- Attachment 3 - (Modeling Input and Output Files) PWC Average Use Rates (1 of 2) (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-use-rates-a.zip>(1 pg, 121.2 MB)
- Attachment 3 - (Modeling Input and Output Files) PWC Average Use Rates (2 of 2) (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-use-rates-b.zip>(1 pg, 110.7 MB)
- Attachment 3 - (Modeling Input and Output Files) PWC Average Upper Bound Rates (1 of 2) (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-upp-rates-a.zip>(1 pg, 125.9 MB)
- Attachment 3 - (Modeling Input and Output Files) PWC Average Upper Bound Rates (2 of 2) (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-3-upp-rates-b.zip>(1 pg, 106.8 MB)
- Attachment 4 - Monitoring Data Files (ZIP) <https://www3.epa.gov/pesticides/nas/chlorpyrifos/dwa/attachment-4.zip>(1 pg, 736.4 MB)

The assessments are available in the public docket in EPA-HQ-OPP-2008-0850 <https://www.regulations.gov/docket/epa-hq-opp-2008-0850> at www.regulations.gov <https://www.regulations.gov/>.

2020 – Proposed Interim Decision

In Dec. 2020, EPA released the *Proposed Interim Decision for the Registration Review of Chlorpyrifos* <https://epa.gov/ingredients-used-pesticide-products/proposed-interim-decision-registration-review-chlorpyrifos> for a 60-day public comment period. EPA also invited comments on the benefits assessments, the Sept. 2020 revised human health risk assessment, draft ecological risk assessment, and revised drinking water assessment. By holding the comment period at the same time, the public had access to more information and could provide more informed, robust comments. On Feb. 5, 2021, EPA extended the public comment period for an additional 30 days until Mar. 7, 2021. EPA is currently reviewing public input and will respond to comments prior to issuing an interim decision.

EPA Action on the Federal Food, Drug, and Cosmetic Act (FFDCA) Petition and Litigation

2007 FFDCA Petition

In Sept. 2007, environmental advocacy organizations submitted a petition <https://www.nrdc.org/sites/default/files/hea_10072201a.pdf> to EPA under FFDCA, requesting that EPA revoke all chlorpyrifos tolerances and cancel all chlorpyrifos registrations.

2015 Proposed rule to revoke tolerances

In 2015, EPA proposed to revoke chlorpyrifos tolerances. (80 FR 69080 (Nov. 6, 2015)). Based on data available at the time, the Agency concluded that it was unable to make a safety finding as required under FFDCA due to exposure to drinking water in certain watersheds. EPA acknowledged that it was continuing to work on additional hazard analysis and refinements to its drinking water assessment. Then in 2016, EPA revised its human health risk assessment and drinking water exposure assessment. The Agency sought additional comment on those documents, which provided further support for the tolerance revocation proposal (81 FR 81049 (Nov. 17, 2016)).

2017-2019 – Denial of Petition to Revoke Tolerances

In Mar. 2017, EPA denied the 2007 petition requesting revocation of all pesticide tolerances for chlorpyrifos. The Agency concluded that despite several years of study, the science addressing neurodevelopmental effects remains unresolved and further evaluation of the science during the remaining time for completion of registration review is warranted. As a part of the ongoing registration review, the Agency stated that it would continue to review the science addressing neurodevelopmental effects of chlorpyrifos.

Read the Federal Register notice announcing our response to the petition .

Several parties filed objections to EPA's denial of the petition. The Agency responded, by issuing an order denying those objections. EPA concluded that the data provided with the 2007 petition were not sufficiently valid, complete, and reliable to support the request for revocation.

Read the Federal Register notice announcing our response to the petition .

Ninth Circuit litigation

Environmental advocacy groups and several States challenged EPA's denial orders in the U.S. Court of Appeals for the Ninth Circuit. In Apr. 2021, the Ninth Circuit <https://cdn.ca9.uscourts.gov/datastore/opinions/2021/04/29/19-71979.pdf> issued its decision, finding that EPA's denial was arbitrary and capricious based on the record before the Court and directing EPA to grant the petition, issue a final rule revoking the tolerances or modifying the tolerances if EPA could determine the tolerances were safe, and to modify or cancel food-use registrations for chlorpyrifos under FIFRA.

2021 – Final Tolerance Rule

In Aug. 2021, EPA released the Final Tolerance Rule for Chlorpyrifos <https://www.regulations.gov/document/epa-hq-opp-2021-0523-0001>, which revoked all tolerances for chlorpyrifos for chlorpyrifos. With this action, EPA complied with the Ninth Circuit's order directing EPA to issue a final rule in response to the 2007 petition. The final rule for chlorpyrifos is located in docket EPA-HQ-OPP-2021-0523 <https://www.regulations.gov/docket/epa-hq-opp-2021-0523> at www.regulations.gov <https://www.regulations.gov/>.

On Feb. 25, 2022 <https://epa.gov/newsreleases/epa-takes-next-step-keep-chlorpyrifos-out-food-protecting-farmworkers-and-childrens>, EPA released its response denying the objections and requests for hearing on those objections to the final rule as well as requests to stay the final rule. The response to the objections for chlorpyrifos is located in docket EPA-HQ-OPP-2021-0523 <https://www.regulations.gov/docket/epa-hq-opp-2021-0523> at www.regulations.gov <https://www.regulations.gov/>. EPA also issued letters to the registrants of chlorpyrifos products with registered food uses. confirming that tolerances expired as of Feb. 28, 2022, and requesting registrants act to cancel these uses.

The majority of registrants submitted cancellation requests and/or label amendments to reflect the tolerance revocation.

On Aug. 31, 2022, EPA issued a cancellation order <https://www.federalregister.gov/documents/2022/08/31/2022-18838/cancellation-order-for-certain-chlorpyrifos-registrations> responding to several requests to voluntarily cancel whole chlorpyrifos products. In addition, on Dec. 14, 2022, EPA published a notice of receipt of voluntary requests to cancel <https://www.regulations.gov/docket/epa-hq-opp-2022-0223> certain pesticide registrations and terminate food uses. On Dec. 14, 2022, EPA issued a Notice of Intent to Cancel <https://www.regulations.gov/document/epa_frdoc_0001-29051> (NOIC) three chlorpyrifos pesticide products because the registrant's request for voluntary cancellation did not remove all food uses from the labels.

2023 Update

EPA's 2021 Final Tolerance Rule was challenged by a chlorpyrifos registrant and several grower groups in the Eighth Circuit Court of Appeals. On November 2, 2023, the Eighth Circuit issued a ruling vacating EPA's final rule and remanding the matter to EPA for further proceedings.

As of the issuance of the Eighth Circuit's mandate on December 28, 2023, all chlorpyrifos tolerances are automatically in effect once again.

The Eighth Circuit's decision stated that EPA should have considered modification of tolerances in addition to complete revocation and noted that the Agency had "identified 11 specific candidates" of food and feed crop uses in a PID EPA issued in 2020. Consequently, the Agency expects to expeditiously propose a new rule to revoke the tolerances associated with all but the 11 uses referenced by the court.

EPA is also engaged in discussions with the registrants to further reduce exposures associated with the 11 uses of chlorpyrifos that were referenced by the Eighth Circuit, a process that will also include taking into account the 2020 draft document and public comments received thereto. This approach would allow use on alfalfa, apple, asparagus, cherry (tart), citrus, cotton, peach, soybean, strawberry, sugar beet, wheat (spring), and wheat (winter) with additional restrictions for geographic location and rate of application to address safety of the tolerances, as well as potential additional restrictions to protect farmworkers and other vulnerable populations, and vulnerable species and their habitats.

In addition, chlorpyrifos is currently under registration review and the Agency continues to work to implement the National Marine Fisheries Service's 2022 Biological Opinion <https://www.fisheries.noaa.gov/resource/document/biological-opinion-chlorpyrifos-diazinon-and-malathion> on chlorpyrifos, diazinon, and malathion. EPA will continue to work to protect farmworkers, endangered species and their habitats, and the nation's most vulnerable populations (including children) through its ongoing registration review and ESA processes for chlorpyrifos uses.

2024 Update

On February 5, 2024, the U.S. Environmental Protection Agency issued a Federal Register Notice to amend the Code of Federal Regulations to reflect the November 2, 2023 Eighth Circuit Court of Appeals' ruling. The Eighth Circuit Court officially issued its

mandate for this decision on December 28, 2023, which immediately reinstated the chlorpyrifos tolerances.

EPA is also engaged in discussions with the registrants to further reduce exposures in specific geographic locations and at specific application rates associated with these 11 uses of chlorpyrifos to address safety of the tolerances.

At this time, final cancellation orders, including their terms for existing stocks of products subject to those cancellation orders and related return programs for chlorpyrifos products, remain in place unless and until amended by EPA.

Registration Review Schedule

Chlorpyrifos is still under evaluation in registration review, a program that re-evaluates all pesticides on a 15-year cycle. Registration review ensures pesticides will not cause unreasonable adverse effects when used according to label directions and precautions, and that there is a reasonable certainty of no harm from dietary and residential exposure. All documents related to the registration review can be located in the registration review docket EPA-HQ-OPP-2008-0850 <https://www.regulations.gov/docket/epa-hq-opp-2008-0850> at www.regulations.gov <https://www.regulations.gov/>.

EPA will continue to evaluate the remaining chlorpyrifos uses as part of the ongoing registration review for chlorpyrifos. Anticipated milestones in the completion of the chlorpyrifos registration review may include:

- Responding to comments in a document that addresses comments on the PID, the risk assessments, and benefits assessments;
- Developing an interim decision <https://epa.gov/pesticide-reevaluation/registration-review-process#decision> that incorporates the developments since the PID; and
- Evaluating possible endocrine effects associated with the use of chlorpyrifos in the Endocrine Disruptor Screening Program (EDSP).

EPA Action under the Endangered Species Act (ESA)

On Jan. 18, 2017, as part of the registration review process and to meet its obligation under Section 7 of the ESA, EPA issued nationwide biological evaluations (BEs) on chlorpyrifos, diazinon, and malathion to assess risks to threatened and endangered (listed) species from registered uses of these organophosphate pesticides. EPA also initiated formal consultation with the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) (together, the Services) based on the BE conclusions that these pesticides may affect certain listed species and/or their designated critical habitats.

In 2019, EPA reinitiated formal consultation on these pesticide products to consider new information that was not available when NMFS issued its final biological opinion (BiOp). As part of the reinitiated consultation, EPA and NMFS provided opportunities for public and stakeholder engagement, including an opportunity for pesticide registrants to submit additional information and inform EPA and NMFS of pending changes to product labeling. EPA also supplied additional pesticide usage data to inform NMFS's analysis.

In March 2022 <https://epa.gov/pesticides/epa-posts-draft-revised-biological-opinion-malathion-chlorpyrifos-and-diazinon-public>, EPA released NMFS's draft revised BiOp for malathion, chlorpyrifos and diazinon for public comment, specifically requesting input on potential mitigation measures. The draft revised BiOp <https://www.regulations.gov/document/epa-hq-opp-2022-0172-0001> identified species that could be jeopardized by how malathion, chlorpyrifos and diazinon were used before this consultation process.

However, during the consultation process, NMFS, EPA, the U.S. Department of Agriculture, and pesticide registrants worked together to identify mitigation measures to address potential effects to listed species. Registrants involved in the consultation agreed to implement these measures by modifying their product labels. To help inform the final BiOp, EPA provided NMFS with the comments received on the draft BiOp and a summary of the comments.

In the final BiOp <https://www.fisheries.noaa.gov/national/consultations/pesticide-consultations#information-on-pesticide-consultations>, NMFS considered the agreed-upon mitigation measures and determined that, once implemented, they will reduce the potential

effects of malathion, chlorpyrifos and diazinon products, and will avoid jeopardy to listed species and adverse modification of designated critical habitat. The NMFS final biological opinion was completed and published on June 30, 2022.

EPA has issued letters to the registrants of chlorpyrifos requesting registrants to take action to implement these mitigation measures as applicable to their products. EPA is reviewing those amended labels.

Ingredients Used in Pesticide Products Home <https://epa.gov/ingredients-used-pesticide-products>

Basic Information About Pesticide Ingredients <https://epa.gov/ingredients-used-pesticide-products/basic-information-about-pesticide-ingredients>

Pesticide Groups <https://epa.gov/ingredients-used-pesticide-products/chemically-related-groups-active-ingredients>

Pesticide Product Information System <https://epa.gov/ingredients-used-pesticide-products/pesticide-product-information-system-ppis>

About Biopesticides <https://epa.gov/ingredients-used-pesticide-products/what-are-biopesticides>

Contact Us <https://epa.gov/ingredients-used-pesticide-products/forms/contact-us-about-ingredients-used-pesticide-products> to ask a question, provide feedback, or report a problem.

LAST UPDATED ON FEBRUARY 7, 2024

Discover.

Accessibility Statement <https://epa.gov/accessibility/epa-accessibility-statement>

Budget & Performance <https://epa.gov/planandbudget>

Contracting <https://epa.gov/contracts>

EPA www Web Snapshot <https://epa.gov/utilities/wwwepagov-snapshots>

Grants <https://epa.gov/grants>

No FEAR Act Data <https://epa.gov/ocr/whistleblower-protections-epa-and-how-they-relate-non-disclosure-agreements-signed-epa>

Plain Writing <https://epa.gov/web-policies-and-procedures/plain-writing>

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Hotlines <https://epa.gov/aboutepa/epa-hotlines>

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Washington Department of FISH & WILDLIFE (/)

Also in this section

Species & Habitats

- Species in Washington (/species-habitats/species)
- Ecosystems in Washington (/species-habitats/ecosystems)
- Living with wildlife (/species-habitats/living)
- At-risk species (/species-habitats/at-risk)
- Habitat recovery and protection (/species-habitats/habitat-recovery)

Contaminants monitored

The TBiOS team measures a wide range of toxic contaminants across a broad group of organisms, including Pacific herring, English sole, blue mussels, and Pacific salmon. Below is a list of contaminant groups we typically monitor in Puget Sound.

Contaminants Currently Monitored

Group Name	Analytes	Typical Biota Monitored
Persistent Organic Pollutants	11 Polybrominated diphenylethers or PBDEs	fish and invertebrates
Persistent Organic Pollutants	40 Polychlorinated Biphenyls or PCBs	fish and invertebrates
Organochlorine Pesticides	DDTs, DDDs, DDEs, chlordanes, hexachlorocyclohexanes, hexachlorobenzene, Aldrin, Dieldrin, Endosulfan I, and Mirex	fish and invertebrates
Polycyclic Aromatic Hydrocarbons	42 PAHs	invertebrates
Polycyclic Aromatic Hydrocarbons	Metabolites of PAHs	fish bile

Aquatic invasive species (/species-habitats/invasive)

Wildlife diseases (/species-habitats/diseases)

Amphibians and reptiles of Washington (/species-habitats/amphibians-reptiles)

Marine toxic contaminants (/species-habitats/science/marine-toxics)

Wildlife viewing (/species-habitats/wildlife-viewing)

Group Name	Analytes	Typical Biota Monitored
Inorganic Metals	Mercury, lead, cadmium, arsenic, zinc, copper, chromium	fish and mussels

Contaminants of Emerging Concern (newly developed or employed analyses, or analyses being developed)

Group Name	Analytes	Typical Biota Monitored
Estrogenic compounds	Bisphenols, synthetic and natural estrogens	fish and mussels
Pharmeceuticals and Personal Care Products	142 compounds	fish and mussels
Perfluorinated Chemicals	13 compounds including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS)	fish and mussels
Alkylphenols	4-nonylphenol (NP), 4-n-octylphenol (OP), 4-nonylphenol monoethoxylate (NP1EO) and 4-nonylphenyl diethoxylate (NP2EO)	fish and mussels
Current Use Pesticides	Organochlorine, organophosphorus, organonitrogen, triazine, and pyrethroid pesticides	fish and mussels

Log in to the WILD licensing website (https://fishhunt.dfw.wa.gov/#/login)

Get razor clam information (/fishing/shellfishing-regulations/razor-clams)

Event calendar (/events)

Submit a photo (/share)

Report a violation (/about/enforcement/report)

Report a website error (/website-error-report)

(/about)

Contact us (/about/contact)

Regional offices (/about/regional-offices)

Enforcement (/about/enforcement)

Media resources (/about/contact/media)

Fish and Wildlife Commission (/about/commission)

Public Records Requests (/about/administration/public-records)

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Rule making (/about/regulations)

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Errata

For the Industrial Stormwater General Permit Issued on November 20, 2019 and effective on January 1, 2020.

November 25, 2019

Ecology corrected S6.C.2. Footnote 6. Footnote 6 defines the Puget Sound Sediment Cleanup Sites. Ecology has added Oakland Bay/Shelton Harbor to the list.

[6] ***Puget Sound Sediment Cleanup Site*** means: Category 4B (Sediment) portions of Budd Inlet (Inner), Commencement Bay (Inner), Commencement Bay (Outer), Dalco Passage and East Passage, Duwamish Waterway (including East and West Waterway), Eagle Harbor, Elliot Bay, Hood Canal (North), Liberty Bay, Rosario Strait, Sinclair Inlet, and Thea Foss Waterway; Category 5 (Sediment) portions of the Duwamish Waterway; Category 4A (Sediment) portions of Bellingham Bay (Inner); and the Everett/Port Gardener, Oakland Bay/Shelton Harbor, and Port Angeles Harbor sediment cleanup areas, as mapped on Ecology's ISGP website. All references to Category 4A, 4B and 5 pertain to the 2012 EPA-approved Water Quality Assessment.

December 17, 2019

Ecology corrected two typos in Table 3. The changes are marked with underlined blue text and strikethrough red text. The two typos were leaving off the NAICS code 113310 in the Wood Product Manufacturing category and transposing two numbers on the Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing category.

Table 1: Additional Benchmarks and Sampling Requirements Applicable to Specific Industries (screenshot of changes in table)

Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
5. Timber Product Industry (321xxx), Paper and Allied Products (322xxx), Wood Product Manufacturing (321xxx,113310)					
COD	mg/L	120	SM5220-D	10	1/quarter
TSS	mg/L	100	SM2540-D	5	1/quarter
6. Transportation (482xxx-485xxx), Petroleum Bulk Stations and Terminals (4247xx), Transportation Equipment Manufacturing (336xxx), Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing (~~53421~~53241x)					
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
7. Coal Mining (2121xx), Oil and Gas Extraction (2111xx), Nonmetallic Mining and Quarrying, except Fuels (2123xx), Petroleum and Coal Products Manufacturing (324xxx), Nonmetallic Mineral Product Manufacturing (327xxx), Steam Electric					

January 27, 2020

Ecology corrected additional typos in Table 3. The changes are marked with underlined blue text. The typos were leaving off NAICS codes 488210, 4883xx, and 488490 in the transportation category.

Table 2: Additional Benchmarks and Sampling Requirements Applicable to Specific Industries (screenshot of changes in table)

TSS	mg/L	100	SM2540-D	5	1/quarter
6. Transportation (482xxx-485xxx, 488210, 4883xx, 488490,), Petroleum Bulk Stations and Terminals (4247xx), Transportation Equipment Manufacturing (336xxx), Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing (53241X)					
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
7. Coal Mining (2121xx), Oil and Gas Extraction (2111xx), Nonmetallic Mining and Quarrying, except Fuels (2123xx),					

Issuance Date:	November 20, 2019
Effective Date:	January 1, 2020
Expiration Date:	December 31, 2024

INDUSTRIAL STORMWATER GENERAL PERMIT

A National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated With Industrial Activities

State of Washington
Department of Ecology
Olympia, Washington 98504-7600

In compliance with the provisions of
The State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington
and
The Federal Water Pollution Control Act
(The Clean Water Act)
Title 33 United States Code, Section 1251 et seq.

Until this permit expires, is modified or revoked, Permittees that have properly obtained coverage under this general permit are authorized to discharge in accordance with the special and general conditions which follow.

Heather R. Bartlett
Water Quality Program Manager
Washington State Department of Ecology

TABLE OF CONTENTS

LIST OF TABLES

SUMMARY OF PERMIT REPORTS & SUBMITTALS

Permit Section	Submittal	Frequency	Due Date(s)
S1.F	Conditional "No Exposure" Certification (CNE) Form	As necessary	As necessary, with renewals every 5 years
S2.A	Application for Permit Coverage	As necessary	As necessary
S2.B	Request Modification of Permit Coverage	As necessary	As necessary
S2.D	Request Transfer of Coverage	As necessary	As necessary
S8.D	Level 3 Engineering Report	As necessary	May 15th, prior to Level 3 deadline[1]
S8.D	Level 3 O&M Manual	As necessary	30 days after Level 3 installation
S9.B	Discharge Monitoring Reports (DMRs)	1/quarter	February 15th May 15th August 15th November 15th
S9.C	Annual Report	1/year	May 15th
S9.D	SWPPP, if requested by Ecology	Per Ecology request	Within 14 days of request
S9.F	Noncompliance Notification	As necessary	Within 30 days of noncompliance event
G8	Duty to Reapply	1/permit cycle	July 3, 2024

The text of this permit contains words or phrases in ***bold and italics***. These words or phrases are the first usage in the permit and are defined in Appendix 2.

[1] Unless an alternate due date is specified in an order

SUMMARY OF REQUIRED ONSITE DOCUMENTATION[2]

Permit Condition(s)	Document Title
S3	Stormwater Pollution Prevention Plan (SWPPP)[3]
S9.C	Copies of Annual Reports
S9.D.1.a	Copy of Permit
S9.D.1.b	Copy of Permit Coverage Letter
S9.D.1.c	Original Sampling Records (Field Notes and Laboratory Reports)
S7.C & S9.D.1.d	Site Inspection Reports
S9.D.1.j	Copies of Discharge Monitoring Reports (DMRs)

[2] A complete list is contained in Condition S9.D. The Permittee shall make all plans, documents and records required by this permit immediately available to Ecology or the local jurisdiction upon request.

[3] With signed and completed SWPPP Certification Form(s) – see Appendix 3

SPECIAL CONDITIONS

S1. PERMIT COVERAGE

A. Facilities Required to Seek Coverage Under This General Permit

This statewide permit applies to ***facilities*** conducting ***industrial activities*** that discharge ***stormwater*** to a surface waterbody or to a ***storm sewer*** system that drains to a surface waterbody. Beginning on the effective date of this permit and lasting through its expiration date, the Permittee is authorized to discharge stormwater and conditionally approved non-stormwater ***discharges*** to ***waters of the State***. All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit.

The permit requires coverage for private entities, state, and ***local government*** facilities, and includes ***existing facilities*** and ***new facilities***. Facilities conducting industrial activities listed in Table 1 or referenced in S1.A.3 shall apply for coverage under this permit or apply for a Conditional No Exposure exemption, if eligible (Condition S1.F). The ***Department of Ecology (Ecology)*** may also require permit coverage for any facility on a case-by-case basis in order to protect waters of the State (Condition S1.B).

1. Facilities engaged in any industrial activities in Table 1 shall apply for coverage if stormwater from the facility discharges to a surface waterbody, or to a storm sewer system that discharges to a surface waterbody. The ***North American Industry Classification System (NAICS)*** groups generally, but not always, associated with these activities are listed in Table 1.

Table 1: Activities Requiring Permit Coverage and the Associated NAICS Groups

Industrial Activities	NAICS Groups
Metal Ore Mining	2122xx
Coal Mining	2121xx
Oil and Gas Extraction	2111xx
Nonmetallic Mineral Mining and Quarrying, except Fuels (except facilities covered under the Sand and Gravel General Permit)	2123xx
Food, Beverage, and Tobacco Manufacturing	311xxx-312xxx
Textile and Textile Products Mills	313xxx-314xxx
Apparel Manufacturing	315xxx
Wood Products Manufacturing	321xxx, 113310 [a]
Furniture and Related Product Manufacturing	337xxx
Paper Manufacturing	322xxx
Printing and Related Support Activities	323xxx, 5111xx

Industrial Activities	NAICS Groups
Chemicals Manufacturing (including Compost Facilities)	325xxx
Petroleum and Coal Products Manufacturing (except facilities covered under the Sand and Gravel General Permit)	324xxx
Plastics and Rubber Products Manufacturing	326xxx
Leather and Allied Product Manufacturing	316xxx
Nonmetallic Mineral Product Manufacturing (except covered under the Sand and Gravel General Permit)	327xxx
Primary Metal Manufacturing	331xxx
Fabricated Metal Product Manufacturing	332xxx
Machinery Manufacturing	333xxx
Computer and Electronic Product Manufacturing	334xxx
Electrical Equipment, Appliance, and Component Manufacturing	335xxx
Transportation Equipment Manufacturing (except NPDES regulated boatyards)	336xxx
Miscellaneous Manufacturing	339xxx
Warehousing and Storage	493xxx, 531130
Recycling facilities involved in the recycling of materials, including but not limited to, metal scrap yards, battery reclaimers, salvage yards, auto recyclers, and automobile junkyards.	42314x and 42393x
Steam Electric Power Generation (Not covered under *40 CFR §* 423)	N/A
Waste Management and Remediation Services, including, but not limited to, landfills, transfer stations, open dumps, and land application sites, except as described in S1.C.6 or C.7.	562xxx
Hazardous waste treatment, storage, and disposal (TSD) facilities, and recycling facilities regulated under Chapter 173-303 WAC.	562211
Treatment works treating domestic sewage, or any other sewage sludge, or wastewater treatment device or system, used in the storage, recycling, and reclamation of municipal or domestic sewage (including land dedicated to the disposal of sewage sludge that are located within the confines of the facility) with the design flow capacity of 1 million gallons per day (MGD) or more, or required to have a pretreatment program under 40 CFR §403.	22132x
Transportation facilities which have ***vehicle maintenance*** activity, equipment cleaning operations, or airport deicing operations:	
• Railroad Transportation	482xxx, 488210
• Transit and Ground Passenger Transportation	485xxx, 488490, 487110
• Truck Transportation	484xxx
• Postal Service	491xxx

Industrial Activities	NAICS Groups
• Water Transportation	483xxx, 487210, 4883xx, 532411
• Air Transportation	481xxx, 487990
• Petroleum Bulk Stations and Terminals	4247xx
Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing	53241x
Marine Construction	ECY003

[a.] Facilities in this category that are rock crusing, gravel washing, log sorting, or log storage facilities operated in connection with silvicultural activitees defined in 40 CFR 122.27(b)(2)-(3) are considered industrial activity. This does not include the actual harvesting of timber.

2. Any facility that has an existing ***National Pollutant Discharge Elimination System (NPDES)*** permit which does not address all stormwater discharges associated with industrial activity [40 CFR §122.26(b)(14)] shall obtain permit coverage.
3. Any ***inactive facility*** which is listed under ***40 CFR*** §122.26(b)(14) where ***significant materials*** remain onsite and are exposed to stormwater shall obtain permit coverage.

B. Significant Contributors of Pollutants

Ecology may require a facility to obtain coverage under this permit if Ecology determines the facility:

1. Is a ***significant contributor of pollutants*** to waters of the State, including ***groundwater***;
2. May reasonably be expected to cause a violation of any ***water quality standard***; or
3. Conducts industrial activity, or has a NAICS code, with stormwater characteristics similar to any industrial activity or NAICS code listed in Table 1 in S1.A.1.

C. Facilities Not Required to Obtain Coverage

Ecology does not require the types of facilities listed below to obtain coverage under this permit, unless determined to be a significant contributor of pollutants.

1. Industrial facilities that submit an ***application*** and qualify for a Conditional "No Exposure" Exemption. (Condition S1.F)
2. Industrial facilities that discharge stormwater only to a municipal ***combined sewer*** or ***sanitary sewer***. Discharge of stormwater to sanitary or combined sewers shall only occur as authorized by the municipal sewage authority.
3. Industrial facilities that discharge stormwater only to groundwater (e.g., on-site infiltration) with no discharge to ***surface waters of the State*** under any condition, provided the facility doesn't meet the requirements of S1.B.1.
4. Office buildings and/or administrative parking lots from which stormwater does not commingle with stormwater from areas associated with industrial activity.

5. Any discharge that is in compliance with the instructions of an on-scene-coordinator pursuant to 40 CFR § 300 (The National Oil and Hazardous Substances Pollution Contingency Plan) or *33 CFR* § 153.10(e) (Pollution by Oil and Hazardous Substances), in accordance with 40 CFR § 122.3(d).
6. Any ***land application site*** used for the beneficial use of industrial or municipal wastewater for agricultural activities or when applied for landscaping purposes at agronomic rates.
7. Any farmland, domestic garden, or land used for sludge management where domestic sewage sludge (biosolids) is beneficially reused (nutrient builder or soil conditioner) and which is not physically located in the confines of domestic sewage treatment works, or areas that are in compliance with Section 405 (Disposal of Sewage Sludge) of the ***Clean Water Act (CWA)***.
8. Any inactive coal mining operation if:
    a. The performance bond issued to the facility by the appropriate Surface Mining Control and Reclamation Act (SMCRA) authority has been released from applicable state or federal reclamation requirements after December 17, 1990.
    b. The mine does not have a discharge of stormwater that comes in contact with any overburden, raw material, intermediate products, finished products, byproducts, or waste products located on the site of the facility.
9. Closed ***landfills*** that are capped and stabilized, in compliance with Chapter 173-304 WAC, and in which no significant materials or industrial ***pollutants*** remain exposed to stormwater. Permittee's with existing coverage may submit a ***Notice of Termination*** in accordance with Special Condition S13.A.1.

D. Facilities Excluded from Coverage

Ecology will not cover the following facilities or activities under this permit:

1. If any part of a facility, in the categories listed below, has a stormwater discharge subject to stormwater Effluent Limitations Guidelines, New Source Performance Standards (NSPS) Under 40 CFR subchapter N, or Toxic Pollutant Effluent Standards under 40 CFR subchapter D §129; the operator of the facility must apply for an individual NPDES permit or seek coverage under an industry-specific ***general permit*** for those stormwater discharges.

    Below is a list of categories of industries specified in 40 CFR subchapter N for which at least one subpart includes stormwater effluent limitations guidelines or NSPS. Industries included in this list should review the subchapter N guidelines to determine if they are subject to a stormwater effluent limitation guideline for activities which they perform at their site.

40 CFR 411 Cement manufacturing	40 CFR 423 Steam electric power generating
40 CFR 412 Feedlots	40 CFR 434 Coal mining
40 CFR 418 Fertilizer manufacturing	40 CFR 436 Mineral mining and processing
40 CFR 419 Petroleum refining	40 CFR 440 Ore mining and dressing
40 CFR 422 Phosphate manufacturing	40 CFR 443 Paving and roofing materials (tars & asphalt)
40 CFR 449.11(a) Airports with more than 10,000 annual jet departures	

Facilities, which are subject to effluent standards in 40 CFR subchapter D §129: Aldrin/Dieldrin; DDT; Endrin; Toxaphene; Benzidine; or Polychlorinated Biphenyls (PCBs), shall apply for an individual NPDES permit.

2. Nonpoint source silvicultural activities with natural ***runoff*** that are excluded in 40 CFR §122.27.
3. Industrial activities operated by any department, agency, or instrumentality of the executive, legislative, and judicial branches of the Federal Government of the United States, or another entity, such as a private contractor, performing industrial activity for any such department, agency, or instrumentality.
4. Facilities located on "Indian Country" as defined in 18 USC §1151, except portions of the Puyallup Reservation as noted below.

   Indian Country includes:

   a. All land within any Indian Reservation notwithstanding the issuance of any patent, and, including rights-of-way running through the reservation. This includes all federal, tribal, and Indian and non-Indian privately owned land within the reservation.
   b. All off-reservation Indian allotments, the Indian titles to which have not been extinguished, including rights-of-way running through the same.
   c. All off-reservation federal trust lands held for Native American Tribes.

   Puyallup Exception: Following the "Puyallup Tribes of Indians Land Settlement Act of 1989," 25 USC §1773; the permit does apply to land within the Puyallup Reservation except for discharges to surface water on land held in trust by the federal government.
5. Any facility authorized to discharge stormwater associated with industrial activity under an existing NPDES individual or other general permit.
6. All ***construction activities***. Operators of these construction activities shall seek coverage under the Construction Stormwater General Permit or an individual NPDES permit for stormwater associated with construction activity.
7. Facilities that discharge to a waterbody with a ***control plan***, unless this general permit adequately provides the level of protection required by the control plan.
8. ***New dischargers*** to a waterbody listed pursuant to Section 303(d) of the CWA, unless the Permittee meets the requirements of Condition S6.B.
9. Hazardous waste landfills subject to 40 CFR §445, subpart A.

E. Discharges to Ground

1. For sites with a ***discharge point*** to groundwater the terms and conditions of this permit shall apply. However, permittees are not required to sample on-site discharges to ground (e.g., infiltration), unless specifically required by Ecology (Condition G12).

2. Facilities with a discharge point to groundwater through an ***Underground Injection Control well*** shall comply with any applicable requirements of the Underground Injection Control (UIC) regulations, Chapter 173-218 WAC.

F. Conditional "No Exposure" Exemption

1. A facility engaged in industrial activity may qualify for a Conditional “No Exposure” Exemption (CNE) if there is no exposure of industrial materials and activities to rain, snow, snow melt, and/or runoff.

   Industrial materials and activities include, but are not limited to, ***material handling*** equipment or activities, industrial machinery, raw materials, intermediate products, by-products, and final products, or waste products.

   Material handling activities include storage, loading and unloading, transport, or conveyance of any raw materials, intermediate product, by-product, final products, or waste products.

2. To determine if you qualify for a CNE, eleven questions must be answered and certified that none of the following materials or activities are, or will be in foreseeable future, exposed to precipitationIndustrial Stormwater General Permit webpage:

   A. Is anyone using, storing or cleaning industrial machinery or equipment in an area that is exposed to stormwater, or are there areas where residuals from using, storing or cleaning industrial machinery or equipment remain and are exposed to stormwater?

   B. Are there materials or residuals on the ground or in stormwater inlets from spills/leaks?

   C. Are materials or products from past industrial activity exposed to precipitation?

   D. Is material handling equipment used/stored (except adequately maintained vehicles)?

   E. Are materials or products exposed to precipitation during loading/unloading or transporting activities?

   F. Are materials or products stored outdoors (except final products intended for outside use, e.g., new cars, where exposure to storm water does not result in the discharge of pollutants)?

   G. Are materials contained in open, deteriorated or leaking storage drums, barrels, tanks, and similar containers?

   H. Are materials or products handled/stored on roads or railways owned or maintained by the discharger?

   I. Is waste material exposed to precipitation (except waste in covered, non-leaking containers, e.g., dumpsters)?

   J. Does the application or disposal of process wastewater occur (unless otherwise permitted)?

   K. Is there particulate matter or visible deposits of residuals from roof stacks/vents not otherwise regulated, i.e., under an air quality control permit, and evident in the storm water outflow?

3. To apply for an exemption, an electronic application must be submitted to Ecology's Water Quality Permitting Portal (WQWebPortal). The WQWebPortal can accessed at https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Water-quality-permits-guidance/WQWebPortal-guidance.

    a. A Permittee is automatically granted a No Exposure exemption 90 days from Ecology's receipt of a complete and accurate No Exposure Certification Form, unless Ecology informs the applicant in writing or electronically within 90 days that it has denied or approved the request.

    b. Ecology will automatically terminate permit coverage when it grants the No Exposure exemption to a permitted facility.

    c. Facilities which are granted a No Exposure exemption must submit a No Exposure Certification Form to Ecology once every five years.

    d. No Exposure exemptions are conditional. If there is a change at the facility that results in the exposure of industrial activities or materials to stormwater, the facility is required to immediately apply for and obtain a permit.

S2. APPLICATION FOR COVERAGE

A. Obtaining Permit Coverage

1. Unpermitted facilities that require coverage under this permit shall submit to Ecology, a complete and accurate ***Notice of Intent (NOI)*** using Ecology's Water Quality Permitting Portal – Permit Coverage Notice of Intent form as follows:

    a. Existing Facilities

        i. Unpermitted existing facilities that require coverage under this permit shall submit a complete and accurate permit application to Ecology.

        ii. Existing facilities are facilities in operation prior to the effective date of this permit, January 1, 2020.

    b. New Facilities

        New facilities are facilities that begin operation on or after the effective date of this permit, January 1, 2020. All unpermitted new facilities shall*:*

        i. Submit a complete and accurate permit application to Ecology at least 60 days before the commencement of stormwater discharge from the facility.

        ii. The application shall include certification that the facility has met the applicable public notice and ***State Environmental Policy Act (SEPA)*** requirements in WAC 173-226-200(f).

    c. Electronic Submittal

        Use the Water Quality Permitting Portal (WQWebPortal) to submit a complete application for coverage to Ecology.

        For more information about the WQWebPortal, visit: https://secureaccess.wa.gov/ecy/wqwebportal/.

To access the WQWebPortal, you must first register for Secure Access Washington (SAW). For additional information about SAW, visit: https://support.secureaccess.wa.gov/.

B. Modification of Permit Coverage

A Permittee anticipating a significant process change, or otherwise requesting a modification of permit coverage, shall submit a complete Modification of Coverage Form to Ecology. The Permittee shall:

1. Apply for modification of coverage at least 60 days before implementing a significant process change; or by May15th prior to a Corrective Action deadline, if requesting a Level 2 or 3 time extension or waiver request per Condition S8.B-D.
2. Complete the public notice requirements in WAC 173-226-130(5) as part of a complete application for modification of coverage.
3. Comply with SEPA as part of a complete application for modification of coverage if undergoing a significant process change.

C. Permit Coverage Timeline

1. If the applicant does not receive notification from Ecology, permit coverage automatically commences on whichever of the following dates occurs **last**:
    a. The 31st day following receipt by Ecology of a completed application for coverage.
    b. The 31st day following the end of a 30-day public comment period.
    c. The effective date of the general permit.
2. Ecology may need additional time to review the application:
    a. If the application is incomplete.
    b. If it requires additional site-specific information.
    c. If the public requests a public hearing.
    d. If members of the public file comments.
    e. When more information is necessary to determine whether coverage under the general permit is appropriate.
3. When Ecology needs additional time:
    a. Ecology will notify the applicant in writing within 30 days and identify the issues that the applicant must resolve before a decision can be reached.
    b. Ecology will submit the final decision to the applicant in writing. If Ecology approves the application for coverage, coverage begins the 31st day following approval, or the date the approval letter is issued, whichever is later.

D. Transfer of Permit Coverage

Coverage under this general permit shall automatically transfer to a new discharger, if **all** of the following conditions are met:

1. The Permittee (existing discharger) and new discharger submit to Ecology a complete, written, signed agreement (Transfer of Coverage Form) containing a specific date for transfer of permit responsibility, coverage, and liability.
2. The type of industrial activities and practices remain substantially unchanged.
3. Ecology does not notify the Permittee of the need to submit a new application for coverage under the general permit or for an individual permit pursuant to Chapters 173-216, 173-220, and 173-226 WAC.
4. Ecology does not notify the existing discharger and new discharger of its intent to revoke coverage under the general permit. The transfer is effective on the date specified in the written agreement unless Ecology gives notice of revocation.

S3. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A. General Requirements

All Permittees and applicants for coverage under this permit shall implement a ***Stormwater Pollution Prevention Plan (SWPPP)*** developed by ***qualified personnel*** as follows:

1. The SWPPP shall specify the ***Best Management Practices (BMPs)*** necessary to:
    a. Provide ***All Known, Available, and Reasonable methods of prevention, control, and Treatment (AKART)*** of *stormwater pollution*.
    b. Ensure the discharge does not cause or contribute to a violation of the Water Quality Standards.
    c. Comply with applicable federal technology-based treatment requirements under 40 CFR § 125.3.
2. Proper selection and use of ***Stormwater Management Manuals (SWMM).***

    BMPs shall be consistent with:

    a. *2019 Stormwater Management Manual for Western Washington*, for sites west of the crest of the Cascade Mountains; **or**
    b. *2019 Stormwater Management Manual for Eastern Washington*, for sites east of the crest of the Cascade Mountains; **or**
    c. Revisions to the manuals in S3.A.3. a & b, or other stormwater management guidance documents or manuals which provide an equivalent level of ***pollution*** prevention, that are approved by Ecology and incorporated into this permit in accordance with the permit modification requirements of WAC 173-226-230. For purposes of this section, the documents listed in Appendix 10 of the August 1, *2019 Phase I Municipal Stormwater Permit* are hereby incorporated into this permit; **or**
    d. Documentation in the SWPPP that the BMPs selected are ***demonstrably equivalent*** to practices contained in stormwater technical manuals approved by Ecology, including the proper selection, implementation, and maintenance of all applicable and appropriate best management practices for on-site pollution control.

3. Update of the SWPPP

    a. The Permittee shall modify the SWPPP if the owner/operator or the applicable local or state regulatory authority determines during inspections or investigations that the SWPPP is, or would be, ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The Permittee shall modify the SWPPP:

        i. As necessary to include additional or modified BMPs designed to correct problems identified.

        ii. To correct the deficiencies identified in writing from Ecology within 30 days of notice.

    b. The Permittee shall modify the SWPPP whenever there is a change in design, construction, operation, or maintenance at the facility that significantly changes the nature of pollutants discharged in stormwater from the facility, or significantly increases the quantity of pollutants discharged.

    c. If a Permittee covered under the 2015 ISGP needs to update their SWPPP to be consistent with the 2020 ISGP, the update shall be completed by January 30, 2020.

4. Other Pollution Control Plans

    The Permittee may incorporate by reference applicable portions of plans prepared for other purposes at their facility. Plans or portions of plans incorporated by reference into a SWPPP become enforceable requirements of this permit and must be available along with the SWPPP, as required in S9.F. A Pollution Prevention Plan prepared under the Hazardous Waste Reduction Act, Chapter 70.95C RCW, is an example of such a plan.

5. Signatory Requirements

    The Permittee shall sign and certify all SWPPPs in accordance with General Condition G2, each time they revise or modify a SWPPP to comply with Conditions S3.A.4 (Update of the SWPPP), S7 (Inspections) or S8 (Corrective Actions). The SWPPP Certification Form is contained in Appendix 3 of this permit and on Ecology's industrial stormwater website.

B. Specific SWPPP Requirements

The SWPPP shall contain a site map, a detailed assessment of the facility, a detailed description of the BMPs, Spill Prevention and Emergency Cleanup Plan, and a sampling plan. The Permittee shall identify any parts of the SWPPP which the facility wants to claim as confidential business information.

1. The site map shall identify(site map may be multiple pages if needed):

    a. The scale or include relative distances between significant structures and drainage systems.

    b. The size of the property in acres.

    c. The location and extent of all buildings, structures and all impervious surfaces.

    d. Direction of stormwater flow (use arrows).

    e. Locations of all structural source control BMPs.

    f. Locations of all receiving water (including wetlands and drainage ditches) in the immediate vicinity of the facility.

g. Conditionally approved non-stormwater discharges.

h. Areas of existing and potential soil ***erosion*** that could result in the discharge of a ***significant amount*** of turbidity, sediment, or other pollutants.

i. Locations of all stormwater conveyances including ditches, pipes, catch basins, vaults, ponds, swales, etc.

j. Locations of actual and potential pollutant sources.

k. Locations of all stormwater monitoring points.

l. The stormwater drainage areas for each stormwater discharge point off site (including discharges to groundwater).

m. Locations of stormwater inlets and outfalls with a unique identification number for each sampling point and discharge point, indicating any that are identified as substantially identical, and identify, by name, any other party other than the Permittee that owns any stormwater drainage or discharge structures.

n. Combined sewers or MS4s and where stormwater discharges to them.

o. Locations of fueling and ***vehicle*** maintenance areas.

p. Locations and sources of run-on to your site from adjacent properties that may contain pollutants.

2. The facility assessment shall include a description of the facility; an inventory of facility activities and equipment that contribute to or have the potential to contribute any pollutants to stormwater; and, an inventory of materials that contribute to or have the potential to contribute pollutants to stormwater.

   a. The facility description shall describe:

      i. The industrial activities conducted at the site.

      ii. Regular business hours and seasonal variations in business hours or industrial activities.

      iii. The general layout of the facility including buildings and storage of raw materials, and the flow of goods and materials through the facility.

   b. The inventory of industrial activities shall identify all areas associated with industrial activities (see Table 1) that have been or may potentially be sources of pollutants, including, but not limited to, the following:

      i. Loading and unloading of dry bulk materials or liquids.

      ii. Outdoor storage of materials or products.

      iii. Outdoor manufacturing and processing.

      iv. On-site dust or particulate generating processes.

      v. On-site waste treatment, storage, or disposal.

      vi. Vehicle and equipment fueling, maintenance, and/or cleaning (includes washing).

      vii. Roofs or other surfaces exposed to ***air emissions*** from a manufacturing building or a process area.

viii. Roofs or other surfaces composed of materials that may be mobilized by stormwater (e.g., galvanized roofs, galvanized fences).

c. The inventory of materials shall list:

i. The types of materials handled at the site that potentially may be exposed to precipitation or runoff and could result in stormwater pollution.

ii. A short narrative for each material describing the potential of the pollutant to be present in stormwater discharges. The Permittee shall update this narrative when data become available to verify the presence or absence of these pollutants.

iii. A narrative description of any potential sources of pollutants from past activities, materials and spills that were previously handled, treated, stored, or disposed of in a manner to allow ongoing exposure to stormwater. Include the method and location of on-site storage or disposal. List significant spills and significant leaks of toxic or hazardous pollutants.

3. The SWPPP shall identify specific individuals by name or by title within the organization (pollution prevention team) whose responsibilities include: SWPPP development, implementation, maintenance, and modification.

4. Best Management Practices (BMPs)

a. General BMP Requirements

The Permittee shall describe each BMP selected to eliminate or reduce the potential to contaminate stormwater and prevent violations of water quality standards. The SWPPP must explain in detail how and where the selected BMPs will be implemented.

b. The Permittee shall include each of the following mandatory BMPs in the SWPPP and implement the BMPs. The Permittee may omit individual BMPs if site conditions render the BMP unnecessary or infeasible and the Permittee provides alternative and equally effective BMPs. The Permittee must justify each BMP omission in the SWPPP.

i. ***Operational Source Control BMPs***

1) The SWPPP shall include the Operational ***Source Control BMPs*** listed as "applicable" in Ecology's SWMMs, or other guidance documents or manuals approved in accordance with S3.A.3.c.

2) **Good Housekeeping:** The SWPPP shall include BMPs that define ongoing maintenance and cleanup, as appropriate, of areas which may contribute pollutants to stormwater discharges. The SWPPP shall include the schedule/frequency for completing each housekeeping task, based upon industrial activity, sampling results and observations made during inspections. The Permittee shall:

a) Vacuum paved surfaces with a vacuum sweeper (or a sweeper with a vacuum attachment) to remove accumulated pollutants a minimum of once per quarter.

b) Identify and control all on-site sources of dust to minimize stormwater contamination from the deposition of dust on areas exposed to precipitation.

c) Inspect and maintain bag houses monthly to prevent the escape of dust from the system. Immediately remove any accumulated dust at the base of exterior bag houses.

d) Keep all dumpsters under cover or fit with a storm resistant lid that must remain closed when not in use. (Tarps are not considered storm resistant.)

3) **Preventive Maintenance:** The SWPPP shall include BMPs to inspect and maintain the stormwater drainage, source controls, treatment systems (if any), and plant equipment and systems that could fail and result in contamination of stormwater. The SWPPP shall include the schedule/frequency for completing each maintenance task. The Permittee must:

a) Clean catch basins when the depth of debris reaches 60% of the sump depth. In addition, the Permittee must keep the debris surface at least 6 inches below the outlet pipe.

b) Maintain ponds, tanks/vaults, catch basins, swales, filters, oil/water separators, drains, and other stormwater drainage/treatment facilities in accordance with the maintenance standards set forth in the applicable Stormwater Management Manual, other guidance documents or manuals approved in accordance with S3.A.3.c, demonstrably ***equivalent BMPs*** per S3.A.3.d, or an O&M Manual submitted to Ecology in accordance with S8.D.

c) Inspect all equipment and vehicles during monthly site inspections for leaking fluids such as oil, antifreeze, etc. Take leaking equipment and vehicles out of service or prevent leaks from spilling on the ground until repaired.

d) Clean up spills and leaks immediately (e.g., using absorbents, vacuuming, etc.) to prevent the discharge of pollutants.

4) **Spill Prevention and Emergency Cleanup Plan (SPECP):** The SWPPP shall include a SPECP that includes BMPs to prevent spills that can contaminate stormwater. The SPECP shall specify BMPs for material handling procedures, storage requirements, cleanup equipment and procedures, and spill logs, as appropriate. The Permittee shall:

a) Store all hazardous substances, petroleum/oil liquids, and other chemical solid or liquid materials that have potential to contaminate stormwater on an impervious surface that is surrounded with a containment berm or dike that is capable of containing 10% of the total enclosed tank volume or 110% of the volume contained in the largest tank, whichever is greater, or use double-walled tanks.

b) Prevent precipitation from accumulating in containment areas with a roof or equivalent structure or include a plan on how it will manage and dispose of accumulated water if a containment area cover is not practical.

c) Locate spill kits within 25 feet of all stationary fueling stations, fuel transfer stations, mobile fueling units, and used oil storage/transfer stations. At a minimum, spill kits shall include:

   i) Oil absorbents capable of absorbing 15 gallons of fuel. Facilities with a Spill Prevention, Control, and Countermeasures Plan (SPCCP) must have enough oil absorbents capable of absorbing the minimum anticipated spill amount or potential discharge volume identified in that plan if more than 15 gallons.

   ii) A storm drain plug or cover kit.

   iii) A non-water containment boom, a minimum of 10 feet in length with a 12-gallon absorbent capacity.

   iv) A non-metallic shovel.

   v) Two 5-gallon buckets with lids.

d) Not lock shut-off fueling nozzles in the open position. Do not "top-off" tanks being refueled.

e) Block, plug or cover storm drains that receive runoff from areas where fueling, during fueling.

f) Use drip pans or equivalent containment measures during all petroleum transfer operations.

g) Locate materials, equipment, and activities so that leaks are contained in existing containment and diversion systems (confine the storage of leaky or leak-prone vehicles and equipment awaiting maintenance to protected areas).

h) Use drip pans and absorbents under or around leaky vehicles and equipment or store indoors where feasible. Drain fluids from equipment and vehicles prior to on-site storage or disposal.

i) Maintain a spill log that includes the following information for chemical and petroleum spills: date, time, amount, location, and reason for spill; date/time cleanup completed, notifications made and staff involved.

5) **Employee Training:** The SWPPP shall include BMPs to provide SWPPP training for employees who have duties in areas of industrial activities subject to this permit. At a minimum, the training plan shall include:

   a) The content of the training.

      i) An overview of what is in the SWPPP.

      ii) How employees make a difference in complying with the SWPPP and preventing contamination of stormwater.

      iii) Spill response procedures, good housekeeping, maintenance requirements, and material management practices.

b) How the Permittee will conduct training.

c) The frequency/schedule of training. The Permittee shall train employees annually, at a minimum.

d) A log of the dates on which specific employees received training.

6) **Inspections and Recordkeeping:** The SWPPP shall include documentation of procedures to ensure compliance with permit requirements for inspections and recordkeeping. At a minimum, the SWPPP shall:

a) Identify facility personnel who will inspect designated equipment and facility areas as required in Condition S7.

b) Contain a visual inspection report or check list that includes all items required by Condition S7.C.

c) Provide a tracking or follow-up procedure to ensure that a report is prepared and any appropriate action taken in response to visual inspections.

d) Define how the Permittee will comply with signature requirements and records retention identified in Special Condition S9, Reporting and Recordkeeping Requirements.

e) Include a certification of compliance with the SWPPP and permit for each inspection using the language in S7.C.1.c.

f) Include all inspection reports completed by the Permittee (S7.C).

7) ***Illicit Discharges***: The SWPPP shall include measures to identify and eliminate the discharge of ***process wastewater***, ***domestic wastewater***, ***noncontact cooling water***, and other illicit discharges, to stormwater sewers, or to surface waters and groundwaters of the State. The Permittee can find BMPs to identify and eliminate illicit discharges in Volume IV of Ecology's SWMM for Western Washington and Chapter 8 of the SWMM for Eastern Washington.

Water from washing vehicles or equipment, buildings, pavement, steam cleaning and/or pressure washing is considered process wastewater. The Permittee must not allow this process wastewater to comingle with stormwater or enter storm drains; and must collect in a tank for off-site disposal, or discharge it to a sanitary sewer, with written approval from the local sewage authority.

ii. ***Structural Source Control BMPs***

1) The SWPPP shall include the structural source control BMPs listed as "applicable" in Ecology's SWMMs, or other guidance documents or manuals approved in accordance with S3.A.3.c.

2) The SWPPP shall include BMPs to minimize the exposure of manufacturing, processing, and material storage areas (including loading and unloading, storage, disposal, cleaning, maintenance, and fueling operations) to rain, snow,

snowmelt, and *runoff* by either locating these industrial materials and activities inside or protecting them with storm resistant coverings.

Permittees shall:

a) Use grading, berming, or curbing to prevent runoff of contaminated flows and divert run-on away from these areas.

b) Perform all cleaning operations indoors, under cover, or in bermed areas that prevent stormwater runoff and run-on, also that capture any overspray.

c) Ensure that all washwater drains to a collection system that directs the washwater to further treatment or storage and not to the ***stormwater drainage system***.

iii. ***Treatment BMPs***

The Permittee shall:

1) Use treatment BMPs consistent with the applicable documents referenced in Condition S3.A.3.

2) Employ oil/water separators, booms, skimmers or other methods to eliminate or minimize oil and grease contamination of stormwater discharges.

3) Obtain Ecology approval before beginning construction/installation of all treatment BMPs that include the addition of chemicals to provide treatment.

iv. Stormwater Peak Runoff Rate and Volume Control BMPs

Facilities with ***new development*** or redevelopment shall evaluate whether flow control BMPs are necessary to satisfy the state's AKART requirements, and prevent violations of water quality standards. If flow control BMPs are required, they shall be selected according to S3.A.3.

v. ***Erosion and Sediment Control BMPs***

The SWPPP shall include BMPs necessary to prevent the erosion of soils and other earthen materials (crushed rock/gravel, etc.), control off-site sedimentation, and prevent violations of water quality standards. The Permittee shall implement and maintain:

1) Sediment control BMPs such as ***detention*** or retention ponds or traps, vegetated filter strips, bioswales, or other permanent sediment control BMPs to minimize ***sediment*** loads in stormwater discharges.

2) Filtration BMPs to remove solids from catch basins, sumps or other stormwater collection and conveyance system components (catch basin filter inserts, filter socks, modular canisters, sand filtration, centrifugal separators, etc.).

5. Sampling Plan

   The SWPPP shall include a sampling plan. The plan shall:

   a. Identify points of discharge to surface water, storm sewers, or discrete groundwater infiltration locations, such as dry wells or detention ponds.

   b. Include documentation of why applicable parameters are not sampled at each discharge point per S4.B.3 (if applicable). The required documentation includes:

      i. Location of which discharge points the Permittee does not sample applicable parameters because the pollutant concentrations are substantially identical to a discharge point being sampled.

      ii. General industrial activities conducted in the drainage area of each discharge point.

      iii. Best Management Practices conducted in the drainage area of each discharge point.

      iv. Exposed materials located in the drainage area of each discharge point that are likely to be significant contributors of pollutants to stormwater discharges.

      v. Impervious surfaces in the drainage area that could affect the percolation of stormwater runoff into the ground (e.g., asphalt, crushed rock, grass).

      vi. Reasons why the Permittee expects the discharge points to discharge substantially identical effluents.

   c. Identify each sampling location by its unique identifying number such as A1, A2.

   d. Identify staff responsible for conducting stormwater sampling.

   e. Specify procedures for sample collection and handling.

   f. Specify procedures for sending samples to a laboratory.

   g. Identify parameters for analysis, holding times and preservatives, laboratory ***quantitation levels***, and analytical methods.

   h. Specify the procedure for submitting results to Ecology.

S4. GENERAL SAMPLING REQUIREMENTS

A. General Requirements

The Permittee shall conduct sampling of stormwater in accordance with this permit and the SWPPP.

B. Sampling Requirements

1. Sample Timing and Frequency

   a. The Permittee shall sample the discharge from each designated location at least once per quarter:

      1st Quarter = January, February, and March

      2nd Quarter = April, May, and June

3rd Quarter = July, August, and September

4th Quarter = October, November, and December

b. Permittees shall sample the stormwater discharge from the ***first fall storm event*** each year. First fall storm event means the first time on or after September 1st of each year that precipitation occurs and results in a stormwater discharge from a facility.

c. Permittees shall collect samples within the first 12 hours of stormwater discharge events. If it is not possible to collect a sample within the first 12 hours of a stormwater discharge event, the Permittee must collect the sample as soon as practicable after the first 12 hours, and keep documentation with the sampling records (Condition S4.B.3) explaining why they could not collect samples within the first 12 hours; or if it is unknown (e.g., discharge was occurring during start of regular business hours).

d. The Permittee shall obtain ***representative samples***, which may be a single grab sample, a time-proportional sample, or a flow-proportional sample.

e. Permittees need not sample outside of ***regular business hours***, during ***unsafe conditions***, or during quarters where there is no discharge, but shall submit a Discharge Monitoring Report each reporting period (Condition S9.A).

f. Permittees monitoring more than once per quarter shall ***average*** all of the monitoring results for each parameter (except pH and visible oil sheen) and compare the average value to the ***benchmark*** value. However, if Permittees collect more than one sample during a 24-hour period, they must first calculate the ***daily average*** of the individual grab sample results collected during that 24-hour period; then use the daily average to calculate a quarterly average.

2. Sample Location(s)

a. The Permittee shall designate sampling location(s) at the point(s) where it discharges stormwater associated with industrial activity off-site.

b. The Permittee is not required to sample on-site discharges to ground (e.g., infiltration) or sanitary sewer discharges, unless specifically required by Ecology (Condition G12).

c. Ecology may require sampling points located in areas where unsafe conditions prevent regular sampling be moved to areas where regular sampling can occur.

d. The Permittee shall notify Ecology of any changes or updates to sample locations, discharge points, and/or outfalls by submitting an "Industrial Stormwater General Permit Discharge/Sample Point Update Form" to Ecology. The Permittee may be required to provide additional information to Ecology prior to changing sampling locations.

3. Substantially Identical Discharge Points

a. The Permittee shall sample each distinct point of discharge off-site except as otherwise exempt from monitoring as a ***substantially identical discharge point*** per S3.B.5.b. If applicable, the Permittee is only required to monitor applicable parameters at one of the substantially identical discharge points.

The Permittee shall notify Ecology of any changes or updates to sample locations, discharge points, and/or outfalls by submitting an "Industrial Stormwater General Permit Discharge/Sample Point Update Form" to Ecology.

4. Sample Documentation

   For each stormwater sample taken, the Permittee shall record the following information and retain it on-site for Ecology review:

   a. Sample date

   b. Sample time

   c. A notation describing if the Permittee collected the sample within the first 12 hours of stormwater discharge events; or, if it is unknown (e.g., discharge was occurring during start of regular business hours).

   d. An explanation of why the permittee could not collect a sample within the first 12 hours of a stormwater discharge event, if it was not possible. Or, if it is unknown, an explanation of why it is unknown if a sample was collected within or outside the first 12 hours of stormwater discharge.

   e. Sample location (using SWPPP identifying number)

   f. Method of sampling, and method of sample preservation, if applicable.

   g. Individual who performed the sampling

5. Laboratory Documentation

   The Permittee shall retain laboratory reports on-site for Ecology review and shall ensure that all laboratory reports providing data for all parameters include the following information:

   a. Date of analysis

   b. Parameter name

   c. CAS number, if applicable

   d. Analytical method(s)

   e. Individual who performed the analysis

   f. Method detection limit (MDL)

   g. Laboratory quantitation level (QL) achieved by the laboratory

   h. Reporting units

   i. Sample result

   j. Quality assurance/quality control data

6. The Permittee shall maintain the original records onsite and make them available to Ecology upon request.

7. The Permittee can reduce monitoring to once a year for a period of three years (12 quarters) based on consistent attainment of benchmark values when:

   a. Eight consecutive quarterly samples demonstrate a reported value equal to or less than the benchmark value; or for pH, within the range of 5.0 – 9.0.

b. For purposes of tallying consecutive quarterly samples:

   i. Do not include any quarters in which the Permittee did not collect a sample, but should have (e.g., discharge(s) occurred during normal working hours, and during safe conditions; but no sample was collected during the entire quarter). If this occurs, the tally of consecutive quarterly samples is reset to zero.

   ii. Do not include any quarters in which the Permittee did not collect a sample because there was no discharge during the quarter (or the discharges during the quarter occurred outside normal working hours or during unsafe conditions). These quarters are not included in the calculation of eight consecutive quarters, but do not cause the tally to be reset; i.e., they are skipped over.

c. The annual sample must be taken during the 4th quarter. A facility may average the annual sample with any other samples taken over the course of the 4th quarter. The annual sample does not include the first fall storm event.

d. A Permittee whose annual sample exceeds the benchmark during consistent attainment is no longer allowed to claim consistent attainment. The Permittee must begin sampling in accordance with S4.B.

8. A Permittee who has a ***significant process change*** shall not use previous sampling results to demonstrate consistent attainment.

9. Suspension of sampling based on consistent attainment does not apply to pollutant parameters subject to "report only" requirements, oil sheen, or numeric effluent limits based on federal Effluent Limitation Guidelines (Condition S5) or Section 303(d) of the Clean Water Act (Condition S6).

C. Analytical Procedures for Sampling Requirements

The Permittee shall ensure that analytical methods used to meet the sampling requirements in this permit conform to the latest revision of the Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR § 136, unless specified otherwise in this permit.

D. Laboratory Accreditation

1. The Permittee shall ensure that all analytical data required by Ecology is prepared by a laboratory registered or accredited under the provisions of, Accreditation of Environmental Laboratories, Chapter 173-50 WAC.

2. ***Turbidity*** and pH are exempt from this requirement, unless the laboratory must be registered or accredited for any other parameter.

S5. BENCHMARKS, EFFLUENT LIMITATIONS AND SPECIFIC SAMPLING REQUIREMENTS

A. Benchmarks and Sampling Requirements

1. Permittees shall sample their stormwater discharges as specified in Condition S4 and as specified in Table 2.

2. Additional requirements apply to specific industrial categories (S5.B), facilities subject to effluent limitation guidelines (S5.C), and certain discharges to impaired waterbodies (S6).

   If a Permittee's discharge exceeds a benchmark listed in Table 2, the Permittee shall take the actions specified in Condition S8.

Table 2: Benchmarks and Sampling Requirements Applicable to All Facilities

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level [a]	Minimum Sampling Frequency [b]
Turbidity	NTU	25	EPA 180.1 Meter	0.5	1/quarter
pH	Standard Units	Between 5.0 and 9.0	Meter/Paper [c]	±0.5	1/quarter
Oil Sheen	Yes/No	No Visible Oil Sheen	N/A	N/A	1/quarter
Copper, Total	µg/L	Western WA: 14 Eastern WA: 32	EPA 200.8	2.0	1/quarter
Zinc, Total	µg/L	117	EPA 200.8	2.5	1/quarter

[a] The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report. The permittee must also upload the QA/QC documentation from the lab on the QL development.

[b] 1/quarter means at least one sample taken each quarter, year-round.

[c] Permittees shall use either a calibrated pH meter or narrow-range pH indicator paper with a resolution of ± 0.5 SU or better.

B. Additional Sampling Requirements for Specific Industrial Groups

1. In addition to the requirements in Table 2, all Permittees identified by an industrial activity in Table 3 shall sample stormwater discharges as specified in Condition S4 and in Table 3.
2. If a discharge exceeds a benchmark listed in Table 3, the Permittee shall take the actions specified in Condition S8.

Table 3: Additional Benchmarks and Sampling Requirements Applicable to Specific Industries

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level [a]	Minimum Sampling Frequency [b]
1. Chemical and Allied Products (325xxx), Food and Kindred Products (311xxx-312xxx)					
BOD_5	mg/L	30	SM 5210B	2	1/quarter
Nitrate + Nitrite Nitrogen, as N	mg/L	0.68	SM4500 NO3-E/F/H	0.10	1/quarter
Phosphorus, Total	mg/L	2.0	EPA 365.1	0.01	1/quarter
2. Primary Metals(331xxx), Metals Mining (2122xx), Automobile Salvage and Scrap Recycling (42314x and 42393x), Metals Fabricating (332xxx), Machinery Manufacturing (333xxx)					
Lead, Total	µg/L	64.6	EPA 200.8	0.5	1/quarter
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
3. Hazardous Waste Treatment, Storage and Disposal Facilities and Dangerous Waste Recyclers subject to the provisions of Resource Conservation and Recovery Act (RCRA) Subtitle C					
Chemical Oxygen Demand (COD)	mg/L	120	SM5220-D	10	1/quarter
Total Ammonia (as N)	mg/L	2.1	SM4500-NH3- GH	0.02	1/quarter
TSS	mg/L	100	SM2540-D	5	1/quarter
Arsenic, Total	µg/L	150	EPA 200.8	0.5	1/quarter
Cadmium, Total	µg/L	2.1	EPA 200.8	0.25	1/quarter
Cyanide, Total	µg/L	22	EPA 335.4	10	1/quarter
Lead, Total	µg/L	64.6	EPA 200.8	0.5	1/quarter
Mercury, Total	µg/L	1.4	EPA 1631E	0.0005	1/quarter
Selenium, Total	µg/L	5.0	EPA 200.8	1.0	1/quarter
Silver, Total	µg/L	3.4	EPA 200.8	0.2	1/quarter
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
4. Air Transportation[c] (481xxx)					
Total Ammonia (as N)	mg/L	2.1	SM4500-NH3- GH	0.02	1/quarter
BOD_5	mg/L	30	SM 5210B	2	1/quarter
COD	mg/L	120	SM5220-D	10	1/quarter

Parameter	Units	Benchmark Value	Analytical Method	Laboratory Quantitation Level [a]	Minimum Sampling Frequency [b]
Nitrate + Nitrite Nitrogen, as N	mg/L	0.68	SM 4500-NO3-E/F/H	0.10	1/quarter
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
5. Timber Product Industry (321xxx), Paper and Allied Products (322xxx), Wood Product Manufacturing (321xxx)					
COD	mg/L	120	SM5220-D	10	1/quarter
TSS	mg/L	100	SM2540-D	5	1/quarter
6. Transportation (482xxx-485xxx), Petroleum Bulk Stations and Terminals (4247xx), Transportation Equipment Manufacturing (336xxx), Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing (53421)					
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
7. Coal Mining (2121xx), Oil and Gas Extraction (2111xx), Nonmetallic Mining and Quarrying, except Fuels (2123xx), Petroleum and Coal Products Manufacturing (324xxx), Nonmetallic Mineral Product Manufacturing (327xxx), Steam Electric Power Generation					
TSS	mg/L	100	SM2540-D	5	1/quarter
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter
8. Marine Industrial Construction (ECY003)					
Arsenic	µg/L	Report Only[d]	EPA 200.8	0.5	1/quarter
PAH compounds[e]	µg/L	Report Only[d]	EPA 610	10	1/quarter
p-cresol	µg/L	Report Only[d]	EPA 8270D	10	1/quarter
Phenol	µg/L	Report Only[d]	EPA 625.1	4.5	1/quarter
TSS	mg/L	100	SM2540-D	5	1/quarter
Petroleum Hydrocarbons (Diesel Fraction)	mg/L	10	NWTPH-Dx	0.25	1/quarter

[a] The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report. If the Permittee is unable to obtain the required QL due to matrix effects, the Permittee must report the matrix-specific method detection level (MDL) and QL on the DMR. The permittee must also upload the QA/QC documentation from the lab on the QL development.

[b.] 1/quarter means at least one sample taken each quarter, year-round.

[c.] For airports where a single Permittee, or a combination of permitted facilities use more than 100,000 gallons of glycol-based deicing chemicals and/or 100 tons or more of urea on an average annual basis, monitor these additional five parameters in those discharge points that collect runoff from areas where deicing activities occur.

[d] A benchmark does not apply, but permittees must report the sampling result. "Report only" reporting may not be applied to consistent attainment. Ecology will use the data collected during this permit term to determine if the pollutants listed will need to be included in the next permit, and if so, develop benchmarks based on the data received and water quality criteria.

[e] PAH Comounds include: acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

C. Landfills and Airports Subject to Effluent Limitation Guidelines

1. Permittees with discharges from the following activities shall comply with the effluent limits and monitor as specified in Condition S4 and Tables 4 and 5.
2. The discharge of the pollutants at a level more than that identified and authorized by this permit for these activities shall constitute a violation of the terms and conditions of this permit.
3. Permittees operating non-hazardous waste landfills subject to the provisions of 40 CFR §445 Subpart B shall not exceed the effluent limits[4] listed in Table 4.

[4] As set forth in 40 CFR §445 Subpart B, these numeric effluent limits apply to contaminated stormwater discharges from Municipal Solid Waste Landfills that have not been closed in accordance with 40 CFR §258.60, and to contaminated stormwater discharges from those landfills that are subject to the provisions of 40 CFR §257 except for discharges from any of the following facilities: (a) landfills operated in conjunction with other industrial or commercial operations, when the landfill receives only wastes generated by the industrial or commercial operation directly associated with the landfill; (b) landfills operated in conjunction with other industrial or commercial operations, when the landfill receives wastes generated by the industrial or commercial operation directly associated with the landfill and also receives other wastes, provided that the other wastes received for disposal are generated by a facility that is subject to the same provisions in 40 CFR Subchapter N as the industrial or commercial operation, or that the other wastes received are of similar nature to the wastes generated by the industrial or commercial operation; (c) landfills operated in conjunction with CWT facilities subject to 40 CFR §437, so long as the CWT facility commingles the landfill wastewater with other non-landfill wastewater for discharge. A landfill directly associated with a CWT facility is subject to this part if the CWT facility discharges landfill wastewater separately from other CWT wastewater or commingles the wastewater from its landfill only with wastewater from other landfills; or (d) landfills operated in conjunction with other industrial or commercial operations when the landfill receives wastes from public service activities, so long as the company owning the landfill does not receive a fee or other remuneration for the disposal service.

Table 4: Effluent Limits Applicable to Non-Hazardous Waste Landfills Subject to 40 CFR Part 445 Subpart B

Parameter	Units	Average Monthly [a]	Maximum Daily [b]	Analytical Method [c]	Laboratory Quantitation Level [d]	Minimum Sampling Frequency [e]
BOD_5	mg/L	37	140	EPA 405.1 or SM 5210B	2	1/quarter
TSS	mg/L	27	88	SM2540-D	5	1/quarter
Total Ammonia (as N)	mg/L	4.9	10	SM4500-NH3-GH	0.02	1/quarter
Alpha Terpineol	µg/L	16	33	EPA 625.1	N/A [f]	1/quarter
Benzoic Acid	µg/L	71	120	EPA 625.1	N/A [f]	1/quarter
p-Cresol (4-methylphenol)	µg/L	14	25	EPA 8270D	10	1/quarter
Phenol	µg/L	15	26	EPA 625.1	4.5	1/quarter
Zinc, Total	µg/L	110	200	EPA 200.8	2.5	1/quarter
pH	SU	Between 6.0 and 9.0		Meter	±0.1	1/quarter

a. Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. If only one sample is taken during the calendar month, the average monthly effluent limitation applies to that sample. If only one sample is taken during the reporting period, the average monthly effluent limitation applies to that sample.

b. Maximum daily effluent limit means the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. The daily discharge is the average measurement of the pollutant over the day; this does not apply to pH.

c. Or other equivalent EPA-approved method with the same or lower quantitation level.

d. The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR §136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report. The permittee must also upload the QA/QC documentation from the lab on the QL development.

e 1/quarter means at least one sample taken each quarter, year-round.

f EPA method 625.1 does not list quantitation levels for this pollutant. Reporting limits will be performance based and laboratory reporting levels must be included on the DMR.

4. Permittees operating airlines and airports subject to provisions of 40 CFR §449 shall comply with the following:

   a. ***Airfield Pavement*** Deicing. Existing and new primary airports with 1,000 or more annual jet departures (***annual non-propeller aircraft departures***) that discharge wastewater associated with airfield pavement ***deicing*** commingled with stormwater must either use non-urea-containing deicers[5], or meet the effluent limit in Table 5 at every discharge point, prior to any dilution or any commingling with any non-deicing discharge.

Table 5: Effluent Limit Applicable to Airports Subject to 40 CFR Part 449

Parameter	Units	Maximum Daily [a]	Analytical Method [b]	Laboratory Quantitation Level [c]	Minimum Sampling Frequency [d]
Total Ammonia (as N)	mg/L	14.7	SM4500-NH3-GH	0.02	1/quarter

a. Maximum daily effluent limit means the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. The daily discharge is the average measurement of the pollutant over the day.

b. Or other equivalent *EPA*-approved method with the same or lower quantitation level.

c. The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report. If the Permittee is unable to obtain the required QL due to matrix effects, the Permittee must report the matrix-specific method detection level (MDL) and QL on the DMR. The permittee must also upload the QA/QC documentation from the lab on the QL development.

d. 1/quarter means at least one sample taken each quarter, year-round.

D. Conditionally Authorized Non-Stormwater Discharges

1. The categories and sources of non-stormwater discharges identified in Condition S5.D.2, below, are conditionally authorized, provided:

   a. The discharge is otherwise consistent with the terms and conditions of this permit, including Condition S5, S6, and S10.

   b. The Permittee conducts the following assessment for each non-stormwater discharge (except for S5.D.2.a & f) and documents the assessment in the SWPPP, consistent with Condition S3.B.2. The Permittee shall:

      i. Identify each source.

      ii. Identify the location of the discharge into the stormwater collection system.

      iii. Characterize the discharge including estimated flows or flow volume, and likely pollutants which may be present.

[5] Affected Permittees must certify in its annual report that it does not use airfield deicing products that contain urea, or meet the numeric limit in Table 5 (Condition S9.B.4).

iv. Evaluate and implement available and reasonable source control BMPs to reduce or eliminate the discharge.

v. Evaluate compliance of the discharge with the state water quality standards.

vi. Identify appropriate BMPs for each discharge to control pollutants and or flow volumes.

2. Conditionally authorized non-stormwater discharges include:

   a. Discharges from emergency firefighting activities.

   b. Fire protection system flushing, testing, and maintenance.

   c. Discharges of potable water including water line flushing, provided that water line flushing must be de-chlorinated prior to discharge.

   d. Uncontaminated air conditioning or compressor condensate.

   e. Landscape watering and irrigation drainage.

   f. Uncontaminated groundwater or spring water.

   g. Discharges associated with dewatering of foundations, footing drains, or utility vaults where flows are not contaminated with process materials such as solvents.

   h. Incidental windblown mist from cooling towers that collects on rooftops or areas adjacent to the cooling tower. This does not include intentional discharges from cooling towers such as piped cooling tower blow down or drains.

E. Prohibited Discharges

Unless authorized by a separate NPDES or state waste discharge permit, the following discharges are prohibited:

1. The discharge of process wastewater is not authorized. Stormwater that commingles with process wastewater is considered process wastewater.

2. Illicit discharges are not authorized by this permit. Conditionally authorized non-stormwater discharges in compliance with Condition S5.D are not illicit discharges.

F. General Prohibitions

Permittees shall manage stormwater to prevent the discharge of:

1. Synthetic, natural, or processed oil or oil-containing products as identified by an oil sheen, and

2. Trash and floating debris.

S6. DISCHARGES TO IMPAIRED WATERS

A. General Requirements for Discharges to Impaired Waters

Permittees that discharge to an impaired waterbody, either directly or indirectly through a stormwater drainage system, shall conduct sampling and inspections in accordance with Conditions S4, S5, S6, and S7.

B. Eligibility for Coverage of New Discharges to Impaired Waters

Facilities that meet the definition of new discharger and discharge to a ***303(d)-listed waterbody*** (Category 5), or an impaired waterbody with an ***applicable TMDL*** (Category 4A), or a pollution control program for sediment cleanup (i.e., a Category 4B sediment-impaired waterbody) are not eligible for coverage under this permit unless the facility:

1. Prevents all exposure to stormwater of the pollutant(s) for which the waterbody is impaired, and retains documentation of procedures taken to prevent exposure onsite with its SWPPP; **or**
2. Documents that the pollutant(s) for which the waterbody is impaired is not present at the facility, and retains documentation of this finding with the SWPPP; **or**
3. Provides Ecology with data showing that the discharge is not expected to cause or contribute to an exceedance of a water quality standard, and retain such data onsite with its SWPPP. The facility must provide data and other technical information to Ecology sufficient to demonstrate:
    a. For discharges to waters without an EPA approved or established TMDL, that the discharge of the pollutant for which the water is impaired will meet instream water quality criteria at the point of discharge to the waterbody; or
    b. For discharges to waters with an EPA approved or established TMDL, that there are sufficient remaining ***wasteload allocations*** in an EPA approved or established TMDL to allow industrial stormwater discharge and that existing dischargers to the waterbody are subject to compliance schedules designed to bring the waterbody into attainment with water quality standards.

Facilities are eligible for coverage under this permit if Ecology issues permit coverage based upon an affirmative determination that the discharge will not cause or contribute to the existing impairment.

C. Additional Sampling Requirements and Effluent Limits for Discharges to Certain Impaired Waters and Puget Sound Sediment Cleanup Sites

1. Permittees discharging to a 303(d)-listed waterbody (Category 5), either directly or indirectly through a stormwater drainage system, shall comply with the applicable sampling requirements and numeric effluent limits in Table 6. If a discharge point is subject to an impaired waterbody effluent limit (Condition S6.C) for a parameter that also has a benchmark, the effluent limit supersedes the benchmark. Permittees discharging to a 303(d) – listed waterbody (Category 5) that was not 303(d)-listed at the time of 2015 permit coverage shall comply with the applicable sampling requirements and numeric effluent limits in Table 6 as soon as possible, but no later than January 1, 2022.

a. Facilities subject to these limits include, but may not be limited to, facilities listed in Appendix 4.

b. For purposes of this condition, "applicable sampling requirements and effluent limits" means the sampling and effluent limits in Table 6 that correspond to the specific parameter(s) the receiving water is 303(d)-listed for at the time of permit coverage, or total suspended solids (TSS) if the waterbody is 303(d)-listed (Category 5) for sediment quality at the time of permit coverage.

Table 6: Sampling and Effluent Limits Applicable to Discharges to 303(d)-listed Waters

Parameter	Units	Maximum Daily[a]		Analytical Method [b]	Laboratory Quantitation Level [c]	Sampling Frequency[d]
		Freshwater	Marine			
Turbidity	NTUs	25	25	EPA 180.1 Meter	0.5	1/quarter
pH	SU	[i]	Between 7.0 and 8.5	Meter	±0.1	1/quarter
Fecal Coliform Bacteria	# colonies/ 100 mL	Report Only[h]	Report Only[h]	SM 9222D	20 CFU/ 100 mL	1/quarter
E. coli	# colonies/ 100 mL	Report Only[h]	N/A	EPA 1603	20 CFU/ 100 mL	1/quarter
Enterococci	# colonies/ 100 mL	N/A	Report Only[h]	EPA 1600	20 CFU/ 100 mL	1/quarter
TSS [f]	mg/L	30	30	SM2540-D	5	1/quarter
Phosphorus, Total	mg/L	[g]	[g]	EPA 365.1	0.01	1/quarter
Total Ammonia (as N)	mg/L	[g]	[g]	SM 4500 NH_3-GH	0.02	1/quarter
Copper, Total	µg/L	[g]	[g]	EPA 200.8	2.0	1/quarter
Lead, Total	µg/L	[g]	[g]	EPA 200.8	0.5	1/quarter
Mercury, Total	µg/L	2.1	1.8	EPA1631E	0.0005	1/quarter
Zinc, Total	µg/L	[g]	[g]	EPA 200.8	2.5	1/quarter
Pentachlorophenol	µg/L	[g]	[g]	EPA 625.1	10.8	1/quarter

[a] Maximum daily effluent limit means the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. The daily discharge is the average measurement of the pollutant over the day; this does not apply to pH.

[b.] Or other equivalent method with the same reporting level.

[c] The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report. If the Permittee is unable to obtain the required QL due to matrix effects, the Permittee must report the matrix-specific method detection level (MDL) and QL on the DMR. The permittee must also upload the QA/QC documentation from the lab on the QL development.

[d.] 1/quarter means at least one sample taken each quarter, e.g., Q1 = Jan 1 – March 31st, Q2 = April 1 – June 30th

e Permittees shall use either a calibrated pH meter consistent with EPA 9040 or an approved state method.

f. Permittees who discharge to a 303(d)-listed waterbody (Category 5) for sediment quality shall sample discharge for TSS.

g. Site-specific effluent limitation will be assigned at the time of permit coverage.

h. A numeric effluent limit does not apply, but Permittees must sample according to Table 6. In addition, the following mandatory BMPs shall be incorporated into the SWPPP and implemented; the Permittee must:

1) Use all known, available and reasonable methods to prevent rodents, birds, and other animals from feeding/nesting/roosting at the facility. Nothing in this section shall be construed as allowing violations of any applicable federal, state or local statutes, ordinances, or regulations including the Migratory Bird Treaty Act.

2) Perform at least one annual dry weather inspection of the stormwater system to identify and eliminate sanitary sewer cross-connections;

3) Install structural source control BMPs to address on-site activities and sources that could cause bacterial contamination (e.g., dumpsters, compost piles, food waste, animal products):

4) Implement operational source control BMPs to prevent bacterial contamination from any known sources of fecal coliform bacteria (e.g., animal waste);

5) Conduct additional bacteria-related sampling and/or BMPs, if ordered by Ecology on a case-by-case basis.

i The effluent limit for a Permittee who discharges to a freshwater body 303(d)-listed for pH is: Between 6.0 and 8.5, if the 303(d)-listing is for high pH only; Between 6.5 and 9.0, if the 303(d)-listing is for low pH only; and Between 6.5 and 8.5 if the 303(d)-listing is for both low and high pH. All pH effluent limits are applied end-of-pipe.

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2. Permittees discharging to a ***Puget Sound Sediment Cleanup Site***[6] ,either directly or indirectly through a stormwater drainage system, shall comply with this section:

   a. Permittees shall sample the discharge for total suspended solids (TSS) in accordance with Table 7.

   b. If the waterbody is listed within Category 5 (sediment medium) where the ***outfall*** discharges to the waterbody, the discharge is subject to the TSS numeric effluent limit in Table 6.

   c. If the waterbody is not listed within Category 5 (sediment medium) where the outfall discharges to the waterbody, the discharge is subject to the TSS benchmark in Table 7. If a discharge exceeds the TSS benchmark, the Permittee shall comply with Condition S8.

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[6] *Puget Sound Sediment Cleanup Site* means: Category 4B (Sediment) portions of Budd Inlet (Inner), Commencement Bay (Inner), Commencement Bay (Outer), Dalco Passage and East Passage, Duwamish Waterway (including East and West Waterway), Eagle Harbor, Elliot Bay, Hood Canal (North), Liberty Bay, Rosario Strait, Sinclair Inlet, and Thea Foss Waterway; Category 5 (Sediment) portions of the Duwamish Waterway; Category 4A (Sediment) portions of Bellingham Bay (Inner); and the Everett/Port Gardener, Oakland Bay/Shelton Harbor, and Port Angeles Harbor sediment cleanup areas, as mapped on Ecology's ISGP website. All references to Category 4A, 4B and 5 pertain to the 2012 EPA-approved Water Quality Assessment.

Table 7: Benchmarks and Sampling Requirements Applicable to Discharges to Puget Sound Sediment Cleanup Sites that are not Category 5 for Sediment Quality

Parameter	Units	Benchmark Value [a]	Analytical Method	Laboratory Quantitation Level [b]	Minimum Sampling Frequency [c]
TSS	mg/L	30	SM2540-D	5	1/quarter

[a] Permittees sampling more than once per quarter shall average the sample results and compare the average value to the benchmark to determine if it the discharge has exceeded the benchmark value. However, if Permittees collect more than one sample during a 24-hour period, they must first calculate the daily average of the individual grab sample results collected during that 24-hour period; then use the daily average to calculate a quarterly average.

[b] The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method from 40 CFR Part 136 is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the discharge monitoring report. The permittee must also upload the QA/QC documentation from the lab on the QL development.

[c.] 1/quarter means at least one sample taken each quarter, year-round.

d. Permittees shall remove accumulated solids from storm drain lines (including inlets, catch basins, sumps, conveyances lines, and oil/water separators) on or beneath your facility at least once in the term of the permit.

   Permittees shall conduct line cleaning operations (e.g., jetting, vacuuming, removal, loading, storage, and/or transport) using BMPs to prevent discharges of storm drain solids to surface waters of the State.

   Removed storm drain solids and liquids shall be disposed of in accordance with applicable laws and regulations and documented in the SWPPP.

   i. If a Permittee can demonstrate, based on video inspection, in-line storm drain solids sampling, or other documentation, that storm drain line cleaning is not necessary to prevent downstream sediment contamination or recontamination, Ecology may waive this requirement by approving a modification of permit coverage.

   ii. Requests for line cleaning waivers must be accompanied by a modification of coverage form, and a detailed technical basis to support the request. The due date for line cleaning waiver requests is May 15, 2024.

e. Permittees shall sample and analyze storm drain solids in accordance with Table 8 at least once in the term of the permit. Storm drain solids must be collected/sampled from a representative catch basin, sump, pipe or other feature within the storm drain system that corresponds to the discharge point where total suspended solids samples are collected per Condition S6.C. Samples may be either a single grab sample or a composite sample. Samples must be representative of the storm drain solids generated and accumulated in the facility's drainage system. To the extent possible, sample locations must exclude portions of the drainage system affected by water from off-site sources (e.g., run-on from off-site properties, tidal influence, backflow, etc.).

   i. If a Permittee can demonstrate that storm drain solids sampling and analysis is not feasible or not necessary, Ecology may waive this requirement by approving a modification of permit coverage.

ii. Requests for storm drain solids sampling and analysis waivers must be accompanied by a modification of coverage form, and a detailed technical basis to support the request. The due date for solids sampling and analysis waiver requests is May 15, 2021.

f. All storm drain solids sampling data shall be reported to Ecology on a Solids Monitoring Report (SMR) no later than the DMR due date for the reporting period in which the solids were sampled, in accordance with Condition S9.A. A copy of the lab report shall be submitted to Ecology with the SMR.

Table 8: Sampling and Analytical Procedures for Storm Drain Solids

Analyte	Method in Sediment	Quantitation Level [a]
Conventional Parameters		
Percent total solids	SM 2540G, or ASTM Method D 2216	NA
Total organic carbon	Puget Sound Estuary Protocols (PSEP 1997), or EPA 9060	0.1%
Grain size	Ecology Method Sieve and Pipette (ASTM 1997), ASTMD422, or PSEP 1986/2003	NA
Metals		
Antimony, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw [b]
Arsenic, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.1 mg/kg dw
Beryllium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Cadmium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Chromium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.5 mg/kg dw
Copper, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Lead, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Mercury, Total	EPA Method 1631E, or EPA Method 7471B	0.005 mg/kg dw
Nickel, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.1 mg/kg dw
Selenium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.5 mg/kg dw
Silver, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.1 mg/kg dw
Thallium, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	0.2 mg/kg dw
Zinc, Total	EPA Method 200.8 (ICP/MS) , EPA Method 6010 or EPA Method 6020	5.0 mg/kg dw

Analyte	Method in Sediment	Quantitation Level [a]
Organics		
PAH compounds [c]	EPA Method 8270 D	70 µg/kg dw
PCBs (aroclors), Total [d]	EPA Method 8082A	10 µg/kg dw
Petroleum Hydrocarbons		
NWTPH-Dx	NWTPH-Dx	25.0-100.0 mg/ kg dw

[a] The Permittee shall ensure laboratory results comply with the quantitation level (QL) specified in the table. However, if an alternate method is sufficient to produce measurable results in the sample, the Permittee may use that method for analysis. If the Permittee uses an alternative method it must report the test method and QL on the sediment monitoring report. The permittee must also upload the QA/QC documentation from the lab on the QL development. All results shall be reported. For values below the QL, or where a QL is not specified, report results at the method detection limit from the lab and the qualifier of "U" for undetected at that concentration. All results shall be reported. For values below the reporting limit, report results at the method detection limit from the lab and the qualifier of "U" for undetected at that concentration.

[b] dw = dry weight

[c] PAH compounds include: 1-methylnaphthalene, 2-methylnaphthalene, 2-chloronaphthalene, acenaphthylene, acenaphthene anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b, k)fluoranthene, benzo(ghi)perylene, dibenzo(a,h)anthracene, dibenzofuran, carbazole, chrysene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

[d] Total = sum of PCB aroclors 1016+1221+1232+1242+1248+1254+1260

D. Requirements for Discharges to Waters with Applicable TMDLs

1. The Permittee shall comply with applicable TMDL determinations. Applicable TMDLs or TMDL determinations are TMDLs which have been completed by the issuance date of this permit, or which have been completed prior to the date that the Permittee's application is received by Ecology, whichever is later. Ecology will list the Permittee's requirements to comply with this condition on the letter of permit coverage.
2. TMDL requirements associated with TMDLs completed after the issuance date of this permit only become effective if they are imposed through an administrative order issued by Ecology.
3. Where Ecology has established a TMDL wasteload allocation and sampling requirements for the Permittee's discharge, the Permittee shall comply with all requirements of the TMDL as listed in Appendix 5.
    a. If a discharge point is subject to a TMDL-related effluent limit (Condition S6.D) for a parameter that also has a benchmark (Condition S5), the effluent limit supersedes the benchmark.
4. Where Ecology has established a TMDL general wasteload allocation for industrial stormwater discharges for a parameter present in the Permittee's discharge, but has not identified specific requirements, Ecology will assume the Permittee's compliance with the terms and conditions of the permit complies with the approved TMDL.
5. Where Ecology has not established a TMDL wasteload allocation for industrial stormwater discharges for a parameter present in the Permittee's discharge, but has not excluded these discharges, Ecology will assume the Permittee's compliance with the terms and conditions of this permit complies with the approved TMDL.

6. Where a TMDL for a parameter present in the Permittee's discharge specifically precludes or prohibits discharges of stormwater associated with industrial activity, the Permittee is not eligible for coverage under this permit.

S7. INSPECTIONS

A. Inspection Frequency and Personnel

1. The Permittee shall conduct and document visual inspections of the site each month.
2. The Permittee shall ensure that inspections are conducted by qualified personnel.

B. Inspection Components

Each inspection shall include:

1. Observations made at stormwater sampling locations and areas where stormwater associated with industrial activity is discharged off-site; or discharged to waters of the State, or to a storm sewer system that drains to waters of the State.
2. Observations for the presence of floating materials, visible oil sheen, discoloration, turbidity, odor, etc. in the stormwater discharge(s).
3. Observations for the presence of illicit discharges such as domestic wastewater, noncontact cooling water, or process wastewater (including leachate).
    a. If an illicit discharge is discovered, the Permittee shall notify Ecology within seven days.
    b. The Permittee shall eliminate the illicit discharge within 30 days.
4. A verification that the descriptions of potential pollutant sources required under this permit are accurate.
5. A verification that the site map in the SWPPP reflects current conditions.
6. An assessment of all BMPs that have been implemented, noting all of the following:
    a. Effectiveness of BMPs inspected.
    b. Locations of BMPs that need maintenance.
    c. Reason maintenance is needed and a schedule for maintenance.
    d. Locations where additional or different BMPs are needed and the rationale for the additional or different BMPs.

C. Inspection Results

1. The Permittee shall record the results of each inspection in an inspection report or checklist and keep the records on-site, as part of the SWPPP, for Ecology review.
   The Permittee shall ensure each inspection report documents the observations, verifications and assessments required in S7.B and includes:
    a. Time and date of the inspection
    b. Locations inspected

c. Statements that, in the judgment of 1) the person conducting the site inspection, and 2) the person described in Condition G2, the site is either in compliance or out of compliance with the terms and conditions of the SWPPP and this permit.

d. A summary report and a schedule of implementation of the remedial actions that the Permittee plans to take if the site inspection indicates that the site is out of compliance. The remedial actions taken must meet the requirements of the SWPPP and the permit.

e. Name, title, and signature of the person conducting site inspection; and the following statement: "I certify that this report is true, accurate, and complete, to the best of my knowledge and belief."

f. Certification and signature of the person described in Condition G2.A, or a duly authorized representative of the facility, in accordance with Condition G2.B and D.

D. Reports of Non-Compliance

The Permittee shall prepare reports of non-compliance identified during an inspection in accordance with the requirements of Condition S9.E.

S8. CORRECTIVE ACTIONS

A. Implementation of Source Control and Treatment BMPs from Previous Permit

In addition to the Corrective Action Requirements of S8.B-D, Permittees shall implement any applicable Level 1, 2 or 3 Responses required by the previous Industrial Stormwater General Permit(s). Permittees shall continue to operate and/or maintain any source control or treatment BMPs related to Level 1, 2 or 3 Responses implemented prior to the effective date of this permit.

B. Level One Corrective Actions – Operational Source Control BMPs

Permittees that exceed any applicable benchmark value(s) in Table 2, Table 3, and/or Table 7 for any quarter during a calendar year shall complete a Level 1 Corrective Action for each parameter exceeded in accordance with the following:

1. Within 14 days of receipt of sampling results that indicate a benchmark exceedance during a given quarter[7]; or, for parameters other than pH or visible oil sheen, the end of the quarter, whichever is later:

   a. Conduct an inspection to investigate the cause.

   b. Review the SWPPP and ensure that it fully complies with Permit Condition S3, and contains the applicable BMPs from the appropriate Stormwater Management Manual.

[7] Based on quarterly average per Condition S5.A.3, S5.B.2 and/or S6.C.2.c. For pH, and visible oil sheen, quarterly averaging is not allowed, so the 14 days begin upon receipt of a single benchmark exceedance.

c. Make appropriate revisions to the SWPPP to include additional operational source control BMPs with the goal of achieving the applicable benchmark value(s) in future discharges.

2. Summarize the Level 1 Corrective Actions in the Annual Report (Condition S9.B)

3. Level One Deadline: The Permittee shall sign/certify and fully implement the revised SWPPP according to Permit Condition S3 and the applicable Stormwater Management Manual as soon as possible, but no later than the DMR due date for the quarter the benchmark was exceeded.

C. Level Two Corrective Actions – Structural Source Control BMPs

Permittees that exceed an applicable benchmark value in Table 2, Table 3 and/or Table 7 (for a single parameter) for any two quarters during a calendar year shall complete a Level 2 Corrective Action in accordance with S8.C. Alternatively, the Permittee may skip Level 2 and complete a Level 3 Corrective Action in accordance with Condition S8.D.

1. Review the SWPPP and ensure that it fully complies with Permit Condition S3.

2. Make appropriate revisions to the SWPPP to include additional structural source control BMPs with the goal of achieving the applicable benchmark value(s) in future discharges.

3. Summarize the Level 2 Corrective Actions (planned or taken) in the Annual Report (Condition S9.B).

4. **Level 2 Deadline:** The Permittee shall sign/certify the SWPPP using the SWPPP Certification Form found on page 63 of this permit, and fully implement the revised SWPPP according to Permit Condition S3 and the applicable Stormwater Management Manual as soon as possible, but no later than August 31st of the following year.

   a. If installation of necessary structural source control BMPs is not feasible by August 31st of the following year, Ecology may approve additional time, by approving a Modification of Permit Coverage.

   b. If installation of structural source control BMPs is not feasible or not necessary to prevent discharges that may cause or contribute to a violation of a water quality standard, Ecology may waive the requirement for additional structural source control BMPs by approving a Modification of Permit Coverage.

   c. To request a time extension or waiver, a Permittee shall submit a detailed explanation of why it is making the request (technical basis), and a Modification of Coverage form to Ecology in accordance with Condition S2.B, by May 15th prior to Level 2 Deadline. Ecology will approve or deny the request within 60 days of receipt of a complete Modification of Coverage request.

   d. While a time extension is in effect, benchmark exceedances (for the same parameter) do not count towards additional Level 2 or 3 Corrective Actions.

   e. For the year following the calendar year the Permittee triggered a Level 2 corrective action, benchmark exceedances (for the same parameter) do not count towards additional Level 2 or 3 Corrective Actions.

D. Level Three Corrective Actions – Treatment BMPs

Permittees that exceed an applicable benchmark value in Table 2, Table 3, and/or Table 7 (for a single parameter) for any three quarters during a calendar year shall complete a Level 3 Corrective Action in accordance with S8.D. A Level 2 Corrective Action is not required.

1. Review the SWPPP and ensure that it fully complies with Permit Condition S3.
2. Make appropriate revisions to the SWPPP to include additional treatment BMPs with the goal of achieving the applicable benchmark value(s) in future discharges. Revisions shall include additional operational and/or structural source control BMPs if necessary for proper performance and maintenance of treatment BMPs.

   A ***qualified industrial stormwater professional*** shall review the revised SWPPP, sign the SWPPP Certification Form, and certify that it is reasonably expected to meet the ISGP benchmarks upon implementation. Upon written request Ecology may, one time during the permit cycle, waive this requirement on a case-by-case basis if a Permittee demonstrates to Ecology's satisfaction that the proposed Level 3 treatment BMPs are reasonably expected to meet ISGP benchmarks upon implementation.
3. Before installing treatment BMPs that require the site-specific design or sizing of structures, equipment, or processes to collect, convey, treat, reclaim, or dispose of industrial stormwater, the Permittee shall submit an engineering report to Ecology for review.

   a. The engineering report must include:

      i. Brief summary of the treatment alternatives considered and why the proposed option was selected. Include cost estimates of ongoing operation and maintenance, including disposal of any spent media;

      ii. The basic design data, including characterization of stormwater influent, and sizing calculations of the treatment units;

      iii. A description of the treatment process and operation, including a flow diagram;

      iv. The amount and kind of chemicals used in the treatment process, if any. **Note:** Use of stormwater treatment chemicals requires submittal of Request for Chemical Treatment Form;

      v. Results to be expected from the treatment process including the predicted stormwater discharge characteristics;

      vi. A statement, expressing sound engineering justification through the use of pilot plant data, results from similar installations, and/or scientific evidence that the proposed treatment is reasonably expected to meet the permit benchmarks; **and**

      vii. Certification by a licensed professional engineer.

   b. The engineering report shall be submitted no later than the May 15th prior to the Level 3 deadline, unless an alternate due date is specified in an order.

   c. An Operation and Maintenance Manual (O&M Manual) shall be submitted to Ecology no later than 30 days after construction/installation is complete; unless an alternate due date is specified in an order.

4. Summarize the Level 3 Corrective Actions (planned or taken) in the Annual Report (Condition S9.B). Include information on how monitoring, assessment or evaluation information was (or will be) used to determine whether existing treatment BMPs will be modified/enhanced, or if new/additional treatment BMPs will be installed.
5. **Level 3 Deadline:** The Permittee shall sign/certify and fully implement the revised SWPPP according to Permit Condition S3 and the applicable Stormwater Management Manual as soon as possible, but no later than September 30th of the following year.
    a. If installation of necessary treatment BMPs is not feasible by the Level 3 Deadline; Ecology may approve additional time by approving a Modification of Permit Coverage.
    b. If installation of treatment BMPs is not feasible or not necessary to prevent discharges that may cause or contribute to violation of a water quality standard, Ecology may waive the requirement for treatment BMPs by approving a Modification of Permit Coverage.
    c. To request a time extension or waiver, a Permittee shall submit a detailed explanation of why it is making the request (technical basis), and a Modification of Coverage form to Ecology in accordance with Condition S2.B, by May 15th prior to the Level 3 Deadline. Ecology will approve or deny the request within 60 days of receipt of a complete Modification of Coverage request.
    d. While a time extension is in effect, benchmark exceedances (for the same parameter) do not count towards additional Level 2 or 3 Corrective Actions.
    e. For the year following the calendar year the Permittee triggered a Level 3 corrective action, benchmark exceedances (for the same parameter) do not count towards additional Level 2 or 3 Corrective Actions.

S9. REPORTING AND RECORDKEEPING

A. Electronic Reporting Requirements

The Permittee shall submit all NOIs, NOTs, Noncompliance Reports, Annual Reports, DMRs, and other reporting information as required electronically, unless you have a received a waiver from Ecology. All information required to be submitted shall be submitted through Ecology's Water Quality Permitting Portal.

If you are unable to submit electronically (for example, you do **not** have access to the internet), you must contact Ecology to request an Electronic Reporting Waiver form and submit the completed form to Ecology.

B. Discharge Monitoring Reports

1. The Permittee shall submit sampling data obtained during each reporting period on a Discharge Monitoring Report (DMR) or a Solids Monitoring Form (SMR)[8] form provided, or otherwise approved, by Ecology.
2. Upon permit coverage, the Permittee shall ensure that DMRs are submitted to Ecology by the DMR due dates below:

Table 9: Reporting Dates and DMR Due Dates

Reporting Period	Months	DMR Due Date
1st	January-March	May 15
2nd	April-June	August 15
3rd	July-Sept	November 15
4th	October-December	February 15

3. DMRs and SMRs shall be submitted electronically using Ecology's Water Quality Permitting Portal – Discharge Monitoring Report (DMR) application, unless a waiver from electronic reporting has been granted (e.g., if a Permittee does not have broadband internet access). SMR forms, identified as a single sample DMR type, are included with the quarterly DMR forms on the Portal. If a waiver has been granted, reports must be postmarked or delivered to the following address by the due date:

   Department of Ecology
   Water Quality Program – Industrial Stormwater
   PO Box 47696
   Olympia, Washington 98504-7696

4. The first full quarter following permit coverage, the Permittee shall submit a DMR each reporting period, whether or not the facility discharged stormwater from the site.
   a. If no stormwater sample was obtained from the site during a given reporting period, the Permittee shall submit the DMR form indicating "no sample obtained," or "no discharge during the quarter," with a written explanation as to why there was no sample taken or no discharge.
   b. If a Permittee has suspended sampling for a parameter due to consistent attainment, the Permittee shall submit a DMR and indicate that it has achieved consistent attainment for that parameter(s).
5. The Permittee must use the Water Quality Permitting Portal – Permit Submittals application (unless otherwise specified in the permit) to submit all other written permit-required reports by the date specified in the permit unless a waiver has been granted under S9.B. If a

[8] SMR required if Condition S6.C.2 applies.

waiver has been granted, DMRs must be postmarked or delivered to the address listed in S9.B.3 by the due date.

C. Annual Reports

1. The Permittee shall submit a complete and accurate Annual Report to the Department of Ecology no later than May 15th of each year using Ecology's Water Quality Permitting Portal – Permit Submittals application, unless a waiver from electronic reporting has been granted according to S9.B.3. Annual Reports are not required if the Permittee didn't have permit coverage during the previous calendar year.
2. The annual report shall include corrective action documentation as required in S8.B-D. If corrective action is not yet completed at the time of submission of this annual report, the Permittee must describe the status of any outstanding corrective action(s).
3. Permittees shall include the following information with each annual report. The Permittee shall:
    a. Identify the condition triggering the need for corrective action review.
    b. Describe the problem(s) and identify the dates they were discovered.
    c. Summarize any Level 1, 2 or 3 corrective actions completed during the previous calendar year and include the dates it completed the corrective actions.
    d. Describe the status of any Level 2 or 3 corrective actions triggered during the previous calendar year, and identify the date it expects to complete corrective actions.
    e. Primary airport Permittees with at least 1,000 annual jet departures shall include a certification statement in each annual report that it does not use airfield deicing products that contain urea. Alternatively, Permittees shall meet the numeric effluent limit for ammonia in Condition S5.C, Table 5.
4. Permittees shall retain a copy of all annual reports onsite for Ecology review.

D. Records Retention

1. The Permittee shall retain the following documents onsite for a minimum of five years:
    a. A copy of this permit.
    b. A copy of the permit coverage letter.
    c. Records of all sampling information specified in Condition S4.B.3.
    d. Inspection reports including documentation specified in Condition S7.
    e. Any other documentation of compliance with permit requirements.
    f. All equipment calibration records.
    g. All BMP maintenance records.
    h. All original recordings for continuous sampling instrumentation.
    i. Copies of all laboratory reports as described in Condition S3.B.4.
    j. Copies of all reports required by this permit.

k. Records of all data used to complete the application for this permit.

2. The Permittee shall extend the period of records retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee, or when requested by Ecology.

3. The Permittee shall make all plans, documents, and records required by this permit immediately available to Ecology or the local jurisdiction upon request; or within 14 days of a written request from Ecology.

E. Additional Sampling by the Permittee

If the Permittee samples any pollutant at a designated sampling point more frequently than required by this permit, then the Permittee shall include the results in the calculation and reporting of the data submitted in the Permittee's DMR.

If Permittees collect more than one sample during a 24-hour period, they must first calculate the daily average of the individual grab sample results collected during that 24-hour period; then use the daily average to calculate a quarterly average.

F. Reporting Permit Violations

1. In the event the Permittee is unable to comply with any of the terms and conditions of this permit which may endanger human health or the environment, or exceed any numeric effluent limitation in the permit, the Permittee shall, upon becoming aware of the circumstances:

   a. Immediately take action to minimize potential pollution or otherwise stop the noncompliance and correct the problem.

   b. Immediately notify the local jurisdiction and appropriate Ecology regional office of the failure to comply:

      • **Central Region** at (509) 575-2490 for Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, or Yakima County

      • **Eastern Region** at (509) 329-3400 for Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, or Whitman County

      • **Northwest Region** at (425) 649-7000 for Island, King, Kitsap, San Juan, Skagit, Snohomish, or Whatcom County

      • **Southwest Region** at (360) 407-6300 for Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Lewis, Mason, Pacific, Pierce, Skamania, Thurston, or Wahkiakum County

   c. Submit a detailed written report to Ecology within 5 days of the time the Permittee becomes aware of the circumstances, unless Ecology requests an earlier submission. The report shall be submitted using Ecology's Water Quality Permitting Portal – Permit Submittals application, unless a waiver from electronic reporting has been granted according to S9.B.3. The Permittee's report shall contain:

      i. A description of the noncompliance, including exact dates and times.

ii. Whether the noncompliance has been corrected and, if not, when the noncompliance will be corrected.

iii. The steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

d. Upon request of the Permittee, Ecology may waive the requirements for a written report on a case-by-case basis, if the immediate notification (S9.F.1.b) is received by Ecology within 24 hours.

2. Compliance with the requirements of this section does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

G. Public Access to SWPPP

The Permittee shall provide access to, or a copy of, the SWPPP to the public when requested in writing. Upon receiving a written request from the public for the SWPPP, the Permittee shall:

1. Provide a copy of the SWPPP to the requestor within 14 days of receipt of the written request; ***or***
2. Notify the requestor within ten days of receipt of the written request of the location and times within normal business hours when the requestor may view the SWPPP, and provide access to the SWPPP within 14 days of receipt of the written request; ***or***
3. If you provide a URL in your NOI where your SWPPP can be found, and maintain your current SWPPP at this URL, you will have complied with the public availability requirements for the SWPPP. To remain current, you must post any SWPPP modifications, records, and other reporting elements required for the permit term at the same URL as the main body of the SWPPP.

S10. COMPLIANCE WITH STANDARDS

A. Discharges shall not cause or contribute to a violation of Surface Water Quality Standards (Chapter 173-201A WAC), Groundwater Quality Standards (Chapter 173-200 WAC), Sediment Management Standards (Chapter 173-204 WAC), and federal human health-based criteria for Washington (40 CFR 131.45). Discharges that are not in compliance with these standards are prohibited.

B. Ecology will presume compliance with water quality standards, unless discharge monitoring data or other site specific information demonstrates that a discharge causes or contributes to violation of water quality standards, when the Permittee is:

1. In full compliance with all permit conditions, including planning, sampling, monitoring, reporting, and recordkeeping conditions.
2. Fully implementing stormwater best management practices contained in stormwater technical manuals approved by the department, or practices that are demonstrably equivalent to practices contained in stormwater technical manuals approved by Ecology,

including the proper selection, implementation, and maintenance of all applicable and appropriate best management practices for on-site pollution control.

C. Prior to the discharge of stormwater and non-stormwater to waters of the State, the Permittee shall apply all known and reasonable methods of prevention, control, and treatment (AKART). To comply with this condition, the Permittee shall prepare and implement an adequate SWPPP, with all applicable and appropriate BMPs, including the BMPs necessary to meet the standards identified in Condition S10.A, and shall install and maintain the BMPs in accordance with the SWPPP, applicable SWMMs, and the terms and conditions of this permit.

S11. PERMIT FEES

A. The Permittee shall pay permit fees assessed by Ecology and established in Chapter 173-224 WAC.

B. Ecology will continue to assess permit fees until it terminates a permit in accordance with Special Condition S13 or revoked in accordance with General Condition G5.

S12. SOLID AND LIQUID WASTE MANAGEMENT

The Permittee shall not allow solid waste material or ***leachate*** to cause violations of the State Surface Water Quality Standards (Chapter 173-201A WAC), the Groundwater Quality Standards (Chapter 173-200 WAC) or the Sediment Management Standards (Chapter 173-204 WAC).

S13. NOTICE OF TERMINATION (NOT)

A. Conditions for a NOT

Ecology may approve a Notice of Termination (NOT) request when the Permittee meets one or more of the following conditions and Ecology determines that the discharges from the facility are no longer required to be covered under this permit:

1. All permitted stormwater discharges associated with industrial activity that are authorized by this permit cease because the industrial activity has ceased, and no significant materials or industrial pollutants remain exposed to stormwater.
2. The party that is responsible for permit coverage (signatory to application) sells or otherwise legally transfers responsibility for the industrial activity.
3. All stormwater discharges associated with industrial activity are prevented because the stormwater is redirected to a sanitary sewer, or discharged to ground (e.g., infiltration).

B. Procedure for Obtaining Termination

1. The Permittee shall apply for a NOT on a form specified by Ecology (NOT Form).
2. The Permittee seeking permit coverage termination shall sign the NOT in accordance with Condition G2 of this permit.
3. The Permittee shall submit the completed NOT form to Ecology through the WQWebPortal.

GENERAL CONDITIONS

G1. DISCHARGE VIOLATIONS

All discharges and activities authorized by this general permit shall be consistent with the terms and conditions of this general permit. Any discharge of any pollutant more frequently than, or at a level in excess of that identified and authorized by the general permit, shall constitute a violation of the terms and conditions of this permit.

G2. SIGNATORY REQUIREMENTS

A. All permit applications shall be signed:

1. In the case of corporations, by a ***responsible corporate officer***.
2. In the case of a partnership, by a general partner of a partnership.
3. In the case of sole proprietorship, by the proprietor.
4. In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official.

B. All reports required by this permit and other information requested by Ecology shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

1. The authorization is made in writing by a person described above and submitted to the Ecology.
2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters.

C. Changes to authorization. If an authorization under paragraph G2.B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph G2.B.2 above shall be submitted to Ecology prior to, or together with, any reports, information, or applications to be signed by an authorized representative.

D. Certification. Any person signing a document under this section shall make the following certification:

> "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G3. RIGHT OF INSPECTION AND ENTRY

The Permittee shall allow an authorized representative of Ecology, upon the presentation of credentials and such other documents as may be required by law:

A. To enter upon the premises where a discharge is located or where any records shall be kept under the terms and conditions of this permit.

B. To have access to and copy, at reasonable times and at reasonable cost, any records required to be kept under the terms and conditions of this permit.

C. To inspect, at reasonable times, any facilities, equipment (including sampling and control equipment), practices, methods, or operations regulated or required under this permit.

D. To sample or monitor, at reasonable times, any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G4. GENERAL PERMIT MODIFICATION AND REVOCATION

This permit may be modified, revoked and reissued, or terminated in accordance with the provisions of Chapter 173-226 WAC. Grounds for modification, revocation and reissuance, or termination include, but are not limited to, the following:

A. When a change which occurs in the technology or practices for control or abatement of pollutants applicable to the category of dischargers covered under this permit.

B. When effluent limitation guidelines or standards are promulgated pursuant to the CWA or Chapter 90.48 RCW, for the category of dischargers covered under this permit.

C. When a water quality management plan containing requirements applicable to the category of dischargers covered under this permit is approved.

D. When information is obtained which indicates that cumulative effects on the environment from dischargers covered under this permit are unacceptable.

G5. REVOCATION OF COVERAGE UNDER THE PERMIT

A. Pursuant with Chapter 43.21B RCW and Chapter 173-226 WAC, Ecology may terminate coverage for any discharger under this permit for cause. Cases where coverage may be terminated include, but are not limited to, the following:

1. Violation of any term or condition of this permit.

2. Obtaining coverage under this permit by misrepresentation or failure to disclose fully all relevant facts.

3. A change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge.

4. Failure or refusal of the Permittee to allow entry as required in RCW 90.48.090.

5. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations.

6. Nonpayment of permit fees or penalties assessed pursuant to RCW 90.48.465 and Chapter 173-224 WAC.

7. Failure of the Permittee to satisfy the public notice requirements of WAC 173-226-130(5), when applicable.

B. Ecology may require any discharger under this permit to apply for and obtain coverage under an individual permit or another more specific general permit.

C. Permittees who have their coverage revoked for cause according to WAC 173-226-240 may request temporary coverage under this permit during the time an individual permit is being developed, provided the request is made within 90 days from the time of revocation and is submitted along with a complete individual permit application form.

G6. REPORTING A CAUSE FOR MODIFICATION

The Permittee shall submit a new application, or a supplement to the previous application, whenever a material change to the industrial activity or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application shall be submitted at least 60 days prior to any proposed changes. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G7. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G8. DUTY TO REAPPLY

The Permittee shall apply for permit renewal at least 180 days prior to the expiration date of this permit.

G9. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of stormwater shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G10. DUTY TO PROVIDE INFORMATION

The Permittee shall submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also submit to Ecology, upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G11. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G12. ADDITIONAL SAMPLING

Ecology may establish specific sampling requirements in addition to those contained in this permit by administrative order or permit modification.

G13. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to $10,000 and costs of prosecution, or by imprisonment at the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of this permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to $10,000 for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G14. UPSET

Definition – "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limitations because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

An upset constitutes an affirmative defense to an action brought for noncompliance with such technology-based permit effluent limitations if the requirements of the following paragraph are met.

A Permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs or other relevant evidence that: 1) an upset occurred and that the Permittee can identify the cause(s) of the upset; 2) the permitted facility was being properly operated at the time of the upset; 3) the Permittee submitted notice of the upset as required in condition S9.E; **and** 4) the Permittee complied with any remedial measures required under this permit.

In any enforcement proceeding, the Permittee seeking to establish the occurrence of an upset has the burden of proof.

G15. PROPERTY RIGHTS

This permit does not convey any property rights of any sort, or any exclusive privilege.

G16. DUTY TO COMPLY

The Permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G17. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G18. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any sampling device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition, punishment shall be a fine of not more than $20,000 per day of violation, or imprisonment of not more than four years, or both.

G19. REPORTING PLANNED CHANGES

The Permittee shall, as soon as possible, give notice to Ecology of planned physical alterations, modifications, or additions to the permitted industrial activity, which will result in:

A. The permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b).

B. A significant process change, as defined in the glossary of this permit.

C. A change in the location of industrial activity that affects the Permittee's sampling requirements in Conditions S3, S4, S5, and S6.

Following such notice, permit coverage may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation.

G20. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to Ecology, it shall promptly submit such facts or information.

G21. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee shall give advance notice to Ecology by submission of a new application, or supplement to the existing application, at least 45 days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during non-critical water quality periods and carried out in a manner approved by Ecology.

G22. REQUESTS TO BE EXCLUDED FROM COVERAGE UNDER THE PERMIT

A. Any discharger authorized by this permit may request to be excluded from coverage under the general permit by applying for an individual permit.

B. The discharger shall submit to Ecology an application as described in WAC 173-220-040 or WAC 173-216-070, whichever is applicable, with reasons supporting the request. These reasons shall fully document how an individual permit will apply to the applicant in a way that the general permit cannot.

C. Ecology may make specific requests for information to support the request. Ecology shall either issue an individual permit or deny the request with a statement explaining the reason for the denial.

D. When an individual permit is issued to a discharger otherwise subject to the industrial stormwater general permit, the applicability of the industrial stormwater general permit to that Permittee is automatically terminated on the effective date of the individual permit.

G23. APPEALS

A. The terms and conditions of this general permit, as they apply to the appropriate class of dischargers, are subject to appeal by any person within 30 days of issuance of this general permit, in accordance with Chapter 43.21B RCW and Chapter 173-226 WAC.

B. The terms and conditions of this general permit, as they apply to an individual discharger, are appealable in accordance with Chapter 43.21B RCW within 30 days of the effective date of coverage of that discharger. Consideration of an appeal of general permit coverage of an individual discharger is limited to the general permit's applicability or nonapplicability to that individual discharger.

C. The appeal of general permit coverage of an individual discharger does not affect any other dischargers covered under this general permit. If the terms and conditions of this general permit are found to be inapplicable to any individual discharger(s), the matter shall be remanded to Ecology for consideration of issuance of an individual permit or permits.

G24. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit shall not be affected thereby.

G25. BYPASS PROHIBITED

Bypass, which is the intentional diversion of waste streams from any portion of a treatment facility, is prohibited, and Ecology may take enforcement action against a Permittee for bypass unless one of the following circumstances (A, B, or C) is applicable.

A. Bypass for Essential Maintenance without the Potential to Cause Violation of Permit Limits or Conditions

Bypass is authorized if it is for essential maintenance and does not have the potential to cause violations of limitations or other conditions of this permit, or adversely impact public health as determined by Ecology prior to the bypass. The Permittee must submit prior notice, if possible, at least ten days before the date of the bypass.

B. Bypass Which is Unavoidable, Unanticipated, and Results in Noncompliance of this Permit

This bypass is permitted only if:

1. Bypass is unavoidable to prevent loss of life, personal injury, or ***severe property damage***. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass.

2. There are no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment downtime (but not if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance), or transport of untreated wastes to another treatment facility.
3. Ecology is properly notified of the bypass as required in condition S9E of this permit.

C. Bypass which is anticipated and has the Potential to Result in Noncompliance of this Permit

The Permittee must notify Ecology at least thirty days before the planned date of bypass. The notice must contain (1) a description of the bypass and its cause; (2) an analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing; (3) a cost-effectiveness analysis of alternatives including comparative resource damage assessment; (4) the minimum and maximum duration of bypass under each alternative; (5) a recommendation as to the preferred alternative for conducting the bypass; (6) the projected date of bypass initiation; (7) a statement of compliance with SEPA; (8) a request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated; and (9) steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

For probable construction bypasses, the need to bypass is to be identified as early in the planning process as possible. The analysis required above must be considered during preparation of the engineering report or facilities plan and plans and specifications and must be included to the extent practical. In cases where the probable need to bypass is determined early, continued analysis is necessary up to and including the construction period in an effort to minimize or eliminate the bypass.

Ecology will consider the following prior to issuing an administrative order for this type bypass:

1. If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.
2. If there are feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.
3. If the bypass is planned and scheduled to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve or deny the request. The public must be notified and given an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Approval of a request to bypass will be by administrative order issued by Ecology under RCW 90.48.120.

APPENDIX 1 – ACRONYMS

AKART	All Known, Available and Reasonable methods of prevention, control and Treatment
BMP	Best Management Practice
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response Compensation & Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
CWT	Centralized Waste Treatment
EPA	Environmental Protection Agency
ESC	Erosion and Sediment Control
FAA	Federal Aviation Administration
FWPCA	Federal Water Pollution Control Act
NAICS	North American Industry Classification System
NOI	Notice of Intent
NOT	Notice of Termination
NPDES	National Pollutant Discharge Elimination System
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
SARA	Superfund Amendment and Reauthorization Act
SEPA	State Environmental Policy Act
SIC	Standard Industrial Classification
SMCRA	Surface Mining Control and Reclamation Act
SWMM	Stormwater Management Manual
SWPPP	Stormwater Pollution Prevention Plan

TMDL Total Maximum Daily Load

TSS Total Suspended Solids

USC United States Code

WAC Washington Administrative Code

WQ Water Quality

APPENDIX 2 – DEFINITIONS

40 CFR means Title 40 of the Code of Federal Regulations, which is the codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the federal government.

303(d)-Listed water body means waterbodies as listed as Category 5 on Washington State's Water Quality Assessment.

Air Emission means a release of air contaminants into the ambient air.

Airfield Pavement means all paved surfaces on the airside of an airport.

AKART is an acronym for "all known, available, and reasonable methods of prevention, control, and treatment." AKART represents the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants and controlling pollution associated with a discharge.

Annual Non-Propeller Aircraft Departures means the average number of commercial turbine-engine aircraft that are propelled by jet, i.e., turbojet or turbofan, that take off from an airport on an annual basis, as tabulated by the Federal Aviation Administration (FAA).

Applicable TMDL means a TMDL which has been completed either before the issuance date of this permit or the date the Permittee first obtains coverage under this permit, whichever is later.

Application means a request for coverage under this general permit pursuant to WAC 173-226-200. Also called a Notice of Intent (NOI).

Average means arithmetic mean, which is equal to the sum of the measurements divided by the number of measurements.

Benchmark means a pollutant concentration used as a permit threshold, below which a pollutant is considered unlikely to cause a water quality violation, and above which it may. When pollutant concentrations exceed benchmarks, corrective action requirements take effect. Benchmark values are not water quality standards and are not numeric effluent limitations; they are indicator values.

Best Management Practices (BMPs) means schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the State. BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. In this permit BMPs are further categorized as operational source control, structural source control, erosion and sediment control, and treatment BMPs.

Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

Clean Water Act (CWA) means the Federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, and 97-117; USC 1251 et seq.

Combined Sewer means a sewer which has been designed to serve as a sanitary sewer and a storm sewer, and into which inflow is allowed by local ordinance.

Construction Activity means clearing, grading, excavation and any other activity which disturbs the surface of the land. Such activities may include road building, construction of residential houses, office buildings, industrial buildings, and demolition activity.

Control Plan means a total maximum daily load (TMDL) determination, restrictions for the protection of state or federal threatened or endangered species, a groundwater management plan, or other limitations that regulate or set limits on discharges to a specific waterbody or ground water recharge area.

Daily Average means the average measurement of the pollutant throughout a period of 24 consecutive hours starting at 12:01 A.M. and ending at the following 12:00 P.M. (midnight).

Deicing means procedures and practices to remove or prevent any accumulation of snow or ice on: 1) an aircraft; or 2) airfield pavement.

Demonstrably Equivalent means that the technical basis for the selection of all stormwater best management practices are documented within a stormwater pollution prevention plan. The stormwater pollution prevention plan must document: 1) The method and reasons for choosing the stormwater best management practices selected; 2) The pollutant removal performance expected from the practices selected; 3) The technical basis supporting the performance claims for the practices selected, including any available existing data concerning field performance of the practices selected; 4) An assessment of how the selected practices will comply with state water quality standards; and 5) An assessment of how the selected practices will satisfy both applicable federal technology-based treatment requirements and state requirements to use all known, available, and reasonable methods of prevention, control, and treatment.

Detention means the temporary storage of stormwater to improve quality and/or to reduce the mass flow rate of discharge.

Discharge [of a pollutant] means any addition of any pollutant or combination of pollutants to surface waters of the State of Washington from any point source. This definition includes additions of pollutants into surface waters of the State of Washington from: surface runoff which is collected or channeled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a treatment works; and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works.

Discharge Point means the location where a discharge leaves the Permittee's facility. Discharge point also includes the location where a discharge enters the ground on-site (e.g., infiltration BMP).

Discharger means an owner or operator of any facility or activity subject to regulation under Chapter 90.48 RCW or the Federal Clean Water Act.

Domestic Wastewater means water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments, or other places, together with such groundwater infiltration or surface waters as may be present.

Ecology means the Washington State Department of Ecology.

EPA means the United States Environmental Protection Agency.

Equivalent BMPs means operational, source control, treatment, or innovative BMPs which result in equal or better quality of stormwater discharge to surface water or to groundwater than BMPs selected from the SWMM.

Erosion means the wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Erosion and Sediment Control BMPs means BMPs that are intended to prevent erosion and sedimentation, such as preserving natural vegetation, seeding, mulching and matting, plastic covering, filter fences, and sediment traps and ponds.

Existing Facility means a facility that was in operation prior to the effective date of this permit. It also includes any facility that is not categorically included for coverage but is in operation when identified by Ecology as a significant contributor of pollutants.

Facility means any establishment (including land or appurtenances thereto) that is subject to regulation under this permit. See Special Condition S1.

First Fall Storm Event means the first time on or after September 1st of each year that precipitation occurs and results in a stormwater discharge from a facility. This storm event tends to wash off and discharge pollutants that accumulate during the preceding dry months.

General Permit means a permit which covers multiple dischargers of a point source category within a designated geographical area, in lieu of individual permits being issued to each discharger.

Groundwater means water in a saturated zone or stratum beneath the land surface or a surface waterbody.

Hazardous Substance means any liquid, solid, gas, or sludge, including any material, substanct, product, commodigy, or waste, regardless of quantity, that exhibits any of the physical, chemical, or biological properties described in WAC 173-303-090 or 173-303-100.

Illicit Discharge means any discharge that is not composed entirely of stormwater except (1) discharges authorized pursuant to a separate NPDES permit, or (2) conditionally authorized non-stormwater discharges identified in Condition S5.D.

Inactive Facility means a facility that no longer engages in business, production, providing services, or any auxiliary operation.

Industrial Activity means (1) the 11 categories of industrial activities identified in 40 CFR 122.26(b)(14)(i-xi) that must apply for either coverage under this permit or no exposure certification, (2) any facility conducting any activities described in Table 1, and (3) the activities occurring at any facility identified by Ecology as a significant contributor of pollutants. Table 1 lists the 11 categories of industrial activities identified in 40 CFR 122.26(b)(14)(i-xi) in a different format.

Land Application Site means an area where wastes are applied onto or incorporated into the soil surface (excluding manure spreading operations) for treatment or disposal.

Landfill means an area of land or an excavation in which wastes are placed for permanent disposal, and which is not a land application site, surface impoundment, injection well, or waste pile.

Leachate means water or other liquid that has percolated through raw material, product or waste and contains substances in solution or suspension as a result of the contact with these materials.

Local Government means any county, city, or town having its own government for local affairs.

Material Handling means storage, loading and unloading, transportation, or conveyance of any raw material, intermediate product, final product, by-product or waste product.

Municipality means a political unit such as a city, town or county; incorporated for local self-government.

National Pollutant Discharge Elimination System (NPDES) means the national program for issuing, modifying, revoking, and reissuing, terminating, and enforcing permits, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the Federal Clean Water Act, for the discharge of pollutants to surface waters of the State from point sources. These permits are referred to as NPDES permits and, in Washington State, are administered by the Washington Department of Ecology.

New Development means land disturbing activities, including Class IV -general forest practices that are conversions from timber land to other uses; structural development, including construction or installation of a building or other structure; creation of impervious surfaces; and subdivision, short subdivision and binding site plans, as defined and applied in Chapter 58.17 RCW. Projects meeting the definition of redevelopment shall not be considered new development.

New Discharge(r) means a facility from which there is a discharge, that did not commence the discharge at a particular site prior to August 13, 1979, which is not a new source, and which has never received a finally effective NPDES permit for discharges at that site. See 40 CFR 122.2.

New Facility means a facility that begins activities that result in a discharge or a potential discharge to waters of the State on or after the effective date of this general permit.

Noncontact Cooling Water means water used for cooling which does not come into direct contact with any raw material, intermediate product, waste product, or finished product.

North American Industry Classification System (NAICS) means the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. NAICS was developed under the auspices of the Office of Management and Budget (OMB), and adopted in 1997 to replace the Standard Industrial Classification (SIC) system. It was developed jointly by the U.S. Economic Classification Policy Committee (ECPC), Statistics Canada, and Mexico's Instituto Nacional de Estadistica y Geografia to allow for a high level of comparability in business statistics among the North American countries.

Notice of Intent (NOI) – *See "*Application*"*

Notice of Termination (NOT) means a request for termination of coverage under this general permit as specified by Special Condition S13 of this permit.

Operational Source Control BMPs means schedule of activities, prohibition of practices, maintenance procedures, employee training, good housekeeping, and other managerial practices to prevent or reduce the pollution of waters of the State. Not included are BMPs that require construction of pollution control devices.

Operator means any entity with a stormwater discharge associated with industrial activity.

Outfall means the point where a discharge from a facility enters a receiving waterbody or receiving waters.

Pollutant means the discharge of any of the following to waters of the State: dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, domestic sewage sludge (biosolids), munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste. This term does not include sewage from vessels within the meaning of section 312 of the FWPCA nor does it include dredged or fill material discharged in accordance with a permit issued under section 404 of the FWPCA.

Pollution means contamination or other alteration of the physical, chemical, or biological properties of waters of the State; including change in temperature, taste, color, turbidity, or odor of the waters; or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the State as will or is likely to create a nuisance or render such waters harmful, detrimental or injurious to the public health, safety or welfare; or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses; or to livestock, wild animals, birds, fish, or other aquatic life.

Process Wastewater means any non-stormwater which, during manufacturing or processing, comes into direct contact or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. If stormwater commingles with process wastewater, the commingled water is considered process wastewater.

Puget Sound Sediment Cleanup Site means Category 4B (Sediment) portions of Budd Inlet (Inner), Commencement Bay (Inner), Commencement Bay (Outer), Dalco Passage and East Passage, Duwamish Waterway (including East and West Waterway), Eagle Harbor, Elliot Bay, Hood Canal (North), Liberty Bay, Rosario Strait, Sinclair Inlet, and Thea Foss Waterway; Category 5 (Sediment) portions of the Duwamish Waterway; Category 4A (Sediment) portions of Bellingham Bay (Inner); and the Everett/Port Gardener and Port Angeles Harbor sediment cleanup areas, as mapped on Ecology's ISGP website. All references to Category 4A, 4B and 5 pertain to the 2012 EPA-approved Water Quality Assessment.

Qualified Industrial Stormwater Professional means a licensed professional engineer, geologist, hydrogeologist; Certified Professional in Stormwater Quality, Certified Professional in Erosion and Sediment Control; or qualified environmental professional with education and experience in stormwater management and licensed to do business in the State of Washington.

Qualified Personnel means those who (1) possesses the knowledge and skills to assess conditions and activities at the facility that could impact stormwater quality; (2) can evaluate the effectiveness of best management practices required by this permit for this specific facility and its unique operations

and; (3) is familiar with site operations and practices with sufficient authority to commit the organization to the BMPs and actions detailed in the SWPPP..

Quantitation Level (QL) *also known as Minimum Level of Quantitation (ML)* means the lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

Reasonable Potential means the likely probability for pollutants in the discharge to exceed the applicable water quality criteria in the receiving waterbody.

Redevelopment means on a site that is already substantially developed (i.e., has 35% or more of existing impervious surface coverage), the creation or addition of impervious surfaces; the expansion of a building footprint or addition or replacement of a structure; structural development including construction, installation or expansion of a building or other structure; replacement of impervious surface that is not part of a routine maintenance activity; and land disturbing activities.

Regular Business Hours means those time frames when the facility is engaged in its primary production process, but does not include additional shifts or weekends when partial staffing is at the site primarily for maintenance and incidental production activities. Regular business hours do not include periods of time that the facility is inactive and unstaffed.

Representative [sample] means a sample of the discharge that accurately characterizes stormwater runoff generated in the designated drainage area of the facility.

Responsible Corporate Officer means: (i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or (ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions which govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations; the manager can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Runoff means that portion of rainfall or snowmelt water not absorbed into the ground that becomes surface flow.

Sanitary Sewer means a sewer which is designed to convey domestic wastewater.

Sediment means the fragmented material that originates from the weathering and erosion of rocks, unconsolidated deposits, or unpaved yards, and is transported by, suspended in, or deposited by water.

Severe Property Damage means substantial physical damage to property, damage to the treatment facilities which would cause them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

Significant Amount means an amount of a pollutant in a discharge that is amenable to available and reasonable methods of prevention, control, or treatment; or an amount of a pollutant that has a reasonable potential to cause a violation of surface or ground water quality standards or sediment management standards.

Significant Contributor of Pollutant(s) means a facility determined by Ecology to be a contributor of a significant amount(s) of a pollutant(s) to waters of the State.

Significant Materials includes, but is not limited to: raw materials; fuels; materials such as solvents, detergents, and plastic pellets; finished materials such as metallic products; raw materials used in food processing or production; hazardous substances designated under section 101(14) of CERCLA; any chemical the facility is required to report pursuant to section 313 of title III of SARA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with stormwater discharges.

Significant Process Change means any modification of the facility that would result in any of the following:

1. Add different pollutants in a significant amount to the discharge.
2. Increase the pollutants in the stormwater discharge by a significant amount.
3. Add a new industrial activity (SIC) that was not previously covered.
4. Add additional impervious surface or acreage such that stormwater discharge would be increased by 25% or more.

Source Control BMPs means structures or operations that are intended to prevent pollutants from coming into contact with stormwater through physical separation of areas or careful management of activities that are sources of pollutants. This permit separates source control into two types: structural source control BMPs and operational source control BMPs.

Standard Industrial Classification (SIC) is the statistical classification standard underlying all establishment-based federal economic statistics classified by industry as reported in the 1987 SIC Manual by the Office of Management and Budget.

State Environmental Policy Act (SEPA) means the Washington State Law, RCW 43.21C.020, intended to prevent or eliminate damage to the environment.

Storm Sewer means a sewer that is specifically designed to carry stormwater. Also called a storm drain.

Stormwater means that portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a stormwater drainage system into a defined surface waterbody, or a constructed infiltration facility.

Stormwater Drainage System means constructed and natural features which function together as a system to collect, convey, channel, hold, inhibit, retain, detain, infiltrate or divert stormwater.

Stormwater Management Manual (SWMM) or ***Manual*** means the technical manuals prepared by Ecology for stormwater management in western and eastern Washington.

Stormwater Pollution Prevention Plan (SWPPP) means a documented plan to implement measures to identify, prevent, and control the contamination of point source discharges of stormwater.

Structural Source Control BMPs means physical, structural, or mechanical devices or facilities that are intended to prevent pollutants from entering stormwater.

Substantially Identical Discharge Point means a discharge point that shares the following characteristics with another discharge point: 1) the same general industrial activities conducted in the drainage area of the discharge point, 2) the same Best Management Practices conducted in the drainage area of the discharge point, 3) the same type of exposed materials located in the drainage area of the discharge point that are likely to be significant contributors of pollutants to stormwater discharges, and 4) the same type of impervious surfaces in the drainage area that could affect the percolation of stormwater runoff into the ground (e.g., asphalt, crushed rock, grass).

Surface Waters of the State includes lakes, rivers, ponds, streams, inland waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state.

Total Maximum Daily Load (TMDL) means a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet state water quality standards. Percentages of the total maximum daily load are allocated to the various pollutant sources. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The TMDL calculations include a "margin of safety" to ensure that the waterbody can be protected in case there are unforeseen events or unknown sources of the pollutant. The calculation also accounts for seasonable variation in water quality.

Treatment BMPs means BMPs that are intended to remove pollutants from stormwater.

Turbidity means the clarity of water expressed as nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter.

Underground Injection Control Well means a well that is used to discharge fluids into the subsurface. An underground injection control well is one of the following:

1. A bored, drilled, or driven shaft,
2. An improved sinkhole, or
3. A subsurface fluid distribution system. (WAC 173-218-030)

Unsafe Conditions means those that are dangerous or create inaccessibility for personnel, such as local flooding, high winds, or electrical storms, or situations that otherwise make sampling impractical, such as drought or extended frozen conditions.

Unstaffed means the facility has no assigned staff. A site may be “unstaffed” even when security personnel are present, provided that pollutant generating activities are not included in their duties.

Vehicle means a motor-driven conveyance that transports people or freight, such as an automobile, truck, train, or airplane.

Vehicle Maintenance means the rehabilitation, mechanical repairing, painting, fueling, and/or lubricating of a motor-driven conveyance that transports people or freight, such as an automobile, truck, train, or airplane.

Wasteload Allocation (WLA) means the portion of a receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. WLAs constitute a type of water quality based effluent limitation (40 CFR 130.2(h)).

Water Quality Standards means the Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC, Ground Water Quality Standards (Chapter 173-200 WAC), Sediment Management Standards (Chapter 173-204 WAC), and the federal human health-based criteria for Washington (40 CFR 131.45).

Waters of the State includes those waters defined as "waters of the United States" in 40 CFR Subpart 122.2 within the geographic boundaries of Washington State. State statute defines "waters of the State" to include lakes, rivers, ponds, streams, wetlands, inland waters, underground waters, salt waters, and all other surface waters and water courses within the jurisdiction of the state of Washington (Chapter 90.48 RCW).

APPENDIX 3 - SWPPP CERTIFICATION FORM

The Permittee shall use this form to sign and certify that the Stormwater Pollution Prevention Plan (SWPPP) is complete, accurate and in compliance with Conditions S3 and S8 of the Industrial Stormwater General Permit.

- A SWPPP certification form needs to be completed and attached to all SWPPPs.
- Each time a Level 1, 2 or 3 Corrective Action is required, this form needs to be re-signed and re-certified by the Permittee, and attached to the SWPPP.

Is this SWPPP certification in response to a Level 1, 2 or 3 Corrective Action? ☐Yes ☐No

If Yes, Type of Corrective Action: ☐Level 1 ☐Level 2 ☐Level 3*****

Date SWPPP update/revision completed:

Briefly describe SWPPP Update (use back side, if necessary):

***Note:** For Level 3 Corrective Actions, a qualified industrial stormwater professional must review the revised SWPPP, and sign and certify below, in accordance with Condition S8.D.2:

"The Permittee has made appropriate revisions to the SWPPP to include additional Treatment BMPs with the goal of achieving the applicable benchmark value(s) in future discharges. Based on my review of the SWPPP, discharges from the facility are reasonably expected to meet the ISGP benchmarks upon implementation."

Qualified Industrial Stormwater Professional's Printed Name	Title
Qualified Industrial Stormwater Professional's Signature	Date

(cont'd next page)

"I certify under penalty of law that this SWPPP and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate information to determine compliance with the Industrial Stormwater General Permit. Based on my inquiry of the person or persons who are responsible for stormwater management at my facility, this SWPPP is, to the best of my knowledge and belief, true, accurate, and complete, and in full compliance with Permit Conditions S3 and S8, including the correct Best Management Practices from the applicable Stormwater Management Manual. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Operator's Printed Name *****	Title
Operator's Signature *****	Date

***** Federal regulations require this document to be signed in accordance with Condition G2.

APPENDIX 4 - EXISTING DISCHARGERS TO IMPAIRED WATER BODIES

This appendix has a link below to a website list of existing Permittees that discharge pollutants of concern, either directly or indirectly through a stormwater drainage system, to impaired water bodies based on the 2012 EPA-approved water quality assessment and to Puget Sound Sediment Cleanup Sites. https://apps.ecology.wa.gov/paris/ImpairedWaterBodyLimits.aspxh.

Appendix 4 was originally published on Ecology's website on 11/19/2014, and is linked to Ecology's PARIS database. As such, it is subject to revision based upon new information including but not limited to: new facilities, discharge points, and/or outfalls; updates or corrections to ISGP facility locations, stormwater sample points, discharge points, and/or outfall locations.

Appendix 4 is a technical assistance tool intended to support ISGP facilities with permit compliance. Appendix 4 may contain errors or omissions for various reasons, but this does not relieve ISGP facilities of applicable permit requirements If an inconsistency exists between Appendix 4 and ISGP Condition S6, the ISGP takes precedence. Permittees aware of errors or omissions with the information contained in Appendix 4 shall contact Ecology so that an update/correction can be made. If changes or updates are made, based on new or more accurate information, Ecology will notify the affected Permittees directly. Such changes or updates will not become effective until 30 days after the affected dischargers are notified.

APPENDIX 5 - DISCHARGERS SUBJECT TO TMDL REQUIREMENTS

The list of dischargers identified as discharging to water bodies which have completed water quality cleanup plans or TMDLs and associated monitoring requirements can be viewed on Ecology's website at:

https://ecology.wa.gov/DOE/files/14/14a209fd-4090-4d4a-9d5a-debfc3628fa9.pdf.

The most current list can also be obtained by contacting Ecology at:

Industrial Stormwater General Permit
Washington State Department of Ecology
PO Box 47696
Olympia, WA 98504-7696

This list is based on the best information available to Ecology. There will be changes and updates to this list based on new, more accurate information. If changes or updates are made, Ecology will notify the affected Permittees directly. Such changes or updates will not become effective until 30 days after the affected dischargers are notified.