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July 24, 2015

Ms Tiffany Bohee
OCII Executive Director
c/o Mr. Brett Bollinger
San Francisco Planning Department
1650 Mission Street, Suite 400
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Re: **Hydrology, Water Quality and Biological Impacts** - Comments on Draft Subsequent Environmental Impact Report for the Event Center and Mixed Use Development at Mission Bay Blocks 29-32 (Warriors Arena Project); San Francisco Planning Department Case No. 2014.1441E; State Clearinghouse No. 2014112045

Dear Ms Bohee and Mr. Bollinger:

This office represents the Mission Bay Alliance ("Alliance"), an organization dedicated to preserving the environment in the Mission Bay area of San Francisco, regarding the project known as the Event Center and Mixed Use Development at Mission Bay Blocks 29-32 ("Warriors Arena Project" or "Project"). The Mission Bay Alliance objects to approval of this Project and certification of this EIR for the reasons stated in this letter.

This letter incorporates by reference, as comments on the DSEIR, all of the comments on the DSEIR contained in the July 21, 2015, letter report authored by Matt Hageman (attached as Exhibit 1) and the July 21, 2015, letter report authored by Erik Ringelberg and Kurt Balasek (attached as Exhibit 2).

I. The DSEIR Is Not Sufficient as an Informational Document with Respect to the Project's Wastewater Treatment Infrastructure Impacts.

The DSEIR concedes the Project's cumulative wastewater flow , in combination with other approved projects, will exceed the Mariposa Pump Station's capacity, and therefore, the Project will have a significant and unavoidable impact because it "would require or result in the construction of new wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects." (DSEIR, p. 5.7-13 - 5.7-20 [Impact C-UT-2].) But the DSEIR's disclosure of the nature and severity of the potentially significant impacts of building these new wastewater treatment facilities falls far short of CEQA's requirements.

The DSEIR generally describes the type of new wastewater treatment facilities that might be built, stating:

> the SFPUC anticipates that improvements might include actions such as complete pump station replacement, enlarging or realigning the existing sewer main on Mariposa Street between 3rd Street and the Mariposa Pump Station; upgrading and adding dry weather pumps with potential temporary wet weather pump modifications; upgrading or replacing the dry-weather sump in the pump station; constructing new connections to the transport and storage box structure and rehabilitating the structure; and improving the hydraulic capacity of the downstream gravity sewers, if needed. If a new dry weather pump station is required, it could potentially be constructed within approximately a quarter mile radius of the existing Mariposa Pump Station.

(DSEIR, p. 5.7-14.)

The DSEIR then identifies a number of potentially significant impacts of constructing new wastewater treatment facilities necessitated by the Project, stating:

> These construction activities would be expected to result in temporary increases in truck and construction employee traffic, noise, and air pollutant and greenhouse gas emissions. In addition, depending on the site-specific design and location, the pump station improvements could result in physical effects on cultural resources, biological resources, water quality, and hazardous materials.

(DSEIR, p. 5.7-14.)

The DSEIR then vaguely suggests that these impacts could be mitigated to less than significant levels by adopting "typical" mitigation measures, stating:

> Most, if not all, of these potential impacts can generally be mitigated to a less-than-significant level with typical mitigation measures, similar to those identified in the Initial Study and the SEIR for this project. Long-term operational impacts would likely be less than significant because operation of the pump stations would be similar to existing operations of these facilities.

(DSEIR, p. 5.7-14.)

These vague descriptions fail to discharge the City's legal obligations under CEQA to fully describe the Project, including its "reasonably foreseeable consequence" of necessitating the construction of additional wastewater treatment facilities, and to include an "analysis of the environmental effects" of this future action and the mitigation measures that may reduce those impacts. (See e.g., *Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 396 (*Laurel Heights I*) ["an EIR must include a analysis of the environmental effects of future expansion or other action if: (1) it is a reasonably foreseeable consequence of the initial project; and (2) the future expansion or action will be significant in that it will likely change the scope or nature of the initial project or its environmental effects].)

As shown in both the DSEIR's analysis of mitigation measures and the Mission Bay Alliance's comments on many types of impacts that construction of additional wastewater treatment facilities will cause (e.g., air quality, noise, traffic), the "mitigation measures ... identified in the Initial Study and the SEIR for this project" do not ensure that "impacts can generally be mitigated to a less-than-significant level."

Finally, the DSEIR states:

> In the event that additional future wastewater flows would exceed the pump station capacities before the needed wastewater system improvements could be completed, it is assumed that the SFPUC would make internal operational or piping changes to accommodate the additional flows in the interim in order to remain in compliance with RWQCB permit requirements. The interim system modifications would be subject to the approval of the RWQCB under the terms of the Bayside NPDES permit. Approval by the RWQCB would ensure that water quality of the Bay would be protected during the interim period. Any interim system modifications are assumed to be operational or internal to the existing pump stations and therefore would not result in any physical environmental effects.

This remarkable passage suggests that the City is prepared to approve and allow construction of this Project without ensuring the construction of additional, adequate, sewage treatment capacity required by the Project. This is the opposite of responsible planning. Moreover, the City is apparently poised to take this action based on several unsupported assumptions. First, the DSEIR assumes, without discussion or evidentiary support, that interim modifications will not have a significant effect on the environment.

Second, the DSEIR assumes the Project's wastewater impacts on the Bay will only be "interim" until the SFPUC builds or expands permanent new wastewater treatment facilities; and that in this supposedly "interim" period, the Regional Water Quality Control Board will mitigate any "interim" impacts to less than significant. But there is no evidence to support the assumption the Project's wastewater can be treated to avoid significant adverse effects on Bay water quality before the SFPUC builds or expands permanent wastewater treatment facilities. Nor is there evidence that

Regional Water Quality Control Board regulation during any purported "interim" period would avoid significant adverse effects on Bay water quality. Nor is there any evidence as to how long this purportedly "interim" period will last, or how many other projects that will cumulatively exceed the Mariposa Pump Station's capacity will commence operations during this purportedly "interim" period.

Indeed, this DSEIR's approach represents a total abdication of the City's legal responsibility under CEQA to identify the Project's significant effects, to identify mitigation measures that would substantially reduce those effects, and to adopt all feasible mitigation measures that would substantially reduce those effects. To put it colloquially, punting the problem to the SFPUC or Regional Water Quality Control Board does not pass muster under CEQA.

II. The DSEIR Is Not Sufficient as an Informational Document with Respect to the Project's Contaminated Stormwater Impacts on San Francisco Bay Water Quality or Biological Resources.

In the chapter on the Project's Water Quality impacts, the DSEIR evaluates the impact of Combined Sewage Discharges (CSDs or CSOs) to the Bay that exceed treatment capacity of the Mariposa Pump Station due to the combination of increased storm water flows combined with sewage wastewater flows. The DSEIR uses two thresholds of significance based on the City's NPDES permit, stating:

> ● Wet weather flows to combined sewer system: The impact analysis examines whether project related increases in wastewater flows would contribute to combined sewer discharges during wet weather. The impact is considered less than significant if the increased flows would not increase the frequency of combined sewer discharges above the long-term average specified in the NPDES permit for the SEWPCP, the North Point Wet Weather Facility, and Bayside wet-weather facilities.
>
> ● Effluent discharges from SEWPCP: For the analysis of impacts related to changes in the quality of effluent discharges from the SEWPCP, the analysis considers whether discharges of wastewater to the combined sewer system would cause effluent quality to exceed the discharge limitations of the NPDES permit for the SEWPCP. If not, the impact is considered less than significant.

(DSEIR, p. 5.9-30.)

Thus, for purposes of complying with CEQA's requirement that it identify the Project's significant impacts, the DSEIR makes two unsupported assumptions: (1) that City compliance with its NPDES permits will avoid significant impacts, and (2) that the City will in fact comply with its NPDES permits. The DSEIR must support these assumptions with evidence.

In addition, the first threshold quoted above only looks at "frequency of combined sewer discharges above the long-term average" and ignores increases in quantity and duration of overflows. (See DSEIR, pp. 5.9-34 to 5.9-36.) The DSEIR notes:

> The model analyzed the effects of discharging the average flows from the proposed project in combination with the existing average flows in the drainage area. Under this scenario, the frequency of CSDs would not increase, but the volume of the CSDs would increase from 5.34 to 5.63 million gallons and the duration would increase from 17.2 to 17.3 hours.

(DSEIR, 5.9-35.) The DSEIR finds this impact less than significant because it defines "significance" solely in terms of the *number* of CSD events and compliance with the City's NPDES permit, regardless of the *quantity* of sewage discharged, stating:

> Because average and peak wastewater flows from the project site would not increase the frequency of CSD events from the Mariposa sub-basin and would be consistent with the requirements of the NPDES permit, project level water quality impacts related to contributions to an increase in CSD frequency would be *less than significant.*

(DSEIR, 5.9-35, 36.) The DSEIR makes the same finding for the Project's cumulative impact based on the same evidence and the same rationale. (DSEIR, 5.9-35, 36.)

This is a legal error because the DSEIR cannot merely reference a project's compliance with another agency's regulations. Lead agencies must conduct their own fact-based analysis of project impacts, regardless of whether the project complies with other regulatory standards.[1]

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[1] *See*, e.g., *Californians for Alternatives to Toxics v. Department of Food & Agriculture* (2005) 136 Cal.App.4th 1, 16 (lead agencies must review the site-specific impacts of pesticide applications under their jurisdiction, because "DPR's [Department of Pesticide Regulation] registration does not and cannot account for specific uses of pesticides..., such as the specific chemicals used, their amounts and frequency of use, specific sensitive areas targeted for application, and the like"); *Citizens for Non-Toxic Pest Control v. Department of Food & Agriculture (*1986) 187 Cal.App.3d 1575, 1587-1588 (state agency applying pesticides cannot rely on pesticide registration status to avoid further environmental review under CEQA); *Oro Fino Gold Mining Corporation v. County of El Dorado* (1990) 225 Cal.App.3d 872, 881-882 (rejects contention that project noise level would be insignificant simply by being consistent with general plan standards for the zone in question). *See also City of Antioch v. City Council of the City of Pittsburg* (1986) 187 Cal.App.3d 1325, 1331-1332 (EIR required for construction of road and sewer lines even though these were shown on city's general plan); *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 712-718

The 1998 Mission Bay FSEIR sets the stage for this legal error in its finding that CSO impacts on the Bay are less than significant, stating:

> The same conclusions for the proposed project apply to the cumulative effects of Bayside projects, in that the cumulative increase in pollutant mass load from these projects would have a less-than-significant effect on water quality. As shown in Table V.K.8, the project would represent less than 3% of the increased total pollutant load from the Bayside. The cumulative loads for pollutants would generally increase by 4-6%. Thus, the project would cause approximately half of this cumulative increase for the Bayside. To put this in context, City discharges are a very small portion of the region-wide discharges to the Bay. Compared to municipal dischargers in the Bay Area, the load contribution of the Southeast Plant represents about 12 % of all other municipal dischargers, and the Mission Bay project would represent less than 3 % of that 12% (or 0.36% of all municipal wastewater discharged to the Bay). In addition, besides municipal wastewater, other sources of pollutant loading to San Francisco Bay include riverine inputs, nonurban runoff, urban runoff, point sources, dredging/sediment disposal, spills, and atmospheric deposition. Of these sources, point sources, including municipal dischargers and other permitted industrial dischargers, represent about 1-6 % of the total load input to the Bay-Delta estuary. Regarding stormwater discharges, San Francisco Bayside stormwater flows are about 1.8% of the total regional urban storm flow to the Bay. Considering the contribution of the project and of the cumulative Bayside projects in the context of all the other pollutant inputs to the Bay, the cumulative pollutant loading from Bayside projects would be extremely small.

(1998 MB FSEIR, p. V.K.52.)

This logic reflects the "de minimis" and "ratio" rationales rejected in *Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal.App.4th 98, 120 ("*CBE*") ["[T]he relevant question"... is not how the effect of the project at issue compares to the preexisting cumulative effect, but whether "any additional amount" of effect should be considered significant in the context of the existing cumulative effect. [footnote omitted] In the end, the greater the existing environmental problems are, the lower the threshold should be for treating a project's contribution to cumulative impacts as significant. [footnote omitted]"], and *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 720-21 ["They contend in assessing significance the EIR focuses upon the ratio between the project's impacts and the overall problem, contrary to the intent

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(agency erred by "wrongly assum[ing] that, simply because the smokestack emissions would comply with applicable regulations from other agencies regulating air quality, the overall project would not cause significant effects to air quality.").

of CEQA.... We find the analysis used in the EIR and urged by GWF avoids analyzing the severity of the problem and allows the approval of projects which, when taken in isolation, appear insignificant, but when viewed together, appear startling. Under GWF's 'ratio' theory, the greater the overall problem, the less significance a project has in a cumulative impacts analysis. We conclude the standard for a cumulative impacts analysis is defined by the use of the term 'collectively significant' in Guidelines section 15355 and the analysis must assess the collective or combined effect of energy development"].) *Communities* and Kings *County* teach that the significance of a cumulative impact depends on the environmental setting in which it occurs, especially the severity of existing environmental harm.

Therefore, accepting the Hydroconsult numbers at face value, the starting point for assessing whether adding 2.9 million gallons per year[2] of incompletely treated CSD pollution to the existing condition of San Francisco Bay is significant is the existing condition of San Francisco Bay.[3] The DSEIR says very little on the topic. The 1998 Mission Bay FSEIR provides some information, but the DSEIR does not discuss how much of the 1998 Mission Bay FSEIR's information may be outdated as a result of the passage of seventeen years, and is, therefore, unknown.

The 1998 Mission Bay FSEIR characterizes "municipal wastewater" as follows:

> Municipal wastewater is a relatively strong waste stream containing high concentrations of organic matter that will decompose (measured as biochemical oxygen demand because the decomposition requires oxygen), inorganic particulates (measured as total suspended solids), nutrients (measured as total nitrogen and phosphorus), and pathogenic microorganisms. It also contains oil and grease and small quantities of toxic metals, pesticides, solvents, and plasticizers (additives in plastics that maintain softness and pliability). Conventional secondary treatment, as employed by San Francisco at its Southeast Water Pollution Control Plant, greatly reduces the concentrations of most substances in municipal wastewater. On the other hand, dissolved metals and organic substances that are resistant to breakdown by bacteria, may pass through the plant relatively unaltered. This waste stream, after

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[2] 5.63 – 5.34 = 0.29 x 10 = 2.9.

[3] "If the rainstorm is a large one, and the capacity of the storage/transport box sewers is exceeded, treated combined sewer overflows (CSOs) occur at outfalls along the City's shoreline. When combined sewage is temporarily stored in transport/storage structures, floating materials are removed from the water surface and some solids settle to the bottom of the structures. The accumulated solids are then flushed to the treatment plant after the storm has subsided. The treatment that occurs within the structures is approximately equivalent to primary treatment." (1998 MB FSEIR, p. V.K.8-9.)

> treatment, is referred to as municipal wastewater effluent in this SEIR.

(1998 MB FSEIR, p. V.K.4.)

The 1998 Mission Bay FSEIR characterizes "urban stormwater " as follows:

> Urban stormwater is a large-volume wastewater stream. Pollutants contained in urban runoff include street litter, sediment (mostly inorganic particulates, measured as total suspended solids), oil and grease, oxygen-demanding substances, pathogenic microorganisms, toxic metals, and pesticides. The concentrations of oxygen-demanding substances, nutrients, and pathogenic microorganisms are much lower than in untreated municipal wastewater. CSOs exhibit a blend of the untreated characteristics of municipal wastewater and urban stormwater runoff.

(1998 MB FSEIR, p. V.K.4.)

The 1998 Mission Bay FSEIR characterizes the "impairment of Central San Francisco Bay" as follows:

> The State Water Resources Control Board (SWRCB) has listed central San Francisco Bay as impaired on the basis of field surveys of the water column, sediments, sediment toxicity, bivalve bioaccumulation, and water toxicity. The determination relates to mercury, copper, selenium, diazinon, and polychlorinated biphenyls (PCBs).
> • Mercury. The main source of mercury in the Bay is erosion and drainage from abandoned gold and mercury mines. Other sources include natural sources, atmospheric deposition, and various industrial and municipal sources.
> • Copper. Copper enters the Bay through municipal sources, stormwater runoff (primarily through automobile brake pad dust), and other nonpoint sources (such as soils and abandoned mines). These are the three main sources, and they contribute roughly equivalent amounts.
> • Selenium. Selenium enters the Bay through industrial point sources (e.g., oil refineries), agriculture, and natural sources. Control programs are in place to address selenium discharges from oil refineries
> • Diazinon. Diazinon is a pesticide that enters the Bay as runoff from agriculture and, to a lesser extent, residential land uses. Diazinon is a primary component of insecticides. Homeowner pesticide use peaks in late spring and early summer.
> • PCBs. Although PCBs are no longer manufactured in the U.S., PCBs previously released to the environment enter the Bay through stormwater runoff and transport through the food chain. PCB levels in fish have resulted in health advisories for fish consumption.

(1998 MB FSEIR, p. V.K.8-9.)

The above information shows the existing environmental harm (or "preexisting cumulative effect" in the words of *Communities, supra*) is severe, and this Project will make it worse. Therefore, the DSEIR's finding that the Project's cumulative CSD impacts on the Bay are less-than-significant is erroneous as a matter of law. It is based on two legal errors: (1) the exclusion of CSD *quantity* from its threshold of significance, which reflects the "de minimis" and "ratio" rationales rejected in *Communities, supra* and *Kings County, supra*; and (2) the DSEIR's reliance on another agency's regulatory standards (i.e., the NPDES permit) to determine significance under CEQA.

As discussed in the attached reports by Matt Hageman and Erik Ringelberg, the Project's CEQA documents (i.e., the 1998 Mission Bay FSEIR, 2014 NOP/IS, and 2015 DSEIR), fail to analyze or develop mitigation measures to reduce the Project's likely contribution of a suite of toxic chemicals, including PCBs, to San Francisco Bay in amounts deleterious to the Bay's biota.

Further, it is impossible to place the discussion of this entire issue (at DSEIR pages 5.9-34 to 5.9-36) in a meaningful context, because the DSEIR does not inform the reader if the discussion assumes construction or expansion of permanent wastewater treatment facilities by the SFPUC.

Also, the DSEIR says: "the [Hydroconsult] model estimated the annual average frequency, volume, and duration of CSDs that would occur once the Mariposa wet- and dry-weather pump stations reach the combined capacity of 11.2 mgd under existing and project conditions. The model estimates that under existing conditions, CSDs from the Mariposa sub-basin occur approximately 10 times per year with an average volume of 5.34 million gallons and duration of 17.2 hours." (DSEIR, p. 5.9-35.) This text implies that the "Hydroconsult" model includes wet-weather flows and wet-weather CSDs. But the only Hydrocunsult memo cited and included in Appendix HYD states:

> Three scenarios were analyzed: base case, project, and cumulative. The base case scenario includes existing conditions plus developments and improvements expected to be substantially complete previous to occupancy of the GSW arena. The project scenario adds the DWF from the arena only and the cumulative scenario adds the project DWF plus DWF from reasonably foreseeable projects in the basin. In all three scenarios, the wet weather flow (stormwater runoff) is assumed to not contribute to the CSS; rather is treated and pumped directly to the Bay. All DWF from the proposed GSW arena is assumed to flow to the Mariposa pump station (MPS), therefore Mariposa is the only basin analyzed.

(DSEIR, Appendix HYD, p.1.) The statement "wet weather flow (stormwater runoff) is assumed to not contribute to the CSS; rather is treated and pumped directly to the Bay" makes sense if it refers only to stormwater from the Mission Bay Redevelopment Area, because all of that stormwater will be separated from wastewater flows when the separate stormwater system for Mission Bay is completed in 2015. (See DSEIR, p. 5.7-4.)[4] But the DSEIR also states that storm water from areas outside Mission Bay will continue to combine with wastewater flows to the Mariposa Pump Station and will contribute to wet weather CSDs. (DSEIR, p. 5.7-7.)[5] If this is correct, then the Hydroconsult dry-weather analysis is beside the point.

Also, the numbers for Mariposa Pump Station capacity and wastewater or stormwater flows are confusing. For example, DSEIR page 5.9-35 says the Mariposa wet- and dry-weather pump stations have a "combined capacity of 11.2 mgd." DSEIR page 5.7-7 also refers to "the combined capacity of the Mariposa pump station and transport/storage structure (11.2 mgd)."[6] But DSEIR page 5.9-34 says: "The potential effect would be greatest in the reconfigured Mariposa sub-basin, which has a *wet weather capacity of 12 mgd* (italics added)." Which is correct?

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[4]"The separate stormwater system for the Mission Bay South Plan area is currently being implemented by the master developer and includes four drainage zones within the geographic boundaries of the reconfigured Central sub-basin that have already been constructed and one drainage zone within the geographic boundaries of the reconfigured Mariposa sub-basin which is currently under construction. Stormwater in each of the drainage zones flows by gravity to one of five stormwater pump stations in the locations shown on **Figure 5.7-2**, including Pump Station SDPS-5 near the east end of 16th Street. When construction of the fifth drainage basin is completed (anticipated in 2015, prior to construction and operation of the proposed project), all stormwater runoff from Mission Bay South will be conveyed through the separate stormwater system and discharged to the Bay and China Basin Channel (Mission Creek)." (DSEIR, p. 5.7-4 (pdf151).)

[5]"The 240-acre reconfigured Mariposa sub-basin of the combined sewer system is divided into two tributary areas that direct flow to the Mariposa Pump Station. Tributary B includes Potrero Hill to the south of Mariposa Street and is outside of the Mission Bay Plan area; this tributary area directs both rainwater and wastewater to the pump station. Tributary A includes areas to the north of Mariposa Street that are located within the Plan area; in this area, stormwater flows are directed to the separate stormwater system constructed for the Mission Bay South development, and only wastewater flows are directed to the Mariposa Pump Station." (DSEIR, p. 5.7-7.)

[6]"In the event that wet weather flows in the Mariposa subbasin exceed the combined capacity of the Mariposa pump station and transport/storage structure (11.2 mgd), the excess flows are discharged to the Bay as a combined sewer discharge after receiving flow-through treatment in the transport and storage structure."

III. The DSEIR Is Not Sufficient as an Informational Document with Respect to Project Impacts on Biological Resources, Including Wetlands and Wildlife.

A. The City's decision to exclude the Project's impacts on biological resources from the DSEIR is erroneous.

The City's decision to exclude the Project's impacts on biological resources from the DSEIR (see DSEIR, p. 5.1-1) is erroneous as a matter of law. Both the NOP/IS and the DSEIR announce that their analyses are "tiered" to the 1998 Mission Bay FSEIR pursuant to CEQA Guideline 15168(c). (IS, p. 23-24; DSEIR, pp. 1-1, 5.1-2, 3.) Both the NOP/IS and the DSEIR also announce that the standards used to exclude resource topics from the DSEIR are the standards used to determine if a subsequent EIR is required under CEQA section 21166 and Guideline section 15162. (See NOP/IS, pp. 23-25; DSEIR, p. 5.1-3.)

Based on these predicates, the City decided to prepare a focused EIR, and to conduct no environmental review with respect to the following resources: Biological Resources, Aesthetics, Land Use Cultural Resources, Paleontological Resources, Geology and Soils, Recreation, Hazardous Materials, and Population and Housing. As discussed in more detail in the July 27, 2015, letter from the Mission Bay Alliance's legal counsel regarding "tiering," the City's assumption that it may prepare an EIR for this Project that tiers to the 1998 Mission Bay FSEIR is legally incorrect. As discussed in several comment letters submitted on behalf of the Mission Bay Alliance, and below regarding the Project's impacts on biological resources, the evidence relating to these excluded resource topics meets both the "fair argument" standard, as well as the CEQA section 21166 standards. Therefore, the City must prepare and recirculate for public review a Revised Draft EIR addressing all of the Project's environmental impacts.

B. There is substantial evidence supporting a fair argument the Project will have a significant adverse effect on biological resources.

While the NOP/IS give short shrift to on-site biological resources, there is substantial evidence, in the NOP/IS and the attached reports from Matt Hageman and Erik Ringelberg, supporting a fair argument the Project may have significant effects on (1) migratory birds; (2) off-site special status species downstream of the Project, including steelhead (Oncorhynchus mykiss); and (3) the on-site wetland and its ecology and associated wildlife.

With respect to migratory birds, the NOP/IS admits that the 1998 Mission Bay FSEIR did not assess the redevelopment Plan's effects on migratory birds. (NOP/IS, p. 81.) In addition, the NOP/IS concedes the Project may have significant impacts on migratory birds because it recommends the adoption of mitigation measures to substantially reduce these impacts, stating: "With implementation Mitigation Measures M-BI-4a, Preconstruction Surveys for Nesting Birds, and M-BI-4b, Bird Safe Building Practices, the project would not result in any new or substantially more severe significant impacts on resident or migratory bird species than those identified in the FSEIR." (NOP/IS, p. 81.)

This approach violates CEQA in a number of ways. First, as discussed above, the Project is a separate project from the 1998 Redevelopment Plan, or at a minimum, is not within the scope of the 1998 Mission Bay FSEIR. This fact precludes the City from "tiering" to the 1998 FSEIR for any resource, including impacts on biological resources such as migratory birds.[7] Second, trying to mitigate significant impacts before assessing their nature and extent puts the cart before the horse.[8] Third, as discussed above, the NOP/IS's concession that the Project may have significant impacts on migratory birds is substantial evidence supporting a fair argument the Project will have a significant adverse effect on migratory birds; therefore, the City is required to include an assessment of these impacts in the DSEIR.[9] Fourth, even if the City's assumption that CEQA section 21166 applies is correct, the addition of a 750,000 square foot sports arena and an additional 160 foot office tower to the Mission Bay Redevelopment Plan are substantial changes in the Redevelopment Plan that give rise to new potentially significant effects on birds that must be analyzed in the subsequent EIR.

With respect to impacts on special status species, the NOP/IS states:

> At the time of preparation of the Mission Bay FSEIR, the project site contained several buildings and facilities and was noted as lacking any notable vegetative habitat, with no state listed threatened, endangered or rare plants, or rare, threatened or endangered animal species known to occur in the upland portion of the Mission Bay plan area, including the project site. Subsequent to that time, the project site has been subject to building removal, grading, excavation, and construction of paved surface parking lots, fencing and utilities on portions of the site. Other than the creation of the depression as a result of remediation actions, no other changes in the site since the preparation of the FSEIR have altered the characteristics of the site in relation to biological habitat. These changes in conditions on the project site have

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[7] *Sierra Nevada Conservation, supra.*

[8] CEQA does not permit an agency to simply adopt mitigation measures in lieu of fully assessing a project's potentially significant environmental impacts because mere acknowledgment that an impact would be significant is inadequate; the EIR must include a detailed analysis of "how adverse" the impact would be. (*Lotus v. Department of Transportation* (2014) 223 Cal.App.4th 645, 655-56; *Galante Vineyards v. Monterey Peninsula Water Management Dist.* (1997) 60 Cal.App.4th 1109, 1123*; Santiago County Water Dist. v. County of Orange* (1981) 118 Cal.App.3d 818, 831.)

[9] *Protect the Historic Amador Waterways*, *supra*.

> not altered the fact that the site provides no suitable habitat for any sensitive or special status species due to the sparse and ruderal nature of onsite vegetation, as well as the site's location in a densely urbanized environment, as confirmed through the reconnaissance survey and database review of special status species occurrences within the vicinity of the project site. In addition, there have been no substantial changes with respect to the circumstances under which the project would be undertaken, nor has any new information become available that demonstrates new or more severe impacts associated with the proposed project.

(NOP/IS, pp. 78-79.)

But as Mr Ringelberg points out:

> the potential project impacts to the closest federally designated critical habitat is steelhead Oncorhynchus mykiss are ignored. This habitat runs directly adjacent to the project area. In addition, San Francisco manzanita (Arctostaphytos franciscana) critical habitat is present approximately 2.6 miles to the west and should also have been identified and analyzed. The federal critical habitat analysis is missing, and the provided analysis itself is defective. The potential project's impact(s) to these listed species and their critical habitat are therefore unexamined. The project's dust, stormwater, surface flooding, and groundwater place those species at risk from hazardous chemicals.

(Exhibit 2, p. 11.)

As both Mr. Hageman and Mr. Ringelberg point out, none of the Project's CEQA documents assess the effects of toxic chemical runoff on Bay biota, including steelhead. Where, as here, the lead agency fails to study an area of possible environmental impact, a fair argument may be based on the limited facts in the record because deficiencies in the record may enlarge the scope of fair argument by lending a logical plausibility to a wider range of inferences." (*Sundstrom v. County of Mendocino* (1988) 202 Cal.App.3d 296, 311.)

Further, there is substantial evidence in the reports from Matt Hageman and Erik Ringelberg supporting a fair argument the Project may have significant effects on steelhead from toxic runoff. Again, even if CEQA section 21166 applies, CEQA requires including this issue in the subsequent EIR. The Phase 11 reports showing the site is contaminated with a suite of toxic compounds is significant new information showing the potential for new significant effects not previously identified.[10]

With respect to potential impacts on the on-site wetland, the NOP/IS indicates the DSEIR will not assess impacts on the wetland even though the 1998 FSEIR did not, and could not have, analyzed the wetland since it was apparently created sometime after 2005. (See Exhibit 2, Figure 1 and accompanying text.)

Typically if there is a potential wetland resource, there would be a formal delineation prior to release of the DEIR so the resource can be analyzed, and appropriate mitigation developed. Here, the NOP/IS claims it may not be jurisdictional (p. 80), and at the same time attempts to suggest mitigation (p. 81) in case it is. But the mitigation suggested is not enforceable, in violation of CEQA. Further, as discussed above, trying to mitigate impacts before assessing their significance puts the cart before the horse. (*Lotus v. Department of Transportation*, *supra*.)[11]

In addition, the NOP/IS' evidentiary basis for dismissing the wetland from the DSEIR is flimsy, stating:

> Because the excavation depressions on the site are small, isolated features resulting from recently completed hazardous materials remediation activities and are surrounded by paved areas and urban development, these features do not provide the important biological habitat functions and values that are typically associated with federally protected wetlands.

(NOP/IS, pp. 78-79.) But as Mr. Ringelberg points out:

> Conversely, and in rebuttal to their prior assertion that there are readily substitutable habitats nearby, small wetland features can have exceptional ecological value, in particular if they are one of the few remaining features in an urban setting.

(Exhibit 2, p. 6.)

Further, there is substantial evidence in the report from Erik Ringelberg supporting a fair argument the Project may have a significant effect by destroying the on-site wetland. Again, even

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[10]See Letter to Marty Glick re: Phase 2 Subsurface Investigation Approval, Golden State Warriors Arena, Blocks 29-32, San Francisco, CA 94158; Phase II Environmental Site Assessment, Golden State Warriors Arena, Blocks 29-32, Mission Bay, San Francisco, California.

[11]Also, the NOP/IS fails to even mention the state wetland policy (WRAPP) under Porter Cologne (fn. 49).

if CEQA section 21166 applies, CEQA requires including this issue in the subsequent EIR because the presence of the wetland is a change in circumstances since certification of the 1998 FSEIR that gives rise to the potential for new significant effects not previously identified.

IV. The DSEIR Is Not Sufficient as an Informational Document with Respect to the Project's Flooding Risk.

Chapter 5.9 of the DSEIR does not examine the potential for Project induced increases in storm water runoff to "contribute considerably" to cumulative risk of flooding. (See DSEIR p. 5.9-9 to 5.9-18.) Chapter 5.7 does not do so either. Instead, it analyzes whether the Project will require construction of new or additional storm drainage capacity. (See DSEIR, pp. 5.7-18, 19 [Impact C-UT-3].) But the question whether the Project will require construction of new facilities is different than the question whether it will cause the impact such new facilities are intended to avoid. (See e.g., Chapters 5.7 and 5.9 regarding CSD impacts, and the discussion of same in section 1 above.)

The DSEIR's analysis of cumulative stormwater (C-UT-3) states that the impact is less than significant because the capacity of the new, separated stormwater system is adequate. (DSEIR, p. 5.7-18.) This section of the DSEIR cites to "BKF, Mission Bay Blocks 29-32 - Stormwater Memorandum, January 6, 2015." (DSEIR, p. 5.7-18, note 20.) This Stormwater Memorandum, in turn, states:

> G. Major Storm Events
> The storm drain system and pump station are designed to handle runoff from a 5-year storm event. During larger events such as a 100-year storm event, runoff is conveyed through the streets to a controlled overflow to the Bay. The overland flow analysis was studied in the "Revised Summary Drainage Study for the South of Channel Watershed for Mission Bay Project", dated December 1, 2000. Based on December 2000 study, overland flow from drainage basin, where the Project is located (i.e., "Drainage Basin B"), currently enters the Bay via an existing overflow near Mission Bay Boulevard North (North Overflow). Overland flow in Project perimeter streets, except 16th Street, is conveyed to this North Overflow. Overland flow in 16th Street is conveyed to overflow located to the south of Project near park P24. Refer to attached Figure D for the location of the overland flow release.
> The Project will be sufficiently flood proofed to prevent 100-year overland flow in perimeter streets from entering below grade structures or inundating utilities and equipment. Flood proofing will include using protective measures to prevent storm runoff from inundating and/or damaging equipment such as furnaces, boilers, air conditioning compressors, air ducts, electrical system components, electrical wiring, dry conduits, electrical and gas meters, utility rooms, septic tanks, control panels, HVAC systems and fuel systems."

(BKF, Mission Bay Blocks 29-32 - Stormwater Memorandum, January 6, 2015, p. 6.)

There are two missing pieces of this analysis. First, the memorandum tells us "The Project will be sufficiently flood proofed to prevent 100-year overland flow in perimeter streets from entering below grade structures or inundating utilities and equipment." This may be good news for the Project itself, but it tells the reader nothing about the extent to which this Project will contribute to increased flood risk to surrounding properties. The DSEIR does not examine the potential for Project induced increases in storm water runoff to "contribute considerably" to cumulative risk of flooding around the Project. (See DSEIR p. 5.9-9 to 5.9-18.) Second, the DSEIR does not describe the "flood proofing" measures that it says will avoid inundating below grade structures of the Project.

V. The DSEIR Is Not Sufficient as an Informational Document with Respect to Inundation Impacts of the Project.

The DSEIR concedes the Project will be vulnerable to inundation and flooding as a result of a combination of climate change induced sea level rise and storm surge. (DSEIR, pp. 5.9-10-16.) The DSEIR also describes several government initiatives to plan for and protect against such inundation. (DSEIR, p. 5.9-17-18.)

This discussion makes it clear the Mission Bay area, and the Project site in particular, will need to be protected from inundation in the foreseeable future. Therefore, the construction of protective measures is a reasonably foreseeable consequence of Project approval, and the construction of protective measures will change the nature and extent of the Project's environmental impacts. Therefore, the DSEIR must describe these measures and their environmental effects. (Laurel Heights I, supra.)

Thank you for your attention to this matter.

Very Truly Yours,

Tom Lippe

Thomas N. Lippe

List of Exhibits

Exhibits 1 and 2 are referenced in this letter.
Exhibits 3 through 8 are referenced in Exhibit 1 to this letter.
Exhibits 9 through 13 are referenced in Exhibit 2 to this letter.

1. **July 21, 2015, letter report authored by Matt Hageman.**

2. **July 21, 2015, letter report authored by Erik Ringelberg and Kurt Balasek.**

3. **San Francisco Bay Regional Water Quality Control Board September 2013 report; San Francisco Bay PCBs TMDL - Implementation at Cleanup Sites; cited at footnote 1, found on page 2; footnote 3, found on page 4; and footnote 10, found on page 5 of Exhibit 1 above.**

4. **San Francisco Stormwater Design Guidelines, prepared by City of San Francisco, San Francisco Public Utilities Commission and Port of San Francisco, November 2009; footnote 2, found on page 3 of Exhibit 1 above.**

5. **US EPA Polychlorinated Biphenyls (PCBs) - PCBs in Caulk in Older Buildings, February 21, 2014; footnote 4, found on page 4 of Exhibit 1 above.**

6. **San Francisco Estuary Partnership, Taking Action for Clean Water, PCBs in Caulk Project, July 22, 2015; footnote 5, found on page 4 of Exhibit 1 above.**

7. **US EPA Mid-Atlantic Toxic Substances - Polychlorinated Biphenyls (PCBs), PCB Transformers, April 28, 2015; footnote 6, found on page 4 of Exhibit 1 above.**

8. **US EPA Polychlorinated Biphenyls (PCBs) - Contractors: Handling PCBs in Caulk During Renovation, February 21, 2014; footnote 11, found on page 6 of Exhibit 1 above.**

9. **California Native Plant Society - CNPS Botanical Survey Guidelines, December 9, 1983, Revised June 2, 2001; footnote 2, found on page 4 of Exhibit 2 above.**

10. **General Rare Plant Survey Guidelines by Ellen A. Cypher, California State University, Stanislaus, Endangered Species Recovery Program, July 2002; footnote 3, found on page 4 of Exhibit 2 above.**

11. **State of California, California Natural Resources Agency, Department of Fish and Game - Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities, November 24, 2009; footnote 4, found on page 4 of Exhibit 2 above.**

12. **State of California, Department of Fish and Game - Forest and Woodlands Alliances and Stands, September 2010; footnote 10, found on page 7 of Exhibit 2 above.**

13. US EPA Toxic and Priority Pollutants, May 2, 2014; footnote 11, found on page 8 of Exhibit 2 above.

EXHIBIT 1

SWAPE Technical Consultation, Data Analysis and Litigation Support for the Environment

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July 21, 2015

Thomas N. Lippe
The Law Offices of Thomas N. Lippe
201 Mission Street, 12th Floor
San Francisco, CA 94105

Subject: Comments on the Event Center and Mixed-Use Development Project at Mission Bay Blocks 29-32

Dear Mr. Lippe:

We have reviewed the June 5, 2015 Draft Subsequent Environmental Impact Report (DSEIR) for the Event Center and Mixed-Use Development Project ("Project") at Mission Bay Blocks 29-32. GSW Arena LLC (GSW), an affiliate of Golden State Warriors, LLC, which owns and operates the Golden State Warriors National Basketball Association (NBA) team, proposes to construct a multi-purpose event center and a variety of mixed uses, including office, retail, open space and structured parking on an approximately 11-acre site on Blocks 29-32 within the Mission Bay South Redevelopment Plan Area of San Francisco. The proposed event center would host the Golden State Warriors basketball team during the NBA season, and provide a year round venue for a variety of other uses, including concerts, family shows, other sporting events, cultural events, conferences, and conventions.

We have found significant shortcomings in the DSEIR in identifying impacts on Hydrology and Water Quality. A revised DSEIR should be prepared to address these inadequacies and to incorporate mitigation to reduce impacts which otherwise would degrade the water quality of San Francisco Bay.

Hydrology and Water Quality

The DSEIR acknowledges that the San Francisco Bay is impaired under Section 303(d) of the Clean Water Act for chlordane, DDT, dieldrin, dioxins, furan compounds, mercury, polychlorinated biphenyls (PCBs), invasive species, and trash (p. 5.9-22). Of these, PCBs are of the greatest concern for Project water quality impacts. A total maximum daily load (TMDL), limiting PCB discharges, has been issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB) for PCBs in San Francisco Bay and it is proving very difficult and very costly for Bay Area cities, who are responsible for limiting PCB discharges, to meet. According to the RWQCB, Bay Area municipalities will spend millions of dollars to achieve the ten-fold reduction in PCBs required by the TMDL.[1]

The DSEIR utterly fails to evaluate how Project construction may result in discharge of PCBs to San Francisco Bay, leading to further impairment. Failure to conduct this analysis flies in the face of the TMDL mandate which requires reduction of PCB discharge to the Bay and ignores guidance issued by the San Francisco Bay Regional Water Quality Control Board (RWQCB) on reducing PCB discharges at sites that require cleanup and where buildings that likely contain PCBs in construction materials will be torn down.

The Project poses significant threats to water quality of San Francisco Bay from the release of PCBs upon construction from two sources: (1) contamination in soil at sites that will undergo cleanup; and (2) PCBs used in former building materials at the Project site.

Contaminated Sites Pose Potential PCB Impacts

The DSEIR fails to acknowledge the PCB-contamination threat posed from numerous sites that will require cleanup prior to Project construction. The Initial Study (IS), in summarizing information in the Mission Bay SEIR, stated that land uses at Blocks 29-32 included crude oil storage, offices, railroad tracks, trucking-related activities, maintenance and repair facilities, junk yard, stock corral, a gravel plant, bus company facility, equipment rental, storage yard, auto body shop, and a warehouse (p. 108). No evaluation of these sites for PCB-containing equipment was included in the DSEIR and no analysis of any spills that would have originated from such equipment was conducted.

The RWQCB has identified PCBs originating from sites undergoing cleanup on the margins of San Francisco Bay are a major threat to water achieving the TMDL, stating:

> Stormwater runoff from sites containing residual PCBs in soils after state and federal ordered cleanups contribute to PCB sediment concentrations in the Bay and such contributions must be essentially eliminated in order to achieve the TMDL target. For cleanup sites, the TMDL calls for implementing “on-land source control measures, to ensure that on-land sources of PCBs do not further contaminate in-Bay sediments.”

The IS acknowledges the potential threats that contaminants pose during Project development, stating:

> The Mission Bay FSEIR discussed various types of construction activities, including excavation, grading, trenching, soil movement/transport, pile installation, building demolition and removal of underground storage tanks that would potentially expose workers and the public to contaminated soils, dust, soil gases and other hazards. The Mission Bay FSEIR also noted the potential for construction dust-related effects on the aquatic and terrestrial environment.

However, the Mission Bay FSEIR pre-dates the issuance of the RWQCB TMDL for PCBs in San Francisco Bay and mitigation in the Mission Bay FSEIR make no provisions for ensuring that PCBs are not mobilized and transported to the Bay during Project construction. As stated by the RWQCB:

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[1]San Francisco Bay Regional Water Quality Control Board, September 2013, San Francisco Bay PCBs TMDL Implementation at Cleanup Sites: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaypcbs/SF%20Bay%20PCBs%20TMDL%20-%20Considerations%20for%20Cleanup%20Sites%20September%205%202013.pdf, p. 1

> Of particular concern, and often overlooked, is the fact that PCBs in surface soil can be mobilized by stormwater runoff and flow to the Bay.

The RWQCB's concerns are justified by the failure of the DSEIR in identifying how Project construction might contribute to the PCB impairment of San Francisco Bay. The DSEIR, in ignoring this issue, provides no PCB-specific mitigation to prevent the flow of PCBs to the Bay upon construction. Mitigation identified in the Mission Bay FSEIR specified only minimum parameters to be included in a Risk Management Plan for the addressing contaminated soils and groundwater prior to and during construction of individual development projects.

PCBs, when spilled and released to soil, stick strongly to the soil particles that is entrained with stormwater when mobilized during rain events and which leads to PCB deposition in the Bay. The DSEIR offers no mitigation to address this likelihood, and only provides tepid assurance that stormwater will be managed consistent with "San Francisco Stormwater Design Guidelines" (p. 5.9-25). The cited San Francisco Stormwater Design Guidelines makes no special provisions for PCB contamination other than to say:

> Control of PCBs and mercury will be implemented through design measures that limit the mobilization of these pollutants in contaminated soils.[2]

The San Francisco Stormwater Design Guidelines make no further statements about what the PCB design measures would entail and how specifically PCB discharge in stormwater will be limited. The San Francisco Stormwater Design Guidelines are mute on the urgency that faces San Francisco in preventing PCB discharges, in stark contrast to the language use by the RWQCB in issuing the following edict in eliminating all PCB discharges from cleanup sites:

> … it is important that cleanup sites do not contribute any PCBs to surface water runoff. Remedial actions should be conducted so as to eliminate all means of conveyance of PCBs from cleanup sites, including sediment runoff, vehicular drag out, and airborne dust.

Because the issue of PCBs is not specifically addressed, the DSEIR offers an inadequate basis for making the following statement on stormwater contamination:

> Implementation of BMPs and other stormwater control measures required by the updated Phase II General MS4 NPDES Permit; Article 4.2 of the San Francisco Public Works Code, Section 147; and the City's Stormwater Design Guidelines would ensure that the project does not contribute to an increase in discharge of stormwater pollutants to the Bay in discharges from the separate stormwater system. Therefore, impacts related to degradation of water quality and providing an additional source of stormwater pollutants are less than significant in relation to direct stormwater discharges.

Without mitigation and specific measures to address PCB contamination in the Project area, the impacts from Project construction on the already impaired San Francisco Bay may be significant. The DSEIR should acknowledge the PCB contamination potential and offer concrete mitigation to address the

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[2] San Francisco Stormwater Design Guideline, September 2009
http://www.sfwater.org/Modules/ShowDocument.aspx?documentID=2779, p. 14

stormwater transport of PCB-contaminated soils to the Bay. Concrete steps to incorporate, as mitigation in a revised DSEIR and prior to Project construction, include:

- A thorough parcel-by-parcel review of the potential use of PCB-containing equipment;
- Site inspections of each parcel which used electrical equipment and sampling of soil where PCB-containing equipment is identified; and
- Cleanup of PCB-impacted soil at concentrations that exceed 25 ug/kg, consistent with RWQCB guidance.[3]

PCBs in Originating from former land uses at the Project Site have not been Adequately Evaluated

Polychlorinated biphenyls (PCB) contamination originating from materials used in building construction is receiving intense scrutiny from regulatory agencies. The U.S. EPA has acknowledged that demolition of 1950s- to 1970s-era buildings, or cleanup of those sites, may disturb PCB-containing materials used in caulking and as a plasticizer in paints and other coatings.[4] In fact, a recent report has found that PCBs are prevalent in the caulk in Bay Area buildings constructed from 1950 to 1980. PCBs were detected in 88% of the caulk samples tested; 40% of the samples contained greater than 50 ppm PCBs and 20% contained greater than 10,000 ppm PCBs.[5] PCBs were used in electrical transformers manufactured between 1929 and 1977 and are a well-recognized source of soil contamination when fluid is leaked.[6]

According to the US EPA[7]:

> PCBs do not break down in our environment and can have severe health effects on humans. PCBs in the air eventually return to our land and water by settling or from runoff in snow and rain. In our water, PCBs build up in fish and can reach levels hundreds of thousands of times higher than the levels in water. Fish consumption advisories are in effect for PCBs in all five of the Great Lakes. PCBs are the leading chemical risk from fish consumption.

Because PCBs do not break down, PCBs may be present at the Project site from former land uses which include:[8]

- Bulk fuel storage and distribution (approximately 1902 to 1966).
- Railroad operations (approximately 1904 to 1939).
- A machine shop (approximately 1904 to 1927).
- A boiler house (approximately 1904 to 1927).
- Steel mill (approximately 1906 to 1928).
- Well casing manufacturer (1907 to 1975).

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[3] San Francisco Bay Regional Water Quality Control Board, September 2013, San Francisco Bay PCBs TMDL Implementation at Cleanup Sites: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaypcbs/SF%20Bay%20PCBs%20TMDL%20-%20Considerations%20for%20Cleanup%20Sites%20September%205%202013.pdf, p. 2

[4] US EPA, PCBs in Caulk in Older Buildings: http://www.epa.gov/pcbsincaulk/

[5] San Francisco Estuary Project, PCBs in Caulk Project: http://www.sfestuary.org/taking-action-for-clean-water-pcbs-in-caulk-project/

[6] US EPA, Polychlorinated Biphenyls (PCBs) http://www.epa.gov/reg3wcmd/ts_pcbs.htm

[7] Ibid.

[8] Letter from the San Francisco Department of Public Health to Golden State Warriors Arena, June 8, 2015, p. 2

- Warehousing, shipping, and receiving operations for a variety of products including agricultural chemicals, lumber, food, automobiles, metals, etc. (approximately 1910 to 2006).
- A fruit cannery (approximately 1935 to 1961).
- Junk yards, vehicle parking, and vehicle maintenance facilities (approximately 1950 to 2004).
- Ready-mix concrete facilities (approximately 1972 to 2010).

Of these uses, the 1950s-1980 land uses, which include well casing manufacturing, warehousing, a cannery, junk yards, and concrete manufacturing, could have been operated out of building that were constructed with PCB-containing materials and which were supplied with power by PCB-containing transformers. If PCB-containing building materials, such as caulking or paint, were weathered and disposed in soils adjacent to the former buildings, the could remain at concentrations that would serve as a source for contamination of San Francisco Bay, upon erosion by wind or stormwater.

In fact, a limited study conducted in January 2015 did detect PCBs in soil at the Project site. In this study, which took soil samples from only seven locations at the 10.9-acre site, PCBs were detected at 0.016 mg/kg or 16 ug/kg in one sample of the seven locations.[9] Although this is less than the 25 ug/kg RWQCB cleanup requirement, it is 16 times greater than the target PCB sediment concentration of 1 ug/kg in San Francisco Bay.[10] Given that the Project site is located less than 500 feet from the Bay, construction activities that disturb soil pose a significant potential for documented PCBs at the Project site to be transported to the Bay.

I have found no analysis of PCBs used in the building materials of the previously existing structures at the site in the DSEIR or in the Mission Bay FSEIR or how PCBs, documented in soil at the Project site, may be mobilized by construction or by cleanup of contaminated sites, and transported to the Bay. The RWQCB has offered guidance on how to test for materials that may contain PCBs and how to evaluate sites undergoing cleanup on the Bay margin, guidance which was not mentioned in the DSEIR.

The failure to thoroughly analyze the presence of PCBs in the Project area and how Project construction activities would potentially mobilize the PCBs, leading to further impairment of San Francisco Bay, is a significant oversight which ignores a regulatory mandate for construction projects on the Bay margin to evaluate PCBs. A DSEIR should be prepared to include the results of a full evaluation of the potential of former Project site buildings to contain PCBs. A soil sampling study should be targeted to areas where PCBs may have been released or spilled. To ensure the adequacy of the PCB investigation, the study should be conducted under the oversight of the San Francisco Bay Regional Water Quality Control Board which should be engaged, specifically on the issue of potential PCB contamination to originate from Project construction.

The revised DSEIR should identify mitigation that would be necessary to protect PCB-containing materials from being mobilized though stormwater transport and aerial deposition to San Francisco Bay. The revised DSEIR should also include measures to protect construction workers and the health of adjacent residents who may be exposed to PCB-containing dust during demolition or renovation

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[9] Letter from the San Francisco Department of Public Health to Golden State Warriors Arena, June 8, 2015, p. 9

[10] San Francisco Bay Regional Water Quality Control Board, September 2013, San Francisco Bay PCBs TMDL Implementation at Cleanup Sites: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/sfbaypcbs/SF%20Bay%20PCBs%20TMDL%20-%20Considerations%20for%20Cleanup%20Sites%20September%205%202013.pdf, p. 1

activities. The DSEIR should also identify proper disposal practices that are compliant with 40 CFR § 761.62 of the Toxic Substances Control Act. Under this provision, PCB bulk product waste must be disposed in a permitted solid waste landfill or through regulatory approval of risk-based process.[11]

Other Contaminants Pose Risks to the Bay

Recent sampling[12] at the Project site has detected soil contaminants, in addition to the PCB contamination noted above, that include:

[11] US EPA, Contractors: Handling PCBs in Caulk During Renovation: http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/caulk/caulkcontractors.htm

[12] Letter from the San Francisco Department of Public Health to Golden State Warriors Arena, June 8, 2015, pp. 8-10

- 1.2.4-Trimethylbenzene
- Acetone
- Carbon disulfide
- Ethylbenzene
- 2-Butanone
- Xylenes
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k.)fluoranthene
- Chrysene
- Dibenz(a,h)anthracene
- Fluoranthene
- Fluorene
- Indeno(l,2,3-c,d)pyrene
- Naphthalene
- Phenanthrene
- Pyrene
- Antimony
- Barium
- Beryllium
- Cadmium
- Cobalt
- Copper
- Mercury
- Molybdenum
- Silver
- Vanadium
- Zinc

Of these compounds, mercury is identified in the DSEIR as an impairment in San Francisco Bay under Section 303(d) of the Clean Water Act (p. 5.9-22). Mercury, along with the other contaminants listed above, may sorb tightly to soil and be mobilized and transported to the Bay when eroded by stormwater, further degrading water quality.

No specific provisions to manage these contaminants to prevent discharge to the Bay are included in the DSEIR. The DSEIR provides only vague assurance that stormwater will be managed consistent with "San Francisco Stormwater Design Guidelines" which do mention mercury (along with PCBs, as noted above) but offer no specific mitigation to manage these contaminants (p. 5.9-25).

A revised DSEIR should be prepared to identify specific stormwater best management practices (BMPs) to prevent the discharge of contaminated sediment during rain events. The BMPs should be tailored to the each of the contaminants documented in soil at the Project site to prevent discharge and should include consideration of the use of sorbent or flocculent materials, retention basins, berms, silt fences, and bales.

Sincerely,

Matt Hagemann, P.G., C.Hg., QSD, QSP

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Education:

M.S. Degree, Geology, California State University Los Angeles, Los Angeles, CA, 1984.
B.A. Degree, Geology, Humboldt State University, Arcata, CA, 1982.

Professional Certifications:

California Professional Geologist
California Certified Hydrogeologist
Qualified SWPPP Developer and Practitioner

Professional Experience:

Matt has 25 years of experience in environmental policy, assessment and remediation. He spent nine years with the U.S. EPA in the RCRA and Superfund programs and served as EPA's Senior Science Policy Advisor in the Western Regional Office where he identified emerging threats to groundwater from perchlorate and MTBE. While with EPA, Matt also served as a Senior Hydrogeologist in the oversight of the assessment of seven major military facilities undergoing base closure. He led numerous enforcement actions under provisions of the Resource Conservation and Recovery Act (RCRA) while also working with permit holders to improve hydrogeologic characterization and water quality monitoring.

Matt has worked closely with U.S. EPA legal counsel and the technical staff of several states in the application and enforcement of RCRA, Safe Drinking Water Act and Clean Water Act regulations. Matt has trained the technical staff in the States of California, Hawaii, Nevada, Arizona and the Territory of Guam in the conduct of investigations, groundwater fundamentals, and sampling techniques.

Positions Matt has held include:

- Founding Partner, Soil/Water/Air Protection Enterprise (SWAPE) (2003 – present);
- Geology Instructor, Golden West College, 2010 – 2104;
- Senior Environmental Analyst, Komex H2O Science, Inc. (2000 -- 2003);

- Executive Director, Orange Coast Watch (2001 – 2004);
- Senior Science Policy Advisor and Hydrogeologist, U.S. Environmental Protection Agency (1989–1998);
- Hydrogeologist, National Park Service, Water Resources Division (1998 – 2000);
- Adjunct Faculty Member, San Francisco State University, Department of Geosciences (1993 – 1998);
- Instructor, College of Marin, Department of Science (1990 – 1995);
- Geologist, U.S. Forest Service (1986 – 1998); and
- Geologist, Dames & Moore (1984 – 1986).

Senior Regulatory and Litigation Support Analyst:

With SWAPE, Matt's responsibilities have included:

- Lead analyst and testifying expert in the review of over 100 environmental impact reports since 2003 under CEQA that identify significant issues with regard to hazardous waste, water resources, water quality, air quality, Valley Fever, greenhouse gas emissions, and geologic hazards. Make recommendations for additional mitigation measures to lead agencies at the local and county level to include additional characterization of health risks and implementation of protective measures to reduce worker exposure to hazards from toxins and Valley Fever.
- Stormwater analysis, sampling and best management practice evaluation at industrial facilities.
- Manager of a project to provide technical assistance to a community adjacent to a former Naval shipyard under a grant from the U.S. EPA.
- Technical assistance and litigation support for vapor intrusion concerns.
- Lead analyst and testifying expert in the review of environmental issues in license applications for large solar power plants before the California Energy Commission.
- Manager of a project to evaluate numerous formerly used military sites in the western U.S.
- Manager of a comprehensive evaluation of potential sources of perchlorate contamination in Southern California drinking water wells.
- Manager and designated expert for litigation support under provisions of Proposition 65 in the review of releases of gasoline to sources drinking water at major refineries and hundreds of gas stations throughout California.
- Expert witness on two cases involving MTBE litigation.
- Expert witness and litigation support on the impact of air toxins and hazards at a school.
- Expert witness in litigation at a former plywood plant.

With Komex H2O Science Inc., Matt's duties included the following:

- Senior author of a report on the extent of perchlorate contamination that was used in testimony by the former U.S. EPA Administrator and General Counsel.
- Senior researcher in the development of a comprehensive, electronically interactive chronology of MTBE use, research, and regulation.
- Senior researcher in the development of a comprehensive, electronically interactive chronology of perchlorate use, research, and regulation.
- Senior researcher in a study that estimates nationwide costs for MTBE remediation and drinking water treatment, results of which were published in newspapers nationwide and in testimony against provisions of an energy bill that would limit liability for oil companies.
- Research to support litigation to restore drinking water supplies that have been contaminated by MTBE in California and New York.

- Expert witness testimony in a case of oil production-related contamination in Mississippi.
- Lead author for a multi-volume remedial investigation report for an operating school in Los Angeles that met strict regulatory requirements and rigorous deadlines.

- Development of strategic approaches for cleanup of contaminated sites in consultation with clients and regulators.

Executive Director:

As Executive Director with Orange Coast Watch, Matt led efforts to restore water quality at Orange County beaches from multiple sources of contamination including urban runoff and the discharge of wastewater. In reporting to a Board of Directors that included representatives from leading Orange County universities and businesses, Matt prepared issue papers in the areas of treatment and disinfection of wastewater and control of the discharge of grease to sewer systems. Matt actively participated in the development of countywide water quality permits for the control of urban runoff and permits for the discharge of wastewater. Matt worked with other nonprofits to protect and restore water quality, including Surfrider, Natural Resources Defense Council and Orange County CoastKeeper as well as with business institutions including the Orange County Business Council.

Hydrogeology:

As a Senior Hydrogeologist with the U.S. Environmental Protection Agency, Matt led investigations to characterize and cleanup closing military bases, including Mare Island Naval Shipyard, Hunters Point Naval Shipyard, Treasure Island Naval Station, Alameda Naval Station, Moffett Field, Mather Army Airfield, and Sacramento Army Depot. Specific activities were as follows:

- Led efforts to model groundwater flow and contaminant transport, ensured adequacy of monitoring networks, and assessed cleanup alternatives for contaminated sediment, soil, and groundwater.
- Initiated a regional program for evaluation of groundwater sampling practices and laboratory analysis at military bases.
- Identified emerging issues, wrote technical guidance, and assisted in policy and regulation development through work on four national U.S. EPA workgroups, including the Superfund Groundwater Technical Forum and the Federal Facilities Forum.

At the request of the State of Hawaii, Matt developed a methodology to determine the vulnerability of groundwater to contamination on the islands of Maui and Oahu. He used analytical models and a GIS to show zones of vulnerability, and the results were adopted and published by the State of Hawaii and County of Maui.

As a hydrogeologist with the EPA Groundwater Protection Section, Matt worked with provisions of the Safe Drinking Water Act and NEPA to prevent drinking water contamination. Specific activities included the following:

- Received an EPA Bronze Medal for his contribution to the development of national guidance for the protection of drinking water.
- Managed the Sole Source Aquifer Program and protected the drinking water of two communities through designation under the Safe Drinking Water Act. He prepared geologic reports, conducted public hearings, and responded to public comments from residents who were very concerned about the impact of designation.

- Reviewed a number of Environmental Impact Statements for planned major developments, including large hazardous and solid waste disposal facilities, mine reclamation, and water transfer.

Matt served as a hydrogeologist with the RCRA Hazardous Waste program. Duties were as follows:

- Supervised the hydrogeologic investigation of hazardous waste sites to determine compliance with Subtitle C requirements.
- Reviewed and wrote "part B" permits for the disposal of hazardous waste.
- Conducted RCRA Corrective Action investigations of waste sites and led inspections that formed the basis for significant enforcement actions that were developed in close coordination with U.S. EPA legal counsel.
- Wrote contract specifications and supervised contractor's investigations of waste sites.

With the National Park Service, Matt directed service-wide investigations of contaminant sources to prevent degradation of water quality, including the following tasks:

- Applied pertinent laws and regulations including CERCLA, RCRA, NEPA, NRDA, and the Clean Water Act to control military, mining, and landfill contaminants.
- Conducted watershed-scale investigations of contaminants at parks, including Yellowstone and Olympic National Park.
- Identified high-levels of perchlorate in soil adjacent to a national park in New Mexico and advised park superintendent on appropriate response actions under CERCLA.
- Served as a Park Service representative on the Interagency Perchlorate Steering Committee, a national workgroup.
- Developed a program to conduct environmental compliance audits of all National Parks while serving on a national workgroup.
- Co-authored two papers on the potential for water contamination from the operation of personal watercraft and snowmobiles, these papers serving as the basis for the development of nation-wide policy on the use of these vehicles in National Parks.
- Contributed to the Federal Multi-Agency Source Water Agreement under the Clean Water Action Plan.

Policy:

Served senior management as the Senior Science Policy Advisor with the U.S. Environmental Protection Agency, Region 9. Activities included the following:

- Advised the Regional Administrator and senior management on emerging issues such as the potential for the gasoline additive MTBE and ammonium perchlorate to contaminate drinking water supplies.
- Shaped EPA's national response to these threats by serving on workgroups and by contributing to guidance, including the Office of Research and Development publication, Oxygenates in Water: Critical Information and Research Needs.
- Improved the technical training of EPA's scientific and engineering staff.
- Earned an EPA Bronze Medal for representing the region's 300 scientists and engineers in negotiations with the Administrator and senior management to better integrate scientific principles into the policy-making process.
- Established national protocol for the peer review of scientific documents.

Geology:

With the U.S. Forest Service, Matt led investigations to determine hillslope stability of areas proposed for timber harvest in the central Oregon Coast Range. Specific activities were as follows:

- Mapped geology in the field, and used aerial photographic interpretation and mathematical models to determine slope stability.
- Coordinated his research with community members who were concerned with natural resource protection.
- Characterized the geology of an aquifer that serves as the sole source of drinking water for the city of Medford, Oregon.

As a consultant with Dames and Moore, Matt led geologic investigations of two contaminated sites (later listed on the Superfund NPL) in the Portland, Oregon, area and a large hazardous waste site in eastern Oregon. Duties included the following:

- Supervised year-long effort for soil and groundwater sampling.
- Conducted aquifer tests.
- Investigated active faults beneath sites proposed for hazardous waste disposal.

Teaching:

From 1990 to 1998, Matt taught at least one course per semester at the community college and university levels:

- At San Francisco State University, held an adjunct faculty position and taught courses in environmental geology, oceanography (lab and lecture), hydrogeology, and groundwater contamination.
- Served as a committee member for graduate and undergraduate students.
- Taught courses in environmental geology and oceanography at the College of Marin.

Matt taught physical geology (lecture and lab and introductory geology at Golden West College in Huntington Beach, California from 2010 to 2014.

Invited Testimony, Reports, Papers and Presentations:

Hagemann, M.F., 2008. Disclosure of Hazardous Waste Issues under CEQA. Presentation to the Public Environmental Law Conference, Eugene, Oregon.

Hagemann, M.F., 2008. Disclosure of Hazardous Waste Issues under CEQA. Invited presentation to U.S. EPA Region 9, San Francisco, California.

Hagemann, M.F., 2005. Use of Electronic Databases in Environmental Regulation, Policy Making and Public Participation. Brownfields 2005, Denver, Coloradao.

Hagemann, M.F., 2004. Perchlorate Contamination of the Colorado River and Impacts to Drinking Water in Nevada and the Southwestern U.S. Presentation to a meeting of the American Groundwater Trust, Las Vegas, NV (served on conference organizing committee).

Hagemann, M.F., 2004. Invited testimony to a California Senate committee hearing on air toxins at schools in Southern California, Los Angeles.

Brown, A., Farrow, J., Gray, A. and **Hagemann, M.**, 2004. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and the Resulting Impact to Drinking Water Wells. Presentation to the Ground Water and Environmental Law Conference, National Groundwater Association.

Hagemann, M.F., 2004. Perchlorate Contamination of the Colorado River and Impacts to Drinking Water in Arizona and the Southwestern U.S. Presentation to a meeting of the American Groundwater Trust, Phoenix, AZ (served on conference organizing committee).

Hagemann, M.F., 2003. Perchlorate Contamination of the Colorado River and Impacts to Drinking Water in the Southwestern U.S. Invited presentation to a special committee meeting of the National Academy of Sciences, Irvine, CA.

Hagemann, M.F., 2003. Perchlorate Contamination of the Colorado River. Invited presentation to a tribal EPA meeting, Pechanga, CA.

Hagemann, M.F., 2003. Perchlorate Contamination of the Colorado River. Invited presentation to a meeting of tribal repesentatives, Parker, AZ.

Hagemann, M.F., 2003. Impact of Perchlorate on the Colorado River and Associated Drinking Water Supplies. Invited presentation to the Inter-Tribal Meeting, Torres Martinez Tribe.

Hagemann, M.F., 2003. The Emergence of Perchlorate as a Widespread Drinking Water Contaminant. Invited presentation to the U.S. EPA Region 9.

Hagemann, M.F., 2003. A Deductive Approach to the Assessment of Perchlorate Contamination. Invited presentation to the California Assembly Natural Resources Committee.

Hagemann, M.F., 2003. Perchlorate: A Cold War Legacy in Drinking Water. Presentation to a meeting of the National Groundwater Association.

Hagemann, M.F., 2002. From Tank to Tap: A Chronology of MTBE in Groundwater. Presentation to a meeting of the National Groundwater Association.

Hagemann, M.F., 2002. A Chronology of MTBE in Groundwater and an Estimate of Costs to Address Impacts to Groundwater. Presentation to the annual meeting of the Society of Environmental Journalists.

Hagemann, M.F., 2002. An Estimate of the Cost to Address MTBE Contamination in Groundwater (and Who Will Pay). Presentation to a meeting of the National Groundwater Association.

Hagemann, M.F., 2002. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and the Resulting Impact to Drinking Water Wells. Presentation to a meeting of the U.S. EPA and State Underground Storage Tank Program managers.

Hagemann, M.F., 2001. From Tank to Tap: A Chronology of MTBE in Groundwater. Unpublished report.

Hagemann, M.F., 2001. Estimated Cleanup Cost for MTBE in Groundwater Used as Drinking Water. Unpublished report.

Hagemann, M.F., 2001. Estimated Costs to Address MTBE Releases from Leaking Underground Storage Tanks. Unpublished report.

Hagemann, M.F., and VanMouwerik, M., 1999. Potential Water Quality Concerns Related to Snowmobile Usage. Water Resources Division, National Park Service, Technical Report.

VanMouwerik, M. and **Hagemann, M.F**. 1999, Water Quality Concerns Related to Personal Watercraft Usage. Water Resources Division, National Park Service, Technical Report.

Hagemann, M.F., 1999, Is Dilution the Solution to Pollution in National Parks? The George Wright Society Biannual Meeting, Asheville, North Carolina.

Hagemann, M.F., 1997, The Potential for MTBE to Contaminate Groundwater. U.S. EPA Superfund Groundwater Technical Forum Annual Meeting, Las Vegas, Nevada.

Hagemann, M.F., and Gill, M., 1996, Impediments to Intrinsic Remediation, Moffett Field Naval Air Station, Conference on Intrinsic Remediation of Chlorinated Hydrocarbons, Salt Lake City.

Hagemann, M.F., Fukunaga, G.L., 1996, The Vulnerability of Groundwater to Anthropogenic Contaminants on the Island of Maui, Hawaii. Hawaii Water Works Association Annual Meeting, Maui, October 1996.

Hagemann, M. F., Fukanaga, G. L., 1996, Ranking Groundwater Vulnerability in Central Oahu, Hawaii. Proceedings, Geographic Information Systems in Environmental Resources Management, Air and Waste Management Association Publication VIP-61.

Hagemann, M.F., 1994. Groundwater Characterization and Cleanup at Closing Military Bases in California. Proceedings, California Groundwater Resources Association Meeting.

Hagemann, M.F. and Sabol, M.A., 1993. Role of the U.S. EPA in the High Plains States Groundwater Recharge Demonstration Program. Proceedings, Sixth Biennial Symposium on the Artificial Recharge of Groundwater.

Hagemann, M.F., 1993. U.S. EPA Policy on the Technical Impracticability of the Cleanup of DNAPL-contaminated Groundwater. California Groundwater Resources Association Meeting.

Hagemann, M.F., 1992. Dense Nonaqueous Phase Liquid Contamination of Groundwater: An Ounce of Prevention... Proceedings, Association of Engineering Geologists Annual Meeting, v. 35.

<u>Other Experience:</u>

Selected as subject matter expert for the California Professional Geologist licensing examination, 2009-2011.

EXHIBIT 2

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July 21, 2015 BSK Project Number E0906601S

Soluri Meserve
1010 F St, Ste. 100
Sacramento, CA 95814

Subject: DRAFT Biological Resources Review
Mission Bay Subsequent Environmental Impact Report
San Francisco, California

Dear Mr. Soluri:

Per your request, BSK Associates (BSK) reviewed publicly available documents associated with the Draft Subsequent Environmental Impact Report (SEIR) on the Golden State Warriors Event Center and Mixed-Use Development at Mission Bay Blocks 29-32. BSK assessed these documents for potential project impacts on biological resources (following the California Environmental Quality Act [CEQA] Appendix G). The Draft SEIR (DSEIR), the associated 2014 Notice of Preparation-Initial Study (NOP-IS), and the prior Mission Bay Final Subsequent Environmental Impact Report (1998 FSEIR [FSEIR]) were compared to each other, as well as to State of California and federal Geographic Information System (GIS) databases, scientific and technical resources prepared by others, as well as current and historic aerial photographs.

SUMMARY

In our opinion, the SEIR, in several key areas related to biological resources, failed to adequately characterize the nature and the extent of the site's resources; failed to identify the full range of potential significant impacts from the proposed project on those resources; failed to examine those impacts at a sufficient level of detail to understand the project impacts; and, failed to provide adequate mitigation for those resources, both during construction and cumulatively. Specifically, key species and sensitive habitat(s) were left out of the discussion, and mitigation measures were missing, or inadequate, to reduce the impacts of the project on those species below the threshold of significance; and finally, significant changes have occurred at the site affecting both the applicable policies and the relevant resource use since the original analysis.

ECOLOGICAL CONDITIONS REVIEW

The project area has two boundaries, the larger "Mission Bay Redevelopment Plan Area Boundary," (Plan Area) which is described in the 1998 FSEIR and the current "site" boundary (site), which includes Blocks 29-32 within that larger planning boundary (Figure 1). Both boundaries will be used for the purposes of discussion as they relate to the corresponding environmental analysis documents and the project's potential impacts on biological resources. A current aerial photo is provided for detailed site context (Figure 2).

The Plan Area's near surface soils are the result of mixed fills and have been identified by the Natural Resource Conservation Service as: 134, Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes (Figure 3). The soils are the result of historic filling of the Mission Bay with debris, earthquake waste spoils, and other material to reclaim the site from the San Francisco Bay (ESA 2014; Pg. 1). This soils information is consistent with other analyses, developed by others, discussed later.

The U.S. Fish & Wildlife Service, National Wetlands Inventory (NWI) identified several features adjacent to the Plan Area, but none within the site (Figure 4). The relative elevation of these features both within (and nearby) the project boundary appear to correlate with the local shallow water table (ESA 2014; LTR 2015; Pg. 13-14 and Figures A-2 and A-3).

The site itself appears to be a largely ruderal area that has been subject to various anthropogenic disturbances, within an urban setting, containing two large surface parking areas. The site currently contains an open water feature, actively used by wildlife, and a narrow swale to the east (Figure 5). The site's current conditions are detailed in the following site observations.

SITE OBSERVATIONS

The Blocks 29-32 footprint consists of two large paved areas (Southwest parking lot approximately 79,910 sq.ft./1.83 ac. and Northeast parking lot approximately 91,776 sq.ft./2.11 ac.)[1] currently being used as paid parking lots; an area of soil stockpiles (31,066 sq.ft./0.71 ac) on the eastern edge of the property (Terry A. Francois Boulevard); and an adjoining large open field, open water (22,115 sq.ft./0.51 ac) and wetland swale complex, (904 sq.ft./0.02 ac.) (closest to the Southwest parking lot) shown on Figure 2. A series of photographs were taken of the site and the adjoining areas (Attached Photo Plates).

At the time of observation, the open water area encompassed the majority of the water feature, with a patchy, but substantial fringe of palustrine emergent (predominately alkali bulrush [*Bolboschoenus maritimus*]) and riparian plants (willows [*Salix sp*.]). The emergent plants and shrubs were concentrated on the two narrower ends of the water feature. The narrower channel and the seasonal wetlands

[1] 2015 Google Earth

apparent from the aerial photographs (Figures 2a-i) were not clearly visible from the site perimeter fence(es).

Numerous native birds were observed within, and in some cases flying to and from the water body. Several Canada geese (*Branta canadensis*) were seen, including what appear to be adult plumage juveniles; three killdeer (*Charadrius vociferous*), including two juveniles; a female mallard and a juvenile (*Anas platyrhynchos*); several crows (*Corvus brachyrhynchos*); two non-native Eurasian collared-doves (*Streptopelia decaocto*); and numerous non-native rock doves/pigeon (*Columba livia*). The site has significant use for nesting and foraging by these bird species.

2015 DSEIR

The DSEIR uses an incomplete description of the environmental setting in its impact assessment.

The DSEIR incompletely characterizes the site's biological resources in the project site description and existing uses. The sole description of the site as it related to its biological resources in the DSEIR is as follows:

"Immediately east of, and adjacent to, Parking Lot B is a depressed area (measuring approximately 320 feet by 280 feet) created by an excavation and backfill associated with a prior environmental cleanup of that portion of the site. A surface swale extends west within this portion of the site to allow for drainage of surface water into the depression." (Pg. 3-10)

This description fails to mention any of the site biological resources, such as plants or animal or habitats, or the fact that there is a large permanent pond and wetland features in the middle of the site. There is no mention of wildlife use and the existing habitat(s) on the site in the DSEIR. The site's biological resources, including waters, wetlands, wildlife habitat and species are then not discussed at all in the DSEIR (except for the Appendix containing the NOP-IS).

The DSEIR failed to protect species and identify the appropriate list of sensitive natural communities, as well as Critical Habitat designations

1. The potential for Western pond turtles and California red-legged frog is stated as "low" since by their estimation, "No suitable habitat present." However, the perennial pond feature (and for the frog a constructed water feature in particular) is not ideal, but it is certainly suitable habitat. In particular, the analysis (and inferred conclusion) is faulty since low potential does not mean "no" potential, and therefor reasonable steps should be taken to establish or reject the presence of the species and as needed, mitigation. These simple mitigation measures are commonly applied to similar activities

throughout California, and include rare plant surveys, and targeted (focused) species surveys.[2, 3, 4] The rare plant surveys must be timed to the appropriate season, and the focused surveys for the right life stage of the target species. In our experience both in preparing EIRs, and supporting similar construction projects, that in virtually every case, where natural(ized) features exists that can potentially support species of concern, there is an additional mitigation measure that provides a preconstruction survey (or surveys); and if species of concern are likely to occupy the site, the preparation and implementation of a Worker Environmental Awareness Plan (WEAP). The DSEIR solely has a pre-construction breeding bird survey.

2. The potential use (given the habitat values present and prior observations by others) of the site for at least foraging habitat is identified for Peregrine falcon[5], Red-tailed hawk, American kestrel[6], Great blue heron[7], American goldfinch[8] but its loss is not mitigated for (NOP-IS Appendix A. Table 2 A-8). Note: Two species that do not appear to meet the section 3503.5 Eggs, Nests, and Nestlings Protected under the California Department of Fish and Game Code provisions are identified as such in the text.

3. There is <u>significant new information</u> related to the federal designation of Critical Habitat for the listed anadromous fish, the steelhead (*Oncorhynchus [Salmo] mykiss*)[9]. The DSEIR failed to identify that the project has the potential to impact the defined Critical Habitat for the steelhead. This designation was completed in 2005 and was not described in the 1998 Mission Bay FSEIR. Neither the potential of the project activities to impact the steelhead (*See*: Other Biological Resource Issue Areas), or the designation of the status of this plan area was identified in the DSEIR.

The Project's impacts adequately are not fully disclosed in the DSEIR

1. The project fails to identify, assess, and mitigate for the proposed project impacts on the biological resources associated with the site water bodies.

2. The DSEIR analysis restates that there are no new or significant changes to biological resources and appears to rely entirely on the NOP-IS (Pg. 1-9; Pg. 5.1-1; Pg. 1-58/59). Despite these statements, there is in fact a <u>significant new impact</u> identified in the DSEIR from the project to birds identified in the text on Pg. 3-28, "The project sponsor proposes to incorporate bird-safe design measures that would reduce

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[2] http://www.cnps.org/cnps/rareplants/pdf/cnps_survey_guidelines.pdf
[3] http://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/rare_plant_protocol.pdf
[4]https://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf
[5] Identified as "present" in 1998 FSEIR Table K.2
[6] Identified as "present" in 1998 FSEIR Table K.2
[7] Identified as "present" in 1998 FSEIR Table K.2
[8] Identified as "present" in 1998 FSEIR Table K.2
[9] Federal Register / Vol. 70, No. 170 / Friday, September 2, 2005 / Rules and Regulations

the potential effects of the proposed buildings, signage and lighting on birds." And, that impact requires and was provided a new mitigation measure: The project sponsor shall design and implement the project consistent with the San Francisco *Standards for Bird-Safe Buildings* and Planning Code Section 139, as approved by OCII. OCII shall consult with the Planning Department and the Zoning Administrator concerning project consistency with Planning Code Section 139." (Pg. 1-59)

Nowhere in the DSEIR is there an analysis of which bird species would be subject to these strike impacts, what time of year, or which types of impacts they were subject to. There was no discussion of the determination of thresholds for the bird injury and/or death associated with the project, and no explanation about how or why the mitigation proposed would be sufficient to reduce those injury and/or deaths below a specified threshold.

The Project's impacts are not appropriately mitigated in the DSEIR

The DSEIR analysis, at a minimum, should have been fully developed to reflect the 2015 federal Wetland Policy modifications, the observations of its own wetland experts, and the numerous state and federal wetland policies and regulations that apply to this site. It is our opinion that the DSEIR fails to mitigate for impacts to waters and wetlands at the site; as well as the potential impacts to biological resources within and around the site through contact with hazardous waste. Effective mitigation measures are available to reduce the impacts below significance. These comments are more fully explained under the NOP-IS analysis below.

2014 NOP-IS

The 2014 NOP-IS Applies the Prior Impact Analysis to the Modified Current Setting

1. The NOP-IS (Pg. 76) re-characterizes the 1998 FSEIR in order to minimize the type, extent and value of current ecological features of the site. The analysis conflates the prior CEQA analysis with the current ecological conditions, without fully assessing the significant changes that currently exist under and the impacts of the project on the biological resources. The analysis further parses the "upland" species and habitat from the aquatic species and habitat, without identifying and relating the project impacts associated with each of those contexts. For example, the proposed project has both direct (loss of habitat) and indirect environmental impacts (potential contamination) to both terrestrial and aquatic resources, within and adjacent to the site (dust, groundwater and stormwater), but these impacts are not fully identified (impacts identified only to nesting and flying birds). The project must be evaluated with an associated impact analysis that defines the specific project impacts on the site's (and Plan Area) biological resources.

2. There are <u>substantially new ecological conditions</u> at the site that differ from the description provided in the FSEIR, the project analysis under the NOP-IS newly identifies water bodies as wetland features, but fails to provide analysis of the project impacts on those features, define their regulatory status, and

identify suitable mitigation according to its regulatory status (NOP-IS, Pg.78; ESA 2014; WRA 2014). For example, if the features are only determined to be regulated by the State there is typically one set of mitigation measures similar to those identified in the IS-NOP, if they are both state and federal, additional measures may be required, however those measures are dependent on a series of tests, and since the project may be subject to CWA 404(b)(1) provisions, significant additional analysis and mitigation may be required.

Instead, the analysis claims that the habitat is: "…limited due to the sparse and ruderal nature of onsite vegetation, as well as the site's location in a densely urbanized environment. While several bird species were observed foraging and hunting onsite, these species are common to San Francisco and would continue to be supported by vegetation communities and water features found in the project vicinity." By its own admission the analysis states that these features would be permanently lost, but that impact doesn't matter because there is some other place for the species to go. It fails to fully define what the biological impacts are, and then identify where (to which nearby features) these species would go.

Further the analysis states: "Because the excavation depressions on the site are small, isolated features resulting from recently completed hazardous materials remediation activities and are surrounded by paved areas and urban development, these features do not provide the important biological habitat functions and values that are typically associated with federally protected wetlands." Conversely, and in rebuttal to their prior assertion that there are readily substitutable habitats nearby, small wetland features can have exceptional ecological value, in particular if they are one of the few remaining features in an urban setting.

This biological resource information in the NOP-IS was only analyzed in a cursory manner, simply recapitulating the site observations, without fully identifying and evaluating the CEQA-required biological resource impacts from the project. Without a full technical understanding of which resources are impacted, mitigation cannot, and indeed was not, adequately developed- as these measures depend on the nature and extent of the resources impacted. The standards of significance are not identified, and fail to show the application of thresholds to the project impacts for wetlands and other special ecological habitats.

For example, on Pg. 78 of the analysis, the NOP-IS identifies use of the site's open water and wetland by a variety of native plants and animals:

"Site reconnaissance revealed the deepest part of the excavation within this area contains standing water with a mixture of ruderal vegetation described above, and wetland plants, including alkali bulrush (*Bolboschoenus maritimus*), brass buttons (*Cotula coronopifolia*), fat-hen (*Atriplex prostrata*), and saltgrass (*Distichlis spicata*), present around its perimeter. The standing water supports common wildlife as evidenced by a snowy egret (*Egretta thula*) hunting at the water's edge and a black phoebe (*Sayornis nigricans*) sallying insects from a vegetative perch."

Despite these observations, the analysis fails to accurately characterize the site habitats, and reconcile the appropriate list of species regulatory concern (Table 1, Attachment 1). The habitats observed by BSK (2014) and ESA (2014) at the site appear to include: open water, shallow water with emergent vegetation (alkali wetland), mud flats, riparian fringe (locally called scrub), ruderal grassland, seasonal wetlands, and open/disturbed shrubland. California identifies one of these habitat types as sensitive: *Bulboschoenus maritimus* (Salt marsh bulrush marshes) Alliance, status S3[10] (S3 = Vulnerable in the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation from the state.)

For illustration of the biological resources analysis defects, as they related to waters and wetlands, the following section provides a site waters and wetland feature history and summary analysis of how the provided data and analysis are insufficient or incorrect.

WATERS AND WETLAND FEATURE HISTORY

The term "wetlands" from a Clean Water Act (CWA) 404 perspective generally means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands typically include swamps, marshes, bogs, and similar areas. These are typically identified using a three-part test, examining the presence of water, wetland (hydric) soil, and wetland dependent (hydrophytic) vegetation, following specific guidance(s). The federal CWA section 404(b)(1) Guidelines list both wetlands and mud flats as types of “special aquatic sites.”

A wetland under California’s regulations contains the following features, an area that is covered by shallow water or where the surface soil is saturated, either year-round or during periods of the year; where that water coverage has caused a lack of oxygen in the surface soil; and, has either no vegetation or plants of a type that have adapted to shallow water or saturated soil. Some examples are fresh water marshes, bogs, riparian areas, vernal pools, coastal mud flats and salt marshes. In this case, there are both a permanent water body and a seasonal feature (possibly a small complex) with wetland characteristics by the admission of the experts who prepared the environmental documentation for the project. These characteristics meet the definitions contained in the various regulations, including 14 CCR 13577(b), Cal. Pub. Res. Code § 30121. The open water feature and its wetland (hydrophytic) vegetation were verified in the field, and through the use of aerial photos, showing their presence over time, both by season and by year.

The site is within the footprint of the historic Mission Bay, which has been filled in over time (ESA 2014; Pg. 1). The original Bay muds are still found below the site, as evidenced by the site soil borings (LTR 2015; Pg. 13 and Figures A-2 and A-3). The excavation intercepted local shallow groundwater and is

[10] https://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/natcomlist.pdf

evidently maintained by that natural source (LTR 2015; Pg. 14). The site also has seasonal wetland features which appear to be dominated by stormwater. It is not clear that these seasonal features would not be maintained for far longer in the spring, but they have been captured through an excavated trench apparently intended to drain them to the open water body (ESA 2014; Pg. 2). The site "remedial" activities thus captured the local water table and allowed for the expression of open water and wetland features (ESA 2014; Pg. 2). The ESA analysis goes on to specifically identify that the: "…deeper excavation and surrounding shallow depressions within the proposed project site are features that exhibit hydrology and vegetation characteristics of wetlands. Hydric soil is presumed present due to the year-round inundation and presence of obligate wetland plants." (ESA 2014; Pg. 3)

Federal Jurisdiction-Wetlands created by human actions fall under discrete classes under Federal jurisdiction. Most typically these are agricultural features that are caused by the movement of water from one location to another, such as a dam providing water to a canal constructed in uplands. In this case however, the site was originally a tidal mudflat or estuary wetland which has since reverted back to a wetland (ESA 2014). In addition, even if it was not originally a water or wetland, it currently meets those adjacency, and direct hydrologic connectivity requirements under the Final Clean Water Rule (2015; 33 CFR Part 328 and 40 CFR Parts 110, 112, 116, 117, 122, 230, 232, 300, 302, and 401); and, even manmade wetlands and water bodies have restrictions on discharges under 33 CFR 323.4(b).

There are Federal exemptions for specific construction associated activities. These exemptions (33 CFR 323.4 - Discharges not requiring permits) are invalidated, however: "If any discharge of dredged or fill material resulting from the activities listed in paragraphs (a) (1) through (6) of this section contains any toxic pollutant listed under section 307 of the CWA such discharge shall be subject to any applicable toxic effluent standard or prohibition, and shall require a section 404 permit." (33 CFR 323.4(b)).

The site's water and soils include several chemicals identified under CWA section 307 as toxic pollutants (BBL 2006; LTR 2015).[11] Those chemicals include the following 12 Priority Pollutants found in the Phase II (LTR 2015; Table 4 and Table 5):

1. Benzene
2. Naphthalene
3. Cyanide
4. Antimony
5. Arsenic
6. Chromium
7. Copper
8. Lead
9. Mercury
10. Nickel

[11] http://water.epa.gov/scitech/methods/cwa/pollutants-background.cfm

11. Selenium
12. Zinc

Therefore, the site is *not exempted* under 33 CFR 323.4 because it contains 12 of the chemicals identified as priority pollutants under section 307.

The proponents' consultant, WRA, in a separate analysis, claims exemption from the CWA under yet a different test (without identifying that any exemption is *invalidated* by the section 307 test described above (WRA 2014; Pg. 2)). WRA states that: "1986 (51 Fed. Reg. 41206) (e) Water-filled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States."

The site owner's continuing failure to backfill the excavation and its abandonment for the past decade, despite being under Order No. R2-2005-0028 and its RRMP, constitutes abandonment and its clear reversion to the definition of waters, wetlands and/or other special aquatic site. WRA's explanation, contrary to demonstrating how the site may be exempted as an incidental construction feature, documents how that feature has been abandoned. Therefore the exemption also does not apply on that basis.

Indeed, there is no merit to the further argument made by WRA (Pg. 4) that: "As described in the RWQCB Order No. R2-2005-0028, the Project Area was to be excavated and backfilled in preparation for future development as part of the overall Mission Bay redevelopment plan." The site was not backfilled. It should be noted by WRA's argument there could never be a case for reversion under the CWA, because any naturalized feature would simply 'be ready' for some postulated future backfilling. The provided analysis fails to show: 1. How the feature has not reverted and 2. How the exemption override under 33 CFR 323.4 does not apply due to the presence of section 307 toxic chemicals. Regardless, WRA is silent on the open water and wetland features in context of the State water and wetland policy and applicable regulations.

California Jurisdiction-California does not have the same exemptions in its waters and wetland framework as exist under the CWA. California derives its authority from different sources (Porter-Cologne Water Quality Control Act and various other Acts) for its policies, and includes all man-made features under its jurisdiction. Therefore the site's water features, regardless of origin, appear to be regulated and protected waters and wetlands of the State.

The NOP-IS acknowledges that the project would result in the fill of a wetland (and without identifying it Pg. 76, its associated fringe riparian zone), however, the proponent has not yet (and does not propose to) characterized the wetlands to determine their jurisdictional status (Pg. 78). The failure to prepare the jurisdictional determination prior to public comment eliminates full public disclosure and the ability to assess the potential reasonableness and efficacy of mitigation measures. Moreover, the specified failure to establish specific (offsite) mitigation may violate CEQA's mandate to impose all feasible mitigation measures, and may fail to meet both Porter Cologne and the Clean Water Act permitting requirements for filling wetlands and waters.

SITE ABANDONMENT AND NEW EXPOSURES

The Site's Failure to Fill the Excavation Has Led to Wetland Formation and New and Unanalyzed Exposures

The site petroleum-related remedial activities exposed the local water table and allowed for the expression of wetland characteristics and the site which have become naturalized over time (ESA 2014; Pg. 2). These activities have resulted in the creation of stockpiles of material adjacent or near to these wetland features that in some cases: "…contains contaminants that exceed hazardous waste threshold concentrations and will require special handling and disposal," (LTR 2015; Pg. 1). These activities took place over several years culminating in a Phase II remedial action that left the excavated area open and abandoned in 2005 (LTR 2015; Pg. 6). The Revised Risk Management Plan (RRMP, BBS; Pg. 2-3 and 2-3) infers that the excavation was backfilled, however, it was not.

The RRMP further identifies that: "1. Because North Terminal, Parcel X4, OAS and 16th Street East OUs are currently under development, interim risk management measures (IRMMs) designed for undeveloped parcels are not relevant to the protection of human health on those OUs. If development ceases or areas are created with uncovered native soils, IRMMs may again be necessary." (BBS 2006; Table 1) The development of the site still has not occurred, and there is no evidence that the IRMMs have been applied.

The site's open water and wetland features are thus a direct result of the abandonment of a site cleanup allowed to revert back to a 'natural state' for approximately a decade. Not only did natural features evolve in response to this abandonment, but the very abandonment created conditions that may have exposed wildlife to a variety of hazardous chemicals through their use of that habitat (LTR 2015).

The Project Impact Evaluation Modifies the Appendix G Question in a Manner that Eliminates Critical Analysis

The project Impact Evaluation BI-1 fails to follow the language of Appendix G by removing the second half of the question, and reduces the subject matter and detail of its impact analysis accordingly (Pg. 77). The current (2015) Appendix G states:

IV. BIOLOGICAL RESOURCES -- Would the project:

> a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans,

policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

Instead the NOP-IS states:

> "Impact BI ‐ 2: The proposed project would not have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations. (No Impact)"

The result of this text deletion is that the potential for the project to impact U.S. Fish and Wildlife Service designated critical habitat is not analyzed. Therefore, the potential project impacts to the closest federally designated critical habitat is steelhead *Oncorhynchus mykiss* are ignored. This habitat runs directly adjacent to the project area. In addition, San Francisco manzanita (*Arctostaphytos franciscana*) critical habitat is present approximately 2.6 miles to the west and should also have been identified and analyzed. The federal critical habitat analysis is missing, and the provided analysis itself is defective. The potential project's impact(s) to these listed species and their critical habitat are therefore unexamined. The project's dust, stormwater, surface flooding, and groundwater place those species at risk from hazardous chemicals. This issue is discussed in detail in Other Biological Resource Issue Areas.

OTHER BIOLOGICAL RESOURCE ISSUES

The DSEIR is silent on the potential project impacts on offsite fish and wildlife issues associated with stormwater and other discharges from the site to the surrounding area, Mission Creek Channel, and the San Francisco Bay. The DSEIR Appendix MIT Mission Bay FSEIR Mitigation Measures: Applicability to Proposed Project K. Hydrology and Water Quality section (MIT-27 through -29) states that the project would fall under different mitigation measures under different programs (such as the General Stormwater Permit) and that the detailed mitigation requirements from the 1998 FSEIR would not be used. The site's hazardous material history show that the proposed project construction activities pose risks to the environment and its biological resources through the release of hazardous chemical to surface waters, through wind redeposition, stormwater drainage, or unabated stormwater sheet flow above a 5-year design rain event (BBL 2006, LTR 2005). The RMP has not protected these resources because it was not intended to covers these features, followed superseded analytical methods, and even if it was applicable and current, has had implementation failures. Some of these issues are identified in greater detail in a separate document, SWPPP Memorandum BSK Associates, 2015.

There is a direct route from the site to the surrounding area, including the Bay, from dust and stormwater. Stormwater can take several routes off the site, and may enter a sediment trapping system, or not, and flows over a 5-year event run unabated into neighboring properties and the Bay. Currently, there are what appear to be multiple failures to implement and maintain effective Best Management Practices (BMPs) for dust and stormwater. The DSEIR fails to identify these risks and conditions, and fails to identify the potential environmental impacts from the <u>substantially changed new</u>

environmental conditions as a result of the site remedial activities. The DSEIR further identifies that there were detailed mitigation measures for these potential impacts as they related to stormwater (but not biological resources) in the FSEIR, but that they deleted the hazardous material protective elements and simplified the sediment management. The site stormwater operations have management issues that need reconciliation, but the evidence shows a likelihood of these contaminants reaching surface waters, despite the prior BMPs and this must be fully analyzed and the mitigation measures modified correspondingly to reflect those significant new conditions in order to protect biological resources, designated critical habitat and listed fish and wildlife.

CUMULATIVE IMPACTS

In our opinion, the project's impacts on listed species, waters and wetlands, and their loss, were not analyzed in sufficient detail or context to be able to understand what the likely cumulative impacts would be on those and other biological resources. It seems probable that there would be cumulatively considerable impacts from the project given the limited availability of those habitats, and that there are mitigation measures available for those impacts. However, the IS-NOP analysis discusses some broadly applicable mitigation measures for wetlands, then fails to identify or apply any of those mitigation measures in Table 1-2 (NOP/IS Pg. 1-58) Appendix MIT (Pg. MIT-30). There are only two mitigation measures described as applicable to biological resources at the site in the DSEIR, breeding bird use protection and bird strike impacts.

The DSEIR's cumulative impact analysis lacks the degree of detail that the 1988 DEIR completed and fails to apply that analysis to the current waters and wetlands, and contradicts the current DSEIR's findings:

"Wetland habitats in the San Francisco Bay Region continue to be eliminated and altered. Wetlands provide a continuity of habitat between the open waters of the Bay and upland areas. Wetlands increase the wildlife diversity by providing additional habitats, and by providing many of the animals' life history requirements (e.g., feeding, mating, and nesting) in one area." (1988 FEIR Pg. VI.M.12)

According to the project analysis: "The proposed project could potentially result in adverse effects on various bird species through disruption of nests, collisions with buildings, or disorientation from night lighting. These impacts, in combination with other projects along the San Francisco waterfront, could potentially result in cumulative impacts to birds." (NOP/IS Pg. 84) There is no assessment of how many birds or which species would be impacted and how the mitigation would achieve that reduction below the unstated threshold. The document then fails to identify how the mitigation measures would result in a less than significant finding over the cumulative impact analysis area. There is also no supporting analysis for these bird impacts in the 1988 FEIR or 1998 FSEIR.

1998 FSEIR

HABITAT ANALYSIS

No Prior Interior Wetland Presence and Analysis

The 1998 FSEIR states: "This section focuses on the aquatic and wetland habitats of China Basin Channel. Terrestrial habitats in the remainder of the Project Area do not support any significant biological resources, as discussed in the Initial Study (see Appendix A)." At the time of that analysis, there were no documented interior water and wetland features at the site, and therefore the project impacts on waters and wetlands were not analyzed (Pg. II.30). It also is important to note that the mitigation used for the China Basin Channel may, and in some cases may not, be applicable to the project impacts on the current interior wetlands, and thus require significantly new and more detailed analysis for both the impact to these features, and the impacts on their associated species.

HAZARDOUS CHEMICALS

Hazardous Chemical effects on Biota

The FSEIR identified that for the purposes of analyzing wastewater impacts from the project, that "Near-Shore Effects-Treated combined sewer overflows currently occur at Bayside discharge facilities, including facilities at China Basin Channel, at the end of Mariposa Street, and in Islais Creek. The proposed project would marginally increase treated combined sewer overflows and direct stormwater discharges to near-shore waters of the Bay, including China Basin Channel and Islais Creek. Near-shore discharges are not subject to the same rapid mixing and dilution as the deep-water discharges from the Southeast Plant." (Pg. II.27) This effect is generally correct and holds for both wastewater, and typically to an even greater degree, most particulate or soluble chemicals that would come off the site through the groundwater, aerial re-deposition or stormwater/surface transport.

However, in the immediately following section, Effects of Stormwater Discharges, it states that "Under the project, the volume of stormwater directly discharged to near-shore waters of the Bay from the Project Area would increase about 2%. The concentrations of pollutants in the stormwater discharge would change, because the project would intensify land use in the Project Area. Neither the increase in stormwater flow, nor the change in pollutant concentrations would constitute a significant effect on aquatic biota." (Pg. II.28) The recent findings of Class 1 and Class 2 hazardous waste is not taken into account for these analyses and comprise significant new information that requires analysis in the 2015 SEIR because of the different and <u>significantly greater biological impacts</u> of these hazardous materials (LTR 2015).

The FSEIR identifies an analysis of potential adverse ecological effect associated with the current conditions at the site in 1998 (Pg. I.54). It states: "As noted by ENVIRON, no criteria have been developed for the assessment of risk to ecological receptors in the aquatic environment based on comparisons to groundwater chemical concentrations. However, ambient water quality criteria for the protection of marine (saltwater) organisms are used as a conservative means of evaluating the potential risk to surface water organisms." (Pg. I.57) However, since 1998, the San Francisco Regional Water quality Control Board has developed these very criteria as described below.

The 1998 analysis relied on Preliminary Remediation Goals (PRGs) for its analysis, however the San Francisco Regional Water Quality Board (SFRWQB) states in its current guidance document that: "The U.S. EPA Regional Screening Levels or RSLs (formerly PRGs; U.S. EPA, 2013d) address human health concerns associated with direct exposure to chemicals in soil, but do not address ecological concerns. Exposure routes and receptors not addressed by the RSLs, but included in the ESLs [Environmental Screening Levels] are listed below: …groundwater screening levels for the protection of aquatic…habitats/surface water quality…soil screening levels for urban area ecological concerns; (SFRWQB 2013; Pg. 1-3). These exposure routes which apply and are specific to the site are identified in the current Environmental Screening Levels (ESLs). This is <u>new and substantial information</u> that affects the potential environmental impacts to biological resources which was not used in the DSEIR.

Further, the ESLs (the PRGs for that matter) are not legal limits, but they are intended to inform decision-making. However, they may not be protective enough in particular for "…sediment or sensitive ecological habitats (such as wetlands or endangered-species habitats). The need for a detailed human health or ecological risk assessment should be evaluated on a site-by-site basis for areas where significant concerns may exist (SFRWQB 2013; Pg. ES-1 and 2).

The prior FEIR analysis identifies that in their opinion there were no significant species or habitats at the site, and therefore the analysis was specifically intended not to be protective of terrestrial habitat or interior wetlands, and therefore does not apply to the current conditions: "As previously described, chemicals present in the soils could potentially impact the health of the ecological environment if terrestrial or nesting avian species come into direct contact with soils which contain elevated levels of chemicals, or if the chemicals in exposed soil were to be released into China Basin Channel or San Francisco Bay through surface water runoff. Additionally, chemicals present in the soil and groundwater could potentially impact the aquatic environment if the chemicals leach from the soil into the groundwater and subsequently migrate to China Basin Channel or San Francisco Bay. As discussed in the Mission Bay Final Environmental Impact Report (FEIR), the current and future conditions within the Project Area do not provide a habitat capable of supporting a significant terrestrial or nesting avian wildlife community. Accordingly, potential exposures that terrestrial species could have with soils would not represent a significant effect on the terrestrial wildlife community." FEIR 1998; Pg. I.54) The current conditions are <u>significantly different</u> and specifically excluded from the prior 1998 analysis and the current ESL methods do apply to these conditions.

The 1998 "risk analysis" applies the PRG criteria for impacts on biological resources in the Bay as a result of offsite groundwater movement only. It also uses average values and only for selected contaminants.

This is an artificial narrowing of chemicals that can have biological impacts, and likely a major reduction of the risk by not using the maximum observed concentration and the biologically relevant risk drivers. For example, species are exposed to actual concentrations, not site averages. By using the observed peak concentrations, it establishes the appropriate worst case scenario and sets the upper limits for the purposes of developing mitigation.

However, groundwater is but one of several potential routes by which contaminants can leave the site. Wind can blow contaminated dust and stormwater (containing both fine sediment and dissolved contaminants) can also run off the site. The RMP and RRMP also do not apply and cannot be relied upon because they specifically rely on the previous risk analysis, which does not look at terrestrial or interior wetlands.

Additional Mechanisms of Impacts to Biological Resources

Some of the mechanisms for biological impacts from the project's contribution to contaminants are through bio-accumulation, as well as the unanalyzed bio-concentration: "These contaminants could be directly lethal to smaller organisms, and could accumulate in the food chain and become successively more concentrated in a process known as bio-accumulation. Through bio-accumulation, the toxic concentrations could reach levels in which they are lethal to larger organisms, such as birds or marine mammals. Turbidity and toxicity from re-suspended sediments could also interfere with beneficial uses of the channel, such as spawning of Pacific herring." (1998 FSEIR Pg. II.31) The FSEIR analysis describes just one of the potential mechanisms for biological impacts from the project-associated hazardous chemicals, then identifies that it is significant and mitigatable, but then simply ignores that potential mechanism for other species that would potentially come in contact with the same material. The analysis should instead examine the various chemical of concern, their individual and joint biological impacts (chemicals can have additive (or counteracting) or multiplicative effects) and their routes of exposure (wind, groundwater or stormwater) and asses the risk drivers for each species (or trophic surrogate).

There are <u>newly identified</u> Class 1 and 2 hazardous waste materials at the site, the <u>newly identified</u> use of the site by diverse biota, the designated Critical Habitat, and similar release pathways off of the site. These changed conditions require analysis of both onsite impacts and offsite impacts. The lines of reasoning, based on high contaminant concentrations at/close to the site, poor mixing in the shallows, and bio-concentration/bio-accumulation should also be applied to the current physical conditions and the elevated contaminant concentrations.

Mitigation for Hazardous Materials

The analysis provided above in the 1998 FSEIR relied on the dilution effect of the Bay, despite its own earlier analysis that there would be significant impacts which required mitigation, but cumulatively there would be no impact (1998 FSEIR Pg. II.27). General stormwater impacts are not the same as impacts from solid phase and dissolved phase hazardous materials. Specific analysis must be developed to identify which capture or treatment systems are required for which hazardous constituent in which phase. For example, large particles traveling in the stormwater system could be trapped through a conventional filtration system, however, overflow of that system (and/or poor maintenance) by design flow above a 5-year rain event could cause that material to be flushed directly into the Bay. Very fine size and dissolved phase chemicals typically require specific treatment technologies to stop their direct movement to the Bay during mobilizing rain events. The mitigation does not appear to be sufficient to protect biota from hazardous materials identified at the site in the LTR 2015 report.

Cumulative Hazardous Issues

The same failure to identify, and therefore analyze cumulative impacts, as a result of newly identified hazardous materials also applies to cumulative impacts from these chemicals: "To put this in context, City discharges are a very small portion of the region-wide discharges to the Bay. Considering the contribution of the project and of the cumulative Bayside projects in the context of all the other pollutant inputs to the Bay, the cumulative pollutant loading from the Bayside projects would be extremely small." (1998 FSEIR Pg. II.29) The cumulative impacts of hazardous materials (not just generalized pollutants) would be specific to certain species in the Bayside proximate to the site, not generically in the context of the entirety of the Bay. It is inappropriate to consider the entirety of the Bay in the cumulative impacts specifically because of the mechanics of chemical redistribution identified in another section in the FSEIR (1998 FSEIR Pg. II.27, and see above). The analysis provided in the FSEIR does not cover the hazardous materials and fails to look at the appropriate biological context, including resident and locally foraging migrants, and must be reanalyzed in light of the new cumulative impact information. In our opinion, because of the new analysis methods and standards, and the lack of mitigation for soluble or stormwater transportable hazardous materials, the project's impacts on aquatic biological resources is cumulatively significant after mitigation. Mitigation measures are readily available for these potential impacts, but they require a careful analysis of the specific hazardous constituents and what levels of contamination are acceptable to develop.

REFERENCES

BBL Environmental Associates [BBL], 2006. Revised Risk Management Plan, Former Petroleum Terminals and Related Pipelines Located at Pier 64 and the Vicinity, City and County of San Francisco, California. (August, 2006)

ESA Associates [ESA], 2014. Habitat Value Assessment at the Mission Bay Blocks 29-32 Project Site. (11/6/14)

Langan Treadwell Rollo [LTR], 2015. Phase II Environmental Site Assessment, Golden State Warriors Arena, Blocks 29-32, Mission Bay, San Francisco, California. (June, 2015)

San Francisco Regional Water Quality Control Board [SFRWQCB], 2013. User Guide. December 2013.

US Environmental Protection Agency [EPA], 2015. Final Clean Water Rule http://www2.epa.gov/cleanwaterrule/final-clean-water-rule

WRA Consultants [WRA], 2014. Construction Related Depressions at Golden State Warriors Mission Bay Site. (10/1/14)

LIMITATIONS

Our review was limited to the Ecological-related aspects as they are identified in the project environmental documents provided or otherwise made available for review. Additional information related to the project may be available through other sources, but were not reviewed for the purposes of this analysis.

The observations, assessment and recommendations submitted in this report are based upon the data obtained from listed reports prepared by others, limited field investigation, and site observations. The report does not reflect variations which may occur beyond the assessed area. BSK's services were be performed in a manner consistent with the level of care and skill ordinarily exercised by other professionals practicing in the same locale and under similar circumstances at the time the work is performed. No warranty, either expressed or implied, is included. The findings of the field observation may have a potential for negative impact(s) on the value or suitability of the site for some purposes. BSK cannot assume liability for any such negative impact(s). Permitting requirements or permit interpretations may change over time. The findings of this report are valid as of the present. However, changes in the conditions of the site can occur with the passage of time, whether caused by natural processes or the human-induced changes on this property or adjacent properties. In addition, changes in applicable or appropriate standards or practices may occur, whether they result from legislation, governmental policy, or the broadening of knowledge.

We appreciate the opportunity to be of service to Soluri Meserve and trust that this correspondence provides you with the information necessary at this time. Please contact us with any questions regarding the review comments presented this letter.

Respectfully submitted,
BSK Associates

Erik Ringelberg
Senior Scientist
Ecological Services Group Manager

Kurt Balasek, PG, CHg, CSD
Senior Hydrogeologist

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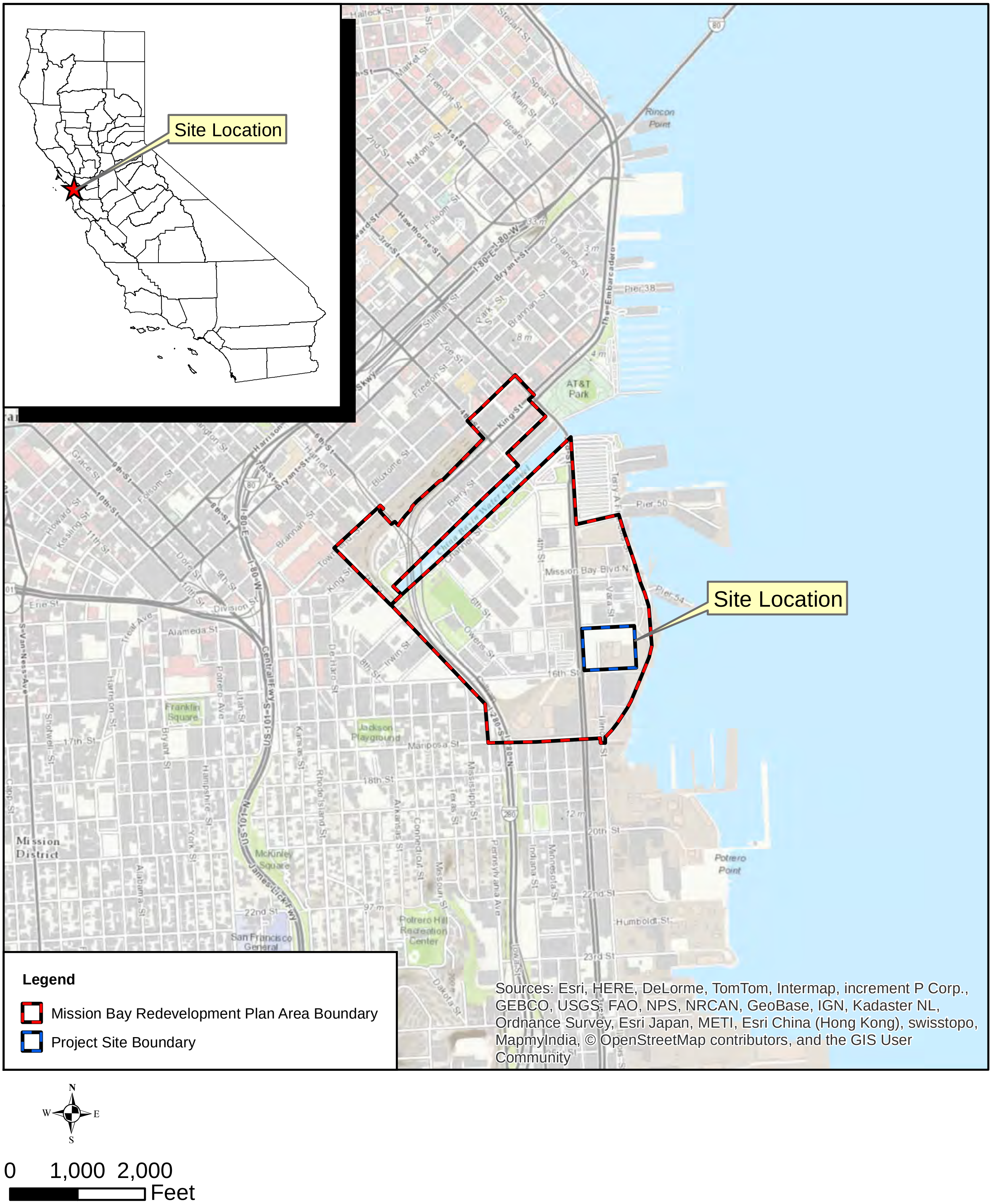

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Review - Mission Bay Subsequent Environmental Impact Report San Francisco, California	Figure 1 Vicinity Map

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Review - Mission Bay Subsequent Environmental Impact Report San Francisco, California	Figure 2 Current Aerial Photograph

Legend

Mission Bay Redevelopment Plan Area Boundary

Project Site Boundary

Symbol | Map Unit

131 | Urban land

134 | Urban land-Orthents, reclaimed complex, 0 to 2 percent slopes

W | Water

Source: USDA NRCS SSURGO Soil Survey Data
http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

0 300 600 Feet

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Review - Mission Bay Subsequent Environmental Impact Report San Francisco, California	Figure 3 Project Area Soil Map

Legend

- Mission Bay Redevelopment Plan Area Boundary
- Project Site Boundary

Wetland Type

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

Source: U.S. Fish & Wildlife Service, National Wetlands Inventory, http://www.fws.gov/wetlands/Data/State-Downloads.html

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Review - Mission Bay Subsequent Environmental Impact Report San Francisco, California	Figure 4 National Wetland Inventory

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Review - Mission Bay Subsequent Environmental Impact Report San Francisco, California	Figure 5 Observed Wetland Features

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Erik Ringelberg – Ecological Services Group Manager

Professional Background:

Mr. Ringelberg began his career as an environmental scientist in 1992. His academic background includes a B.Sc. in Microbiology from Colorado State University, a M.Sc. in Environmental Science from Lesley University in Cambridge, Massachusetts, and he is a Ph. D. candidate at the University of Montana, in Riparian and Wetland Ecology. He has directed organizations, managed departments, technical staff, contractors, and volunteers for the public and private sectors. He has coordinated development and restoration projects with state and federal oversight agencies, and developed threatened and endangered species management plans. Mr. Ringelberg directed and advised non-profit, tribal, and local government agencies on special studies, wildlife mitigation measures, habitat management and restoration for listed species.

Mr. Ringelberg has completed numerous California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) analyses and associated field studies, including protocol studies for listed avian, terrestrial, and aquatic species and their associated habitats in California, Nevada, and Montana. He has delineated over 30 miles of Streamside Management Zones, US Army Corps of Engineers - Wetlands and Ordinary High Water Marks, and California "isolated" waters. Mr. Ringelberg has also directed both large and small-scale wetland and river restorations.

Relevant Project Experience:

Field Studies

Multi-species Habitat Utilization Analysis
Glacier National Park, including spotted sandpiper (*Actitis macularius*), Barrows goldeneyes (*Bucephala islandica*), Harlequin duck (*Histrionucus histrionucus*) and common merganser (*Mergus merganser*).

Habitat Reconstruction Analysis
Reconstruction of pre-impact conditions using stratified random statistical analysis of NHP data, and site specific data from local informants, for the Yerington, Nevada area.

Avian Mitigation Measure Development
Stone Lake National Wildlife Refuge Association (CEQA/NEPA EIR/EIS in development); Yolo Basin Foundation Putah Creek Stream Restoration (CEQA EIR in development); and, numerous CEQA projects in the Central Valley of California.

Breeding Bird Surveys
Caltrans-Highway 50; and, numerous development projects in Alameda, Glenn, Madera, Sacramento, San Joaquin, Solano, Stanislaus, Tehama, and Yolo Counties.

QUALIFICATIONS

Certifications:
DFW Scientific Collections Permit SC-10511, 2015
Hazardous Analysis and Critical Control Point: Aquatic Nuisance Species, USFWS, 2003
Constructed Wetland Designer; UW, Madison, 1993
40-CFR Hazardous Waste Handling, 1992-1993

Education:
Ph.D., candidate (ABD) Riparian and Wetland Research Program, University of Montana, School of Forestry, Missoula, MT, 2003

M.Sc., Environmental Science, Lesley University, Cambridge, MA, 1991

B.Sc., Microbiology (Business concentration), Colorado State University, Fort Collins, CO, 1987

Experience:
BSK Associates 2009-Present
Wallace-Kuhl 2009-2006
PLF 2006-2003
KYNF 2003-2000

Bat Surveys
Multi-species bat surveys for development projects in Yolo County.

Burrowing owl (*Athene cunicularia hypugaea*). Protocol-level field surveys in Fresno, Solano and Yolo Counties, California.

Northern spotted owl (*Strix occidentalis caurina*). Protocol-level field surveys in Napa County for wind projects.

Swainson's hawk (*Buteo swainsoni*). Protocol-level field surveys in Solano and Yolo Counties, California.

California tiger salamander (*Ambystoma californiense*). Supported protocol-level field surveys in Calaveras County.

Red-legged frog (*Rana draytonii*). Supported rotocol-level field surveys in in Calaveras County.

Clear Lake Hitch (*Lavinia exilicauda chi*). Hatchery establishment, field collections and protocol development in Lake County.

Focused Rare Plant Surveys (various). Surveys in Calaveras, Kern, Napa, Sacramento, San Joaquin, Solano, Stanislaus, Tehama, and Yolo Counties.

Worker Environmental Awareness Protection Plans
Preparation and presentation of Worker Environmental Awareness Protection (WEAP) Plans for project which may have potential to impact Special status species and breeding birds in Kern, Solano and Yolo Counties.

Field Ecology

Putah and Cache Creek Plans, Yolo County, CA, Washoe County, and Lyon County NV - Technical Advisor on habitat analysis, restoration (and SMARA-equivalent) planning for Yolo County Resource Management Planning Area for Cache Creek, advisor for large-scale watershed restorations (and dam removal) on Putah Creek; and, restoration and management plans for the Pyramid Lake Paiute Reservation. Developed historic species lists for Cache Creek and Yerington region.

Pyramid Lake Paiute Tribe, Big Valley, Robinson, and Upper Lake Rancherias, in Washoe County NV and Clear Lake County, CA - Directed a multi-disciplinary lake and river research-management program for threatened and endangered species. Provided technical support for federal and state-listed species and those of tribal concern (Lahontan cutthroat trout, Cui-ui, Clearlake hitch, Sacramento perch, and tui chub), including managing 6 hatcheries, a water quality laboratory, and tagging programs.

Missoula County Riparian Inventory and Classification Project, Missoula County, MT - Co-funded, developed, and managed the Missoula County riparian inventory. Researched the integration of riparian and wetland vegetation, habitat, and stream classifications.

Confidential Client - Ethnographic study assessing cultural uses of plants, animal, insects and minerals.

Awards

Secretary of Defense, Environmental Award for Pyramid Lake Torpedo and Bombing Range Remediation Project, Team recipient. 2006.

George Bright Graduate Fellowship for academic achievement and exceptional service to the School of Forestry. 1994-1995.

Jesse M. Bierman Scholarship for academic achievement and potential in the life sciences. 1994.

Certifications

Hazardous Analysis and Critical Control Point: Aquatic Nuisance Species, USFWS
Constructed Wetland Designer; University of Wisconsin, Madison
40-CFR Hazardous Waste Handling

Grants

US Bureau of Reclamation, DTR. 2005

Fish and Wildlife Service, TLIP. 2012, 2011, 2010, 2009, 2005, 2004.

Natural Resources Conservation Service. 2004.

Publications, Presentations and Reports

Ringelberg, Erik. "California's Water Crisis: The Delta and Beyond." *California's Constitutional Crisis and Reclaiming the Public Good.* 2009. Heyday Books.

Ringelberg, Erik. "Stakeholder Involvement in Department of Energy Decision Making: A Stakeholder's Perspective." *American Nuclear Society*. 2002.

Invited Speaker:

"Large Scale Wetlands Mapping: New Technology and Databases" and "Mitigation and Restoration Challenges" for Lorman's: "Wetland Regulation in California" Sacramento, CA, 2014.

"Agricultural Impacts from Restoration Activities in the Delta." Watershed Education Foundation. Stockton, CA. 2014.

"Elk Slough Restoration and Flood Control Opportunities." Watershed Education Foundation. Sacramento CA. 2013.

"Lessons Learned from Stream Restorations in the Central Valley." Landscape Architecture Department. University of California, Davis. CA. 2013.

"Managing Project Environmental Risks" (co-presenter). 17th Annual Conference. American Public Works Association. Richmond, CA. 2013.

Ringelberg, Erik. "Riparian Restoration - Team Approaches." Landscape Architecture. University of California, Davis. CA. 2011. Lecture.

Ringelberg, Erik and Osha Meserve. "Habitat Conservation Planning and the Bay Delta Conservation Plan." UC Davis School of Law. University of California, Davis. CA. 2011.

Ringelberg, Erik and Dietrick McGinnis "Restoring a rare native fish, the Hitch *Lavinia exilicauda chi*: preliminary biology, ecology, and an initial adaptive management plan." Society for Ecological Restoration, Annual Conference. Mammoth, CA. 2010.

Ringelberg, Erik. "Applied Ecosystem Restoration." Wildlife, Fish and Conservation Biology, Habitat Conservation and Restoration. University of California, Davis. CA. 2009. Lecture.

Ringelberg, Erik. "Adaptive Management, principles and guidelines." Central Valley Regional Water Quality Control Board, Mercury TMDL and BPA Amendment. Stockton, CA. 2009. Lecture.

Ringelberg, Erik. "Hitch Ecology and Adaptive Management." Hinthil Environmental Resource Consortium. Middletown, CA. 2009. Lecture.

Ringelberg, Erik. "Hitch Ecology and Tagging Program." Chi Council. Lakeport, CA. 2009. Lecture.

Ringelberg, Erik. "Riparian Management, Cache and Putah Creeks." Restoring habitats Conference, Cache Creek Conservancy. Woodland, CA. 2009. Lecture.

Ringelberg, Erik. "Wetland Soils" and "Restoration, Construction, and General Principles: Lessons Learned." Ducks Unlimited Wetland Engineering Seminar. San Francisco, CA. 2008. Lecture.

Ringelberg, Erik. "Vernal Pool Establishment, a Multidisciplinary Approach." Society of Wetland Scientists. Sacramento, CA. 2007. Lecture.

Ringelberg, Erik. "Mercury Impacts on a Tribal Fisheries." Natives Impacted by Mining Conference, Reno, NV, 2005. Lecture.

Ringelberg, Erik. "Hatchery Program for Native Fish Species." Western States Water Council Conference and Desert Terminal Lakes Conference, Salt Lake City, UT 2005. Lecture.

Ringelberg, Erik. "Changing Directions in Tribal Fisheries." Lahontan Cutthroat Trout Interagency Meeting, Reno, NV 2004 and 2005. Lecture.

Ringelberg, Erik. "Riparian Ecology and Restoration" and "Riparian Ecology, Delineation, and Streamside Management Zones." University of Montana, School of Forestry, Missoula, MT, 1999. Lecture.

Ringelberg, Erik. "The Harlequin Duck, Habitat Use and Behaviors along a Rocky Mountain Stream." Joint Meeting of Montana Regional Society of American Foresters and The Wildlife Society, Missoula, MT, 1997. Lecture.

Research and educational work featured in Western Water: "Remnants of the Past: Management Challenges of Terminal Lakes,"; and, Sandstrom, Per (1996); Identification of potential linkage zones for grizzly bears in the Swan-Clearwater Valleys using GIS. M.Sc. Thesis; University of Montana; *Birder's World* article: "The Harlequin Duck"; *Wildbird* article, "Duck Tales" *Wildbird* article; untitled film depicting issues around water policy in the Sacramento-San Joaquin Delta, and, the film "The Innu vs. Inco at Voisey's Bay."

Technical Reports

Cache Creek Annual Assessment, Yolo County Board of Supervisors. 2011, 2010, 2009, and 2008.

Hitch Status in Clearlake's watershed. USFWS. 2011, 2010 and 2009.

10-year Management plan for the Lahontan cutthroat trout and the cui-ui. USFWS-PLPT. 2006

Inventory and Assessment of Bank Stabilization Projects on reaches of the Clark Fork River, Bitterroot River, Blackfoot River, Lolo Creek, and Nine Mile Creek in Missoula County, Montana. 2000.

Detailed Methods and Materials for the Inventory and Assessment of Bank Stabilization Projects. Missoula County 2000.

Unpublished Manuscripts

Ringelberg, Erik. “Assessment of Rosgen and Strahler Stream Classifications, Examination of the Relationships between Geomorphology and Riparian Habitat.” 1999. Manuscript.

Ringelberg, Erik and Aldred-Cheek, Kristin, “Rural Community Collaborations, a Case Study in Western Montana.” University of Montana. 1999. Manuscript.

Committees and Community Service

Riparian Ecologist - County of Yolo, Technical Advisory Committee. 2008-12. Woodland, CA.

Participant - Abandoned Mines Forum. 2006-present. Sacramento, CA.

Participant - Delta Tributaries Mercury Council. 2008-present. Sacramento, CA.

Commissioner - Regional Water Planning Commission. 2004-5. Reno, NV.

Member - Regional Stormwater Professional Advisory Group. 2004-5. Reno, NV.

Member - Lahontan Trout Recovery- FWS TRI Team. 2003-5. Reno, NV.

Tribal Observer - US Fish and Wildlife Service, Management Oversight Group. 2003-5. Reno, NV.

Member - Secretary of Energy Advisory Board, Alternatives to Incineration Committee, and Steering Committee for Stakeholder’s Forum. 2001-2. Washington, D.C.

Participant - INEEL Long-Term Stewardship Program, St. Cloud State. 2001-2. Idaho Falls, ID.

Chair - Missoula City/County Water Quality Advisory Council. 1993-9. Missoula, NV.

Co-founder - Clark Fork Watershed Education Network. 1999-2001. Missoula, MT.

Member - Montana Watershed Council, and Montana Wetlands Council. 1994-2000. Helena, MT.

Ex-officio Board Member - Swan Ecosystem Center, 1999-2000. Beaverhead, Bighole, and Mineral County (MT) Advisory /Watershed Councils. 1998-2000.

Science Judge - Society of Wetland Scientists, Annual Student Projects. 2007. Sacramento, CA.

Science Judge - Preliminary and Final, Montana State Science Fair. 1995-9. Missoula, MT.

Science Judge - International Wildlife Film Festival. 1994-7. Missoula, MT.

Additional Technical Training

Special Status Amphibians and Reptiles of Northern California, University of California. 2008.

Vernal Pool Workshop, California Native Grasslands Association. 2007.

California *Anostracan* and *Notostracan* Identification Class and Practical Exam, Belk. 2006.

UCSB Vernal Pool Workshop, Society for Ecological Restoration. 2006.

Surface Mining Reclamation Act Lead Agency Training, Department of Conservation. 2006.

Planning and Promoting of Ecological Land Reuse of Remediated Sites**.** USEPA Interstate Technology and Regulatory Council, 2007.

Guidance for Characterization, Design Construction and Monitoring of Mitigation Wetlands. USEPA Interstate Technology and Regulatory Council, 2006.

Professional Organizations

California Invasive Plant Council

California Native Grasslands Association

California Society for Ecological Restoration

Society of Wetland Scientists

Native American Fish and Wildlife Society

Kurt Balasek, PG, CHG, QSD – Senior Hydrogeologist

Professional Background:

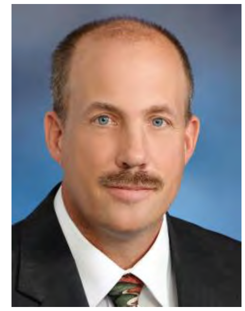
Mr. Balasek is the Sacramento Senior Hydrogeologist for BSK. He has more than 25 years of experience providing geologic, hydrogeologic and environmental consulting to western U.S. businesses and government agencies. His experience includes managing teams of scientists and engineers on projects ranging from large-scale brownfield developments, and CEQA compliance to third party consultation and groundwater studies. He has provided project management of water resource evaluations and conjunctive use studies, as well as numerous petroleum hydrocarbon-related soil and groundwater contamination investigations and remedial designs. Mr. Balasek has completed geologic hazard studies for proposed school sites in accordance with the Office of State Architect requirements and has completed detailed geologic surface mapping assignments in the foothills of the Sierra Nevada.

Mr. Balasek has spent his career working to evaluate hundreds of properties for the purposes of development, redevelopment and preservation as conservation easements. Conducting or leading these evaluations has given Mr. Balasek vast experience preparing site investigation strategies with an emphasis toward negotiating with regulatory agencies regarding future land use. Mr. Balasek has worked with redevelopment teams in numerous northern California cities and extensively under EPA community-wide assessment grants in the Cities of West Sacramento, Esparto, and Rancho Cordova. He has worked with local, State, and Federal agencies in evaluating a wide range of environmental, contaminanted and blighted sites, assessing community needs, and using tools to develop site cleanup goals. His skills of using land use covenants and maintenance tools provides for blighted property that have led to showcases community revitalization efforts. Mr. Balasek has completed numerous landfill characterization studies and provided detailed analysis to assist in consolidation and clean closure decision making.

Representative Project Experience:

City of Rancho Cordova, CA, Community Redevelopment Agency, Brownfield Assessments– Mr. Balasek provided senior management oversight on a community-wide assessment of over 460 properties in Rancho Cordova, California. Approximately 30 parcels warranting Phase I and/or Phase II Environmental Site Assessments (ESAs) were identified. To date, a Phase I and II ESA were conducted on two parcels of a planned community college campus.

Putah Creek Park North Bank Improvement Project- The North Bank Improvement Project stemmed from a federal appropriation of 2 million dollars to enhance the



Qualifications

Registrations:
Professional Geologist,
California, No. 6162

Certified Hydrogeologist,
California, No. 299

Education:
MS, Hydrogeology,
California State University, Chico
1989

BA, Geology. University of
California, Santa Barbara, 1985

Experience:
BSK Associates 2009

1991-2009, Wallace-Kuhl
Director of Environmental Services

1989 – 1991 Terrestrial Tech.
Senior Staff Hydrogeologist

Solano County Transportation Department's automobile bridge replacement at the City of Winters. The project funds are administered by **CalTrans** so extensive coordination with this agency regarding project description and permitting has been a substantial portion of this project. The project was developed by the City of Winters. Mr. Balasek and his team were initially tasked with obtaining the biological opinion for mitigation as it related to disturbance of Valley Elderberry shrubs. Instead of purchasing mitigation credits from a Service-approved mitigation bank, Mr. Balasek and his staff devises a unique plan to develop a small on-site mitigation area within the Winters Putah Creek Nature Park. If approved, the mitigation area will provide enough mitigation credits to offset the Solano County Bridge project, the north bank improvement project and a proposed pedestrian bridge. Money will be set aside for maintenance of the mitigation area in perpetuity but will enable the project proponents to mitigate habitat damage locally and keep local control of the money. To develop this plan, Mr. Balasek and his team developed the financial model to predict the amount of money required to establish a non-wasting endowment. This model was submitted to USFWS and is undergoing review. U.S. Representative Mike Thompson and his staff are involved in the project and are assisting with negotiations with USFWS.

Winters Putah Creek Park Revised Master Plan CEQA Support- Winters, CA- Mr. Balasek and his team prepared the Initial Study/Mitigated Negative Declaration (IS/MND) based on the revised master plan for Winters Putah Creek Park. This document was compiled in advance of implementing several projects outlined in the park master plan. The document was reviewed by the Winters City Council and adopted by the Winters planning commission without comment by the trustee agencies and with only one comment from the public. The document framed the foundation for environmental permitting for all of the following restoration-related projects.

City of West Sacramento, Housing and Community Investment Division, West Sacramento, CA– Mr. Balasek has managed several Environmental Projects for the City of West Sacramento, including: West Capitol Corridor Study, 427 "C" Street, Tower Court, Sacramento Generator, and Vlad's Toyota.

City of Winters PG&E Training Center, Winters CA– During critical property negotiations, due diligence studies revealed the historic presence of an underground fuel storage tank. Me. Balasek we retained by the City on an emergency basis to advise City Council and staff. Mr. Balasek mobilized BSK resources and conducted a comprehensive, soil, groundwater and soil vapor investigation on the site. Mr. Balasek also advised the City throughout the project and represented the City in numerous negotiations with PG&E. As a result of a well planned and executed investigation, a $70 million state-of-the-art training facility project is moving through the CEQA process and is scheduled to break ground late in 2015. This project is a huge success for the small City of Winters and will act as a catalyst for a downtown hotel project. Mr. Blazek's work in the field and at the negotiating table was a key part of the success of this project.

Stockton Worknet Center, Stockton, California– Provided project management for a contaminated site. The site characterization and remediation was funded by a State of California Brownfield Grant. The source of contamination was determined to have come from a pipeline located under railroad tracks. Removal and backfill of soil from an excavation that was 35 feet wide by 400 feet long was completed prior to construction of the new center.

River City Baseball – River Cats Stadium, West Sacramento, California- The site was located adjacent to a chemical mixing plant and as part of the owner's due diligence an environmental assessment was conducted. Contamination of volatile organics was determined and remediation followed. Based on these findings the foundation design was also adjusted to accommodate shallow groundwater. Based on Mr. Balasek's recommendation, Gorsorb™, a passive form of soil vapor testing, was used to delineate the contamination. A Risk Assessment report was provided to determine if the level of contamination exposure based on the properties intended use. All this work was completed at an accelerated pace to facilitate construction.

Colusa County, Three UST Sites, Colusa, California– Underground storage tanks at the County Sheriff's Department, Central Services, and County Jail were removed soil and water samples were tested for contamination. As project manager, Mr. Balasek managed the team who provided soil excavation and shallow groundwater monitoring for petroleum hydrocarbons. The three projects took place concurrently resulting in a cost savings to the county.

Sacramento International Airport Terminal Construction, Sacramento, California-- Mr. Balasek and his team installed monitoring wells and conducted aquifer performance tests in advance of massive dewatering efforts to facilitated construction at the new Sacramento International Airport Terminal project. Data developed from this study was used to quantify discharge volumes and evaluate water quality. The data was subsequently used as the basis for dewatering design related to a large basement structure extending approximately 17 feet below grade for the entire terminal building as well as subterranean tunnel structures. The new Sacramento Terminal opened in the fall of 2011.

Yolo Ranch Agricultural Landfill Remediation, Yolo County, California- Provided project management and oversight during landfill excavation and remediation. This project involved careful coordination with regulatory personnel from the Illegal Abandoned Landfill Group at the former California Integrated Waste Management Board to remove and/or encapsulate a wide range of ag-related waste in the Yolo ByPass. The work involved remediation and subsequent site closure of an agricultural landfill adjacent to sensitive natural habitats. This work was done as part of a property transaction and demonstrated creative problem solving that included an on-site solution which saved the client tens of thousands of dollars.

Butte County, California- Mr. Balasek and his team conducted the base-line hydrogeologic analysis of the site vicinity in support of the gravel mining permit application submitted to Butte County. Mr. Balasek's team also conducted the slope stability evaluations for the propose mine. Both technical documents were used to support an EIR commissioned by Butte County on behalf of the project proponent. In addition, Mr. Balasek's team provided consultation on pit capture and anadromous fish entrapment if high water resulted in overtopping of the pit. The work also involved analyzing resource data to identify the bottom of economically recoverable resource.

Cold Spring Rancheria, Tollhouse, California- Mr. Balasek oversaw the preparation of a comprehensive long range water development program for the Cold Springs Rancheria. This program examined available surface and groundwater resources, outlined potential problems with existing infrastructure and water rights and prioritized projects for improvement. Mr. Balasek and his staff also prepared a revised Quality

Assurance Assessment Plan (QAAP) for the Rancheria that outlined procedures for all field sampling activities. These plans were funded by the Bureau of Indian Affairs and are required planning documents in advance of project implementation funding.

Professional Organizations

American Society of Civil Engineers
Association of Environmental and Engineering Geologists
ASFE - Professional Firms Practicing in the Geosciences
Water Resource Association of Yolo County
Winters Education Foundation
City of Winters, Putah Creek Park Committee
Solano Resource Conservation District
Groundwater Resources Association of California

EXHIBIT 3

San Francisco Bay PCBs TMDL – Implementation at Cleanup Sites

PCB TOTAL MAXIMUM DAILY LOAD (TMDL)

Basin Plan section 7.2.3, San Francisco Bay Polychlorinated Biphenyls TMDL, should be considered during site investigations and cleanups throughout the Region, particularly but not exclusively at sites located on the Bay margin. Of particular concern, and often overlooked, is the fact that PCBs in surface soil can be mobilized by stormwater runoff and flow to the Bay.

Fish tissue PCB concentrations are the direct cause of impairment to the Bay, and therefore the numeric target of the TMDL is a fish tissue PCB concentration protective of human health. The TMDL's fish tissue screening level of 10 ng/g represents a ten-fold reduction in fish tissue PCB concentration. To achieve this, surface sediment PCB concentrations in San Francisco Bay must be reduced to an average of 1 ug/kg. The TMDL's wasteload allocations were developed with the goal of achieving a ten-fold decrease in PCB sources to the Bay.

Of the sources to the Bay, stormwater runoff contributes the greatest mass of PCBs. The PCB TMDL establishes a wasteload allocation for stormwater of 2 kg/yr total PCBs, which represents a ten-fold decrease over the current estimated load. In an effort to achieve this reduction, Bay Area municipalities are pilot-testing remedial actions in areas where street sediments contain PCBs in the 1 mg/kg range *before any remedial action is taken*. Municipalities will spend millions of dollars to achieve the ten-fold reduction in PCBs required by the TMDL.

ACHIEVING THE PCB ALLOCATION AT CLEANUP SITES

Stormwater runoff from sites containing residual PCBs in soils after state- and federal-ordered cleanup contributes to sediment concentrations in the Bay, and such contributions must be essentially eliminated in order to achieve the TMDL target. For cleanup sites, the TMDL calls for implementing "on-land source control measures, to ensure that on-land sources of PCBs do not further contaminate in-Bay sediments."

PCBs cleanups that occur in urban areas often have a cleanup goal based on protection of human health, and this can allow residual PCB concentrations close to or exceeding 1 mg/kg to remain in surface soils. **Regardless of the cleanup goal, it is important that cleanup sites do not contribute any PCBs to surface water runoff. Remedial actions should be conducted so as to eliminate <u>all</u> means of conveyance of PCBs from cleanup sites, including sediment runoff, vehicular drag out, and airborne dust**. Achieving this may require a durable cover of soil, hardscape, or structures to prevent surface exposure of PCBs. The goal is to have zero discharge of residual PCBs at cleanup sites.

PCBs in aquatic environments require cleanup to ecological risk-based concentrations that are generally much lower than the one mg/kg human health level. For example, a San Francisco Bay tidal marsh PCB cleanup concentration was established at 90 ug/kg PCBs to protect clapper rails.

RECOMMENDED PCB ANALYTICAL METHODS

Sampling and analyses are needed to confirm that PCB levels are low enough to achieve the TMDL targets. For cleanup sites in the San Francisco Bay area, the analytical method for PCBs in soils should be capable of detecting total PCBs ***well below*** 1 mg/kg dry weight and approaching 25 ug/kg dry weight for soil, with a high likelihood that all PCBs present in the sample are detected. The Water Board's own Surface Water Ambient Monitoring Program uses a Reporting Level of 0.2 µg/kg for most PCB congeners in sediment.

Analytical methods that we know will attain this data quality objective, and that we recommend using at all cleanup sites, include the following:

- EPA Method 8270D (semivolatiles in soils/waste) modified by EPA Method 1625. Method 1625 is the application of isotope dilution/recovery correction to GC/MS methodology. Total PCBs are determined by summing the individual congener results. Results can be reported as either, or both, congeners or aroclors. Ball-park cost for this analysis is $375/sample.[1]
- EPA Method 1668A or 1668C, which combine high-resolution GC with high-resolution mass spectrometry (HRGC/HRMS). Results are reported for all 209 congeners in µg/kg dry weight. Ball-park cost for this analysis is $800-900/sample.[1] An alternative is to use the same method, but report results for the 40 PCB congeners monitored by the SF Bay Regional Monitoring Program: PCBs 8, 18, 28, 31, 33, 44, 49, 52, 56, 60, 66, 70, 74, 87, 95, 97, 99, 101, l05, 110, 118, 128, 132, 138, 141, 149, l51, 153, 156, 158, 170, 174, 177, 180, 183, 187, 194, 195, 201, and 203. Cost for this alternative may be about 15% less than the full congener analysis.[1]
- Note that cleanups conducted under the authority of the Toxic Substances Control Act (TSCA) have their own PCB analysis requirements. Contact the U.S. Environmental Protection Agency, Region 9, TSCA staff or see http://www.epa.gov/Region9/pcbs/ for further information.

Other analytical methods (such as 8082) generally do not identify and quantify all the PCB congeners that may be present at a cleanup site, which can result in inadequate cleanups. Municipalities are finding PCBs in roads and gutters that may be traced back to "closed" cleanup sites that did not use reasonably rigorous analytical methods and/or cleanup standards.

Methods such as 8082 identify and quantify aroclors by gas chromatography (GC) with an electron capture detector (ECD). Each aroclor consists of a number of PCB congeners. The aroclor is identified by the retention times of the highest peaks in the chromatogram, and is quantified by comparing the height or area of those peaks to those of a pure aroclor standard. Between 5-8 aroclors are typically reported in an 8082 method, depending on the lab method used. Some high production aroclor mixtures, such as 1270 (almost 100% congener 209), are rarely included in the method. In addition, PCBs in the environment undergo volatilization, partitioning, chemical transformation, photo-degradation, and biodegradation over time. These changes confound the matching of an environmental sample to an aroclor pattern. **As a result, other analytical methods often do not measure the total PCBs present in an environmental sample, and we do not recommend relying on such methods at this time.**

[1] Axys Analytical, personal conversation. May 1, 2012.

CAULK SAMPLING & ANALYSIS[2]

Structures, especially non-residential buildings, constructed or renovated between 1950 and 1980 may have PCBs in caulking and other building materials. A local study found that PCBs are prevalent in the caulk in Bay Area buildings constructed during that timeframe. PCBs were detected in 88% of the caulk samples tested; 40% of the samples contained > 50 ppm PCBs and 20% contained > 10,000 ppm PCBs. Please refer to the study's project page for more information about PCBs in caulks and sealants.

The following methods are recommended for sampling and analyzing caulk and sealants suspected of containing PCBs: Remove a one inch strip (or ~10 g) of the sealant sample from the structure using a utility knife with a solvent-rinsed, stainless-steel blade. Collect one sealant sample per sealant type on each structure to fully characterize the PCB content in the structure's sealants.

PCBs can be present in the percentage range in caulk, so a high resolution method is not necessary. EPA Method 8270 (semi-volatile organic compounds by gas chromatography-mass spectrometry) is appropriate. Report analytical results as the total of 209 PCB congeners, or the shorter list of 40 congeners above may be used.

BMPs for Controlling PCBs

Best management practices (BMPs) for controlling PCBs during removal from structures can be found at http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/caulk/caulkcontractors.htm.

BMPs for controlling sediment during site grading and other construction activities are available at http://cfpub.epa.gov/npdes/stormwater/swppp.cfm.

[2] Further information on PCB-containing caulks and sealants can be found at http://www.sfestuary.org/projects/detail.php?projectID=29 and http://www.epa.gov/pcbsincaulk/.

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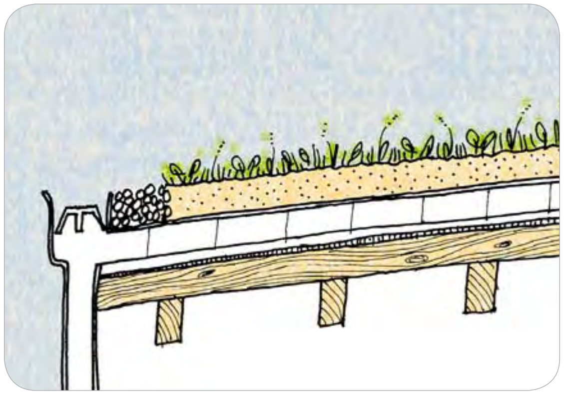
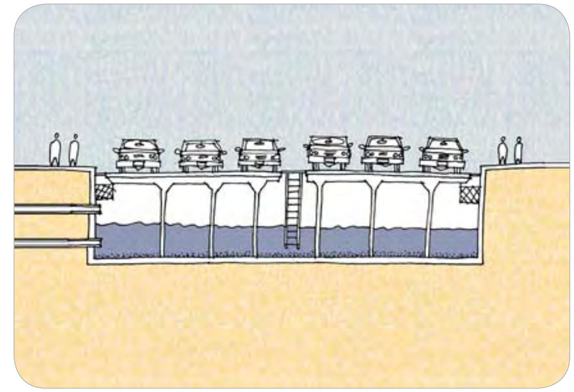
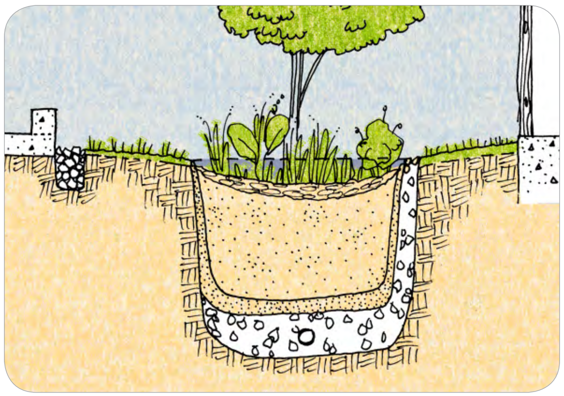
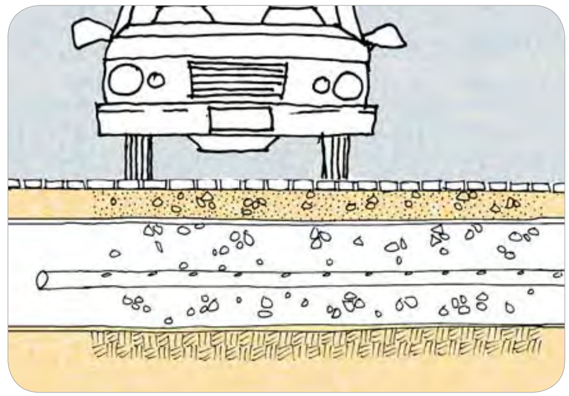
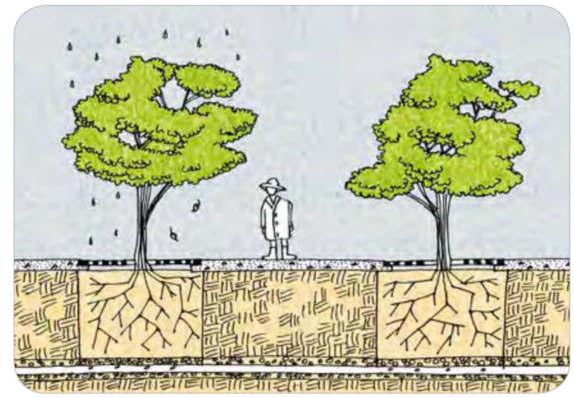
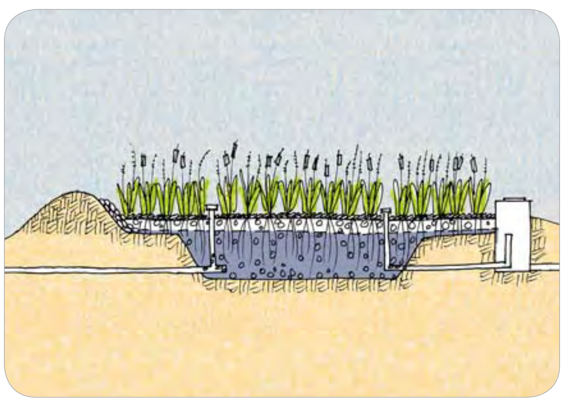
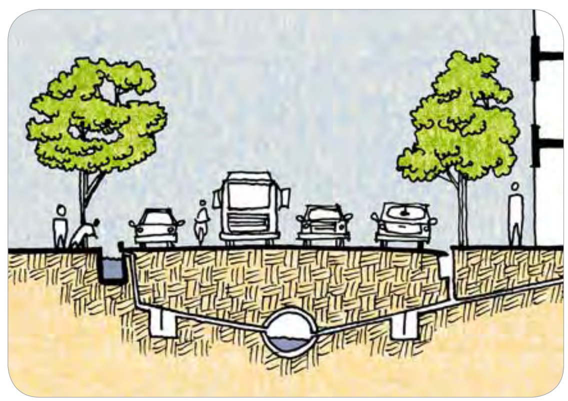
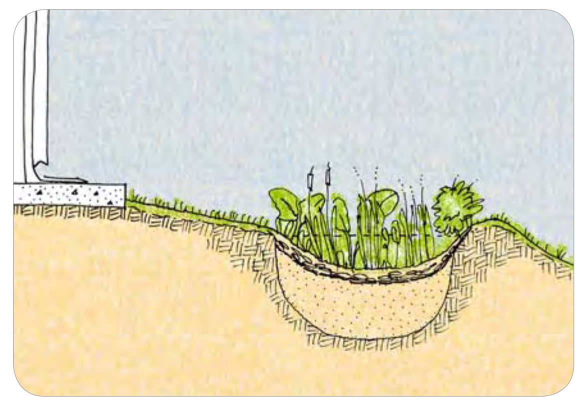
EXHIBIT 4

To Mission Bay Alliance Comment Letter dated July 24, 2015

Re: Hydrology, Water Quality and Biological Impacts - Comments on Draft Subsequent Environmental Impact Report for the Event Center and Mixed Use Development at Mission Bay Blocks 29-32 (Warriors Arena Project); San Francisco Planning Department Case No. 2014.1441E; State Clearinghouse No. 2014112045

EXHIBIT 4



SAN FRANCISCO

stormwater design guidelines

November 2009 Version - Updates and errata will be published as necessary

SAN FRANCISCO stormwater design guidelines

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Jon Loiacano, Principal Engineer

Port of San Francisco

Monique Moyer, Executive Director
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Byron Rhett, Deputy Director, Planning and Development

ACKNOWLEDGEMENTS

The *San Francisco Stormwater Design Guidelines* team would like to thank the Phase I cities that have gone before us and have graciously shared their wisdom, their support, and the many valuable lessons they have learned. We are particularly grateful for the examples set by the counties of Contra Costa and Santa Clara, California and the Cities of Emeryville, California; Portland, Oregon; and Seattle, Washington.

PROJECT TEAM

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Sustainable Watershed Designs

Scott Durbin

CONTENTS

Executive Summary

Stormwater management is a critical municipal responsibility that has a direct impact on public health and safety, surface water quality, and wildlife habitat.

Like many California municipal agencies, the San Francisco Public Utilities Commission (SFPUC) and the Port of San Francisco administer Stormwater Management Programs developed in accordance with the federal Clean Water Act and a State of California National Pollution Discharge Elimination System (NPDES) Permit.

NPDES permits for stormwater specify a suite of activities that municipalities must undertake to reduce pollution in stormwater runoff. One of these is the development, implementation, and enforcement of a program to reduce pollutants in stormwater runoff from new development and redevelopment projects. This effort is commonly referred to as a *post-construction stormwater control program*.

In February 2007, Port and SFPUC staff initiated a community planning effort to develop a regulatory guidance document that fulfills state and federal requirements for post-construction stormwater runoff control. The San Francisco Stormwater Design Guidelines (*Guidelines*) represent the culmination of this effort. The *Guidelines* describe an engineering, planning, and regulatory framework for designing new infrastructure in

Linked bioretention cells are a central part of the design for the Glashaus development in Emeryville, CA.

a manner that reduces or eliminates pollutants commonly found in urban runoff. The *Guidelines* are designed to work within the context of existing San Francisco regulations and policies, and are consistent with the City's and Port's Building Code and Planning Code requirements.

The *Guidelines* are currently directed primarily to San Francisco's **separate storm sewer areas**, which include the Port of San Francisco, Hunters Point Shipyard, Mission Bay, Treasure Island, Candlestick Point, and areas that discharge to inland receiving waters such as Lake Merced. However, the thresholds presented here and the general strategies described to achieve compliance also apply to **combined sewer areas**. While the thresholds and strategies are the same for both combined and separate sewers, the performance measures are different. For information about requirements in combined sewer areas, see page 62.

Low Impact Design

In keeping with San Francisco's policy goals for promoting sustainable development, the *Guidelines* encourage the use of Low Impact Design (LID) to comply with stormwater management requirements. LID applies decentralized, site strategies to manage the quantity and quality of stormwater runoff. LID integrates stormwater into the urban environment to achieve multiple goals. It reduces stormwater pollution, restores natural hydrologic function to San Francisco's watersheds, provides wildlife habitat, and contributes to the gradual creation of a greener city. LID can be integrated into all development types, from public open spaces and recreational areas to high-density housing and industrial areas.

Master-planned or Multi-Parcel Projects

Many future projects in San Francisco will be located in large redevelopment areas and will include construction of significant horizontal infrastructure and open space in addition to subdivided parcels and individual buildings. Master-planned projects, such as Treasure Island, Hunters Point Shipyard, and the Port's Sea Wall Lot 337, can make use of larger LID strategies that provide superior treatment, wildlife habitat, recreational amenities, and other benefits that may not be possible with smaller projects. Constructed wetlands and large-scale rainwater harvesting are just a few examples of LID strategies presented in these *Guidelines* that are ideally suited to large projects.

Using the Stormwater Design Guidelines

The *Guidelines* are intended to lead developers, engineers, and architects through a planning and design process that incorporates stormwater controls into site design. The *Guidelines* provide a policy overview, describe the regulatory context for post-construction stormwater control requirements, and explain how these requirements will be incorporated into San Francisco's planning and permit review process.

The *Guidelines* introduce the stormwater performance measures that must be achieved for project approval and provide detailed instructions for developing a Stormwater Control Plan (SCP), a document which will allow city staff to assess compliance. A worked example illustrates how to complete each step in the design process, and a template for the SCP is included at the end of the document. The *Guidelines* include compliance strategies, a decision tree to assist in the selection of stormwater controls, and spreadsheets for sizing stormwater controls. The requirements outlined in the *Guidelines* are of a technical nature and most project applicants will require the assistance of a qualified civil engineer, architect, or landscape architect in order to comply.

Every applicant seeking a building permit or every project that requires compliance with California Environmental Quality Act (CEQA) process on or after **January 1, 2010** for a new or redevelopment project over 5,000 square feet must complete a SCP showing that they have incorporated appropriate stormwater controls into their project and have met the stormwater performance measures described in these *Guidelines.* SFPUC and Port permit staffs will review SCP submittals for adequacy.

Native plants in bloom in the swales at the Sunset Circle parking lot, an LID feature that protects the water quality of Lake Merced.

Introduction

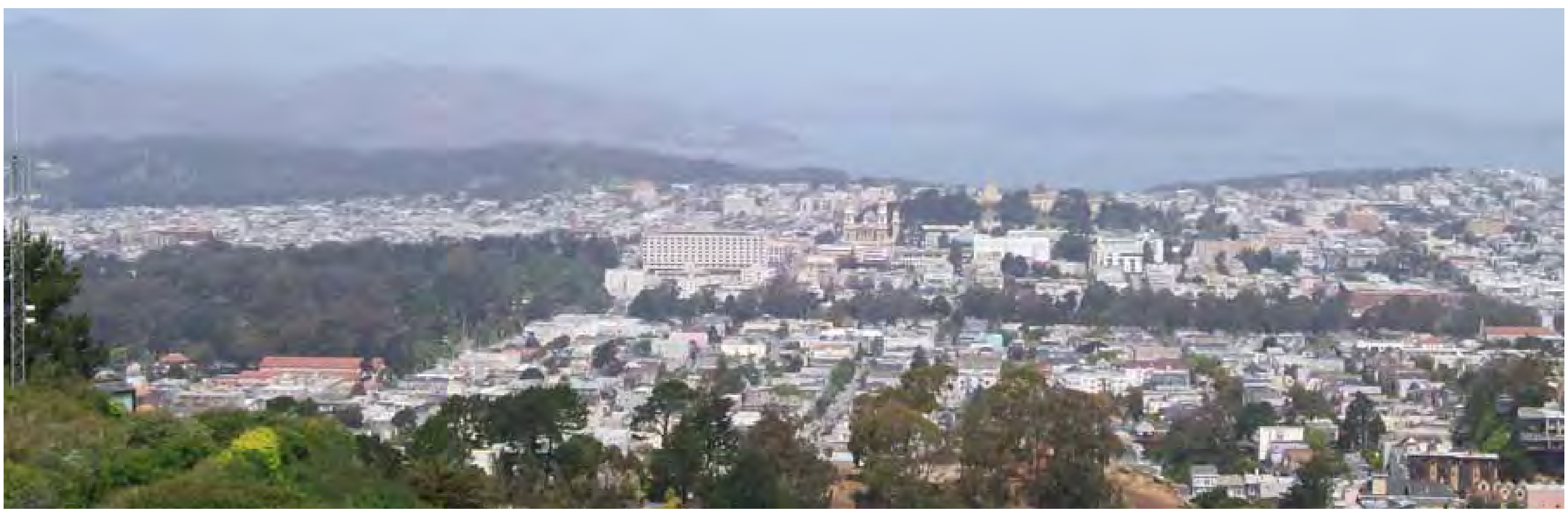
San Francisco's location adjacent to the Pacific Coast and San Francisco Bay, the largest estuary on the west coast of the United States, gives the City significant environmental, social, and economic advantages; it also confers unique responsibilities for water quality protection upon the City and its citizens.

The San Francisco Public Utilities Commission (SFPUC) and the Port of San Francisco (Port) have partnered to create the *San Francisco Stormwater Design Guidelines* (*Guidelines*) for San Francisco's developers, designers, engineers, and the general public. The *Guidelines* are designed to help project applicants implement permanent post-construction stormwater controls. Water quality regulations under the federal Clean Water Act require such controls for new and redevelopment projects in areas served by municipal separate storm sewer systems (MS4s).

While water quality protection is the fundamental driver behind stormwater management, well-designed stormwater controls offer many ancillary benefits. These *Guidelines* encourage innovative and multi-purpose design solutions for meeting stormwater requirements in San Francisco's urban setting. In addition to protecting water quality, well-designed multi-purpose solutions will contribute to attractive civic spaces, open spaces, and streetscapes. They will also protect and enhance wildlife habitat and have the potential to effectively integrate stormwater management into the redevelopment of historic sites.

By implementing the stormwater management strategies articulated in this document, each project applicant will contribute to the incremental restoration of the health of the City's watersheds, protect the Bay and Ocean, and build a greener San Francisco. Patrick Condon, Chair in Landscape and Livable Environments at the University of British Columbia, underscores the contribution that each site can make to a region: "What the cell is to the body, the site is to the region. And just as the health of the body is dependent on the health of the individual cells that make it up, so too is the ecological and economic health of the region dependent on the sites that comprise it."

The *Guidelines* function as both policy document and design tool. They explain the environmental and regulatory drivers behind stormwater management, demonstrate the concepts that inform the design of stormwater controls, describe the benefits that green stormwater infrastructure bring to San Francisco, and take project applicants through the process of creating a Stormwater Control Plan (SCP) to comply with stormwater regulations. The *Guidelines* are specific to San Francisco's environment; they reflect the city's density, climate, diversity of land uses, and varying topography.



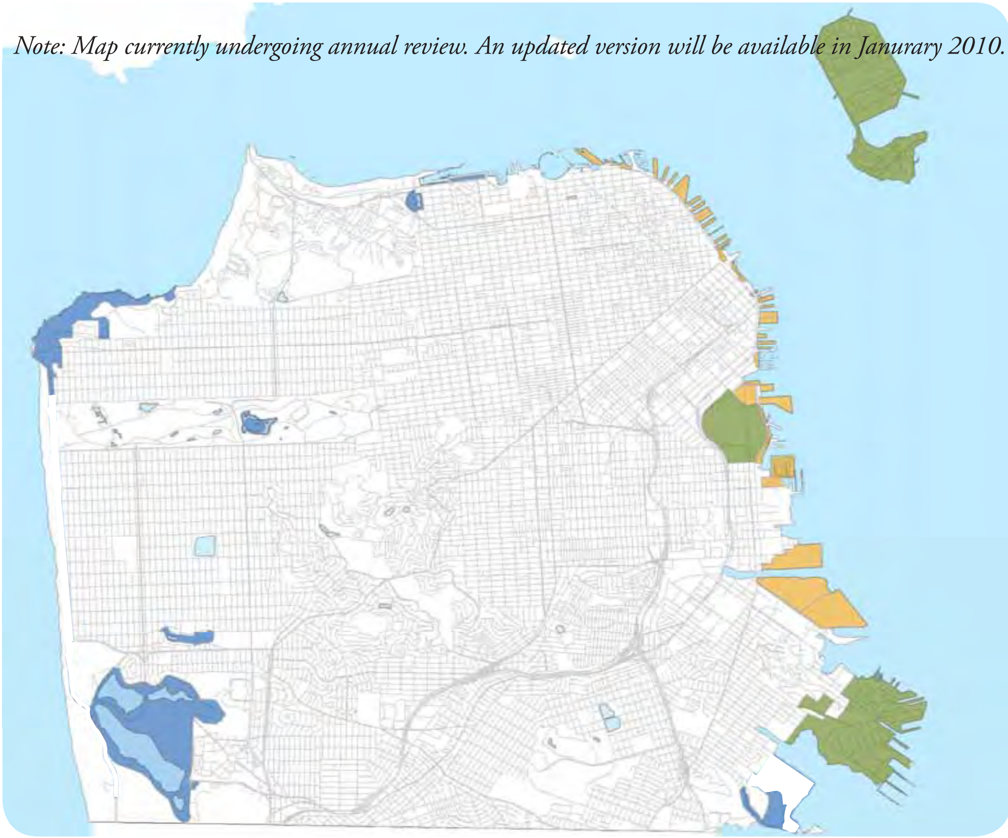
Regulatory Context

The federal Clean Water Act (CWA) establishes the foundation for stormwater regulation across the country. State, regional, and municipal laws and policies under the CWA help to ensure that San Francisco's stormwater requirements are appropriate to the city's geography, climate, and development patterns.

The Clean Water Act

In 1972, Congress passed the Clean Water Act (CWA) to regulate the discharge of pollutants to receiving waters such as oceans, bays, rivers and lakes. Under the CWA, waste discharges from industrial and municipal sources are regulated through the National Pollutant Discharge Elimination System (NPDES) Permit Program. Approximately 90% of San Francisco is served by a **combined sewer system** (see map on page 10) that conveys both sewage and stormwater for treatment to three sewage treatment plants before being discharged to receiving water. Discharges from the treatment plants are subject to the requirements of NPDES permits.

Stormwater runoff, now recognized by the United States Environmental Protection Agency (EPA) as a leading contributor to water quality degradation in the United States, was unregulated until 1987 when section 402(p) was added to the CWA. Section 402(p) established a two-phase plan to regulate polluted stormwater runoff under NPDES. The Phase I permits, finalized in 1990, regulate **municipal separate storm sewer systems (MS4s)** serving populations of 100,000 or more. Stormwater discharges associated with certain types of industrial facilities and construction sites greater than five acres are also



San Francisco Public Utilities Commission
The Port of San Francisco
Redevelopment areas (various owners)

Figure 1. *Separate storm sewer areas and jurisdictions*

Best Management Practices

Stormwater Best Management Practices (BMPs) are measures or programs used to reduce pollution in stormwater runoff. The EPA defines a BMP as a "technique, measure or structural control that is used for a given set of conditions to manage the quantity and improve the quality of stormwater runoff in the most cost-effective manner."

regulated under Phase I. Phase II permits, finalized in 2000, regulate MS4s serving populations of 100,000 or less.

The California State Water Resources Control Board (SWRCB) serves as the implementing agency for NPDES regulations. In 2003, the SWRCB issued the *General Permit for Discharges of Stormwater from Small Municipal Storm Sewer Systems* (General Permit) to regulate small MS4s. San Francisco's MS4 areas cover approximately 10% of the City and serve fewer than 100,000 people. They are therefore subject to Phase II requirements in the General Permit.

The General Permit

To comply with NPDES Phase II regulations, the General Permit requires agencies holding the Phase II NPDES Permit (SFPUC and Port) to develop Stormwater Management Plans (SWMPs) describing the measures that will be implemented to reduce pollution in stormwater runoff in the MS4 areas.

The General Permit requires Permittees to implement four measures for post-construction stormwater management in new and redevelopment projects located in areas served by separate sewers:

1. Develop, implement, and enforce a program to address stormwater runoff from new and redevelopment projects to ensure that controls are in place to prevent or minimize water quality impacts;
2. Develop and implement stormwater management strategies, including a combination of structural and/or non-structural best management practices (BMPs) appropriate for the community;

3. Use an ordinance or other regulatory mechanism to control post-construction runoff from new and redevelopment projects to the extent allowable under the law; and,
4. Ensure the adequate long-term operation and maintenance of BMPs.

Under the General Permit, Permittees have two options for adopting the post-construction stormwater management requirements listed above. The first is to use the minimum design standards listed in Attachment 4 of the Phase II General Permit as a framework for administering post-construction control programs (http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/final_attachment4.pdf).

The second option for compliance is for Permittees to develop a functionally equivalent program that is acceptable to the San Francisco Bay Regional Water Quality Control Board (RWQCB). The Port and the SFPUC have chosen to pursue the latter option by implementing these *Guidelines*, which are largely based on the C.3 Provision of the San Francisco Bay Area Phase I stormwater permits. The C.3 requirements are similar to those in the General Permit, but require more effort on the part of the Permittee to develop a post-construction control program suitable for its climate, geography and development patterns.

Effective January 1, 2010, these *Guidelines* will apply to all projects greater than 5,000 square feet in the City of San Francisco. The *Guidelines* **do not** apply to those projects that have received 1) building permits and/or 2) discretionary approvals by the San Francisco Planning Department, the San Francisco Department of Building

Project Type	Excluded Projects
Commercial, industrial or residential development	*Projects with fewer than 5,000 square feet of developed area that are not part of a larger common plan of development.*
Single family residential development	*Construction of one single family home that is not part of a larger common plan of development and is fewer than 5,000 square feet, with the incorporation of appropriate source control measures, and using landscaping to appropriately treat runoff from impervious surfaces.*
Redevelopment and repair projects	*Interior remodels and routine maintenance and repair, such as roof replacement, exterior painting, utility trenching and repair, pier apron repair and pile replacement, pavement resurfacing, repaving and structural section rehabilitation within the existing footprint.*
Parking lots	*Parking lots of fewer than 5,000 square feet.*

Table 1. *Projects excluded from Stormwater Design Guidelines requirements*

Requirement

All project sites with an area greater than 5,000 square feet must incorporate post-construction stormwater controls that meet the performance measures set forth in these *Guidelines*, including minimizing the sources of stormwater pollutants (see Source Controls, beginning on page 75) and treating a specified flow or volume of stormwater (see Treatment BMPs, beginning on page).

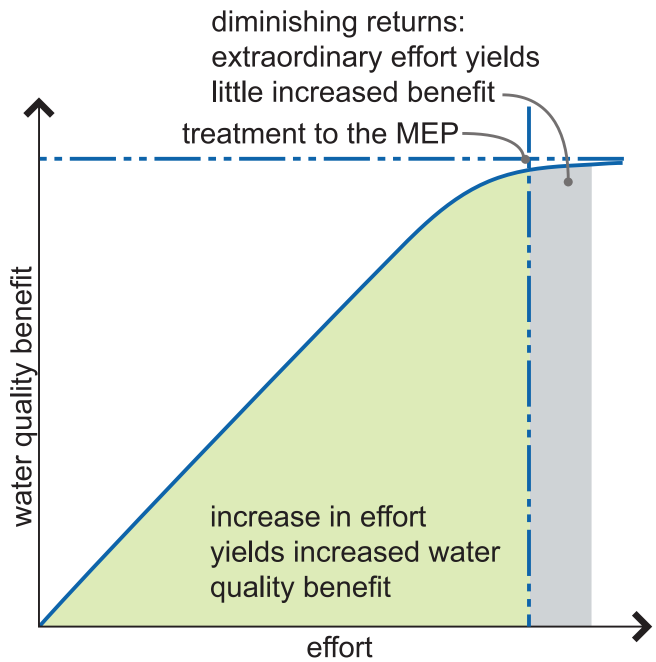


Figure 2. *As the maximum extent practicable (MEP) standard is approached, additional investment in BMPs yields reduced benefit.*

Inspection, the Port of San Francisco Planning Division, or the Port Building Department by January 1, 2010. All new project applications, incomplete project applications, and amendments received thereafter will be subject to these *Guidelines*. Table 1 lists the types of projects that are excluded from the *Guidelines*.

The RWQCB monitors San Francisco's implementation of General Permit requirements. The Port and the SFPUC must submit ongoing reports on their respective development review efforts, the number and type of projects reviewed, and the stormwater control measures included in the projects. To assess the effectiveness of stormwater control measures, the Port and SFPUC must define criteria for compliance. The RWQCB and the EPA require that stormwater control measures be designed to reduce pollution in stormwater runoff to the Maximum Extent Practicable (MEP).

The Maximum Extent Practicable Treatment Standard

MS4 permits require stormwater management strategies to "reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods."

Treatment to the maximum extent practicable (MEP) can be achieved by applying the BMPs that are most effective at treating pollutants in stormwater runoff. The SWRCB has said of the MEP standard that there "must be a serious attempt to comply, and practical solutions may not be lightly rejected." The SWRCB also states that if project applicants implement only a few of the least expensive stormwater BMPs, it is likely that the MEP standard has not been met. If, on the other hand, a project applicant implements all applicable and effective BMPs except those shown to be technically infeasible, or those whose cost would exceed any benefit to be derived, then the project applicant would have achieved treatment to the MEP. As technology and design innovation improve, stormwater BMPs become more effective. The definition of MEP continually evolves with the field to encourage innovation and improved water quality protection. Because of this, some end-of-pipe strategies such as vortex separators, which were considered to meet the MEP standard ten years ago, are no longer accepted as such. Similarly, in cases where just one BMP may have gained project approval in the past, today there are many cases where multiple BMPs will be required in order to achieve treatment to the MEP.

Pollutants of Concern

Because stormwater runs off of diverse sites, it mobilizes many kinds of pollutants. The following list summarizes the main categories of pollutants found in stormwater, their sources, and their environmental consequences.

Gross pollutants mobilized by stormwater include litter, plant debris and floatable materials. Gross pollutants often harbor other pollutants such as heavy metals, pesticides, and bacteria. They also pose their own environmental impacts; they degrade wildlife habitat, water quality, the aesthetic quality of waterways, and are a strangling and choking hazard to wildlife.

Sediment is a common component of stormwater runoff that degrades aquatic habitat and can be detrimental to aquatic life by interfering with photosynthesis, respiration, growth, reproduction, and oxygen exchange. Construction sites, roadways, rooftops, and areas with loose topsoil are major sources of sediment. Sediment is a vehicle for many other pollutants such as trace metals and hydrocarbons. Over half the trace metal load carried in stormwater is associated with sediment. Because of this, sediment removal is a good indicator for reduction of a broader range of pollutants. For the purpose of developing stormwater controls, engineers and designers must consider both coarse and fine ("suspended") sediments.

Oil and grease include a wide range of organic compounds, some of which are derived from animal and vegetable products, others from petroleum products. Sources of oil and grease include leaks and breaks in mechanical systems, spills, restaurant waste, waste oil disposal, and the cleaning and maintenance of vehicles and mechanical equipment.

Nutrients like nitrogen and phosphorous are typically used as fertilizers for parks and golf courses and are often found in stormwater runoff. They can promote excessive and accelerated growth of aquatic vegetation, such as algae, resulting in low dissolved oxygen. Un-ionized ammonia, a form of nitrogen, can be toxic to fish. In San Francisco, nutrients carried in runoff are a significant concern for enclosed freshwater bodies such as Lake Merced, more so than they are for the San Francisco Bay and Pacific Ocean.

Oils and gross pollutants pose a significant threat not only to water quality but also to bay area wildlife.

Stormwater runoff transports trash to local water bodies, where it creates an aesthetic nuisance, harms wildlife, and pollutes receiving waters.

Pesticides (herbicides, fungicides, rodenticides, and insecticides) are often detected in stormwater at toxic levels, even when they have been applied in accordance with label instructions. As pesticide use has increased, so have concerns about their adverse effects on the environment and human health. Accumulation of these compounds in simple aquatic organisms, such as plankton, provides an avenue for biomagnification through the food web, potentially resulting in elevated levels of toxins in organisms that feed on them, such as fish and birds.

Organics can be found in stormwater in low concentrations. They include synthetic compounds associated with adhesives, cleaners, sealants, and solvents that are widely used and are often stored and disposed of improperly.

Bacteria can enter stormwater via sources such as animal excrement, decay of organic materials, and combined sewer discharges. High levels of bacteria in stormwater runoff can lead to beach closures and fishing advisories.

Dissolved metals including lead, zinc, cadmium, copper, chromium, and nickel are mobilized by stormwater when it runs off of surfaces such as galvanized metal, paint, automobiles, and preserved wood, whose surfaces corrode, flake, dissolve, decay, or leach. Metals are toxic to aquatic organisms, can bioaccumulate in fish and other animals, and have the potential to contaminate drinking water supplies.

PCBs and Mercury are legacy contaminants that are found in low concentrations in soils associated with historically industrialized areas. San Francisco Bay is listed by the USEPA as an "impaired water body" for these contaminants. Control of PCBs and mercury will be implemented through design measures that limit the mobilization of these pollutants in contaminated soils.

Synergy with other Regulations and Initiatives

The *Guidelines* are designed to work with San Francisco's existing and emerging regulatory programs and policies. For example, development along the San Francisco waterfront is subject to policies adopted by the Port of San Francisco and the San Francisco Bay Conservation and Development Commission (BCDC); the *Guidelines* are consistent with these policies. Federal, state, and local regulations most relevant to the *Guidelines* are shown in Table 2 at the end of this section.

There are three initiatives underway in San Francisco that directly affect stormwater management in the City and that propose policies parallel to those presented in these *Guidelines*: the *Sewer System Master Plan*, the *Better Streets Plan,* and the Green Building Ordinance. These mutually-supportive efforts are consistent with the stormwater management goals and requirements put forward here.

The SFPUC's *Sewer System Master Plan* (Master Plan) is a comprehensive plan that charts a long-term vision and strategy for the management of the City's wastewater and stormwater. The Master Plan is intended to maximize system reliability and flexibility and to lay a path for capital investment and management of the City's infrastructure for the next 30 years. The Master Plan presents Low Impact Design (LID) as a major tool for addressing the City's drainage management needs. LID is an innovative stormwater management approach that is modeled after nature: it advocates managing runoff at its source using decentralized micro-scale facilities. The Master Plan contains protocols for using LID in ongoing repair and replacement projects as a part of its overhaul of drainage infrastructure.

The *Better Streets Plan* is a collaborative effort between the SFPUC, the Planning Department, the Public Works Department, the City's transit agencies, and other relevant agencies, to create a unified set of standards, guidelines, and implementation strategies that will govern how the City designs, builds, and maintains the public rights-of-way. The goal of the *Better Streets Plan* is to update applicable standards to improve pedestrian safety, enhance landscaping, and identify innovative methods for reducing stormwater runoff from the streets and sidewalks to create a more attractive and sustainable public realm in San Francisco.

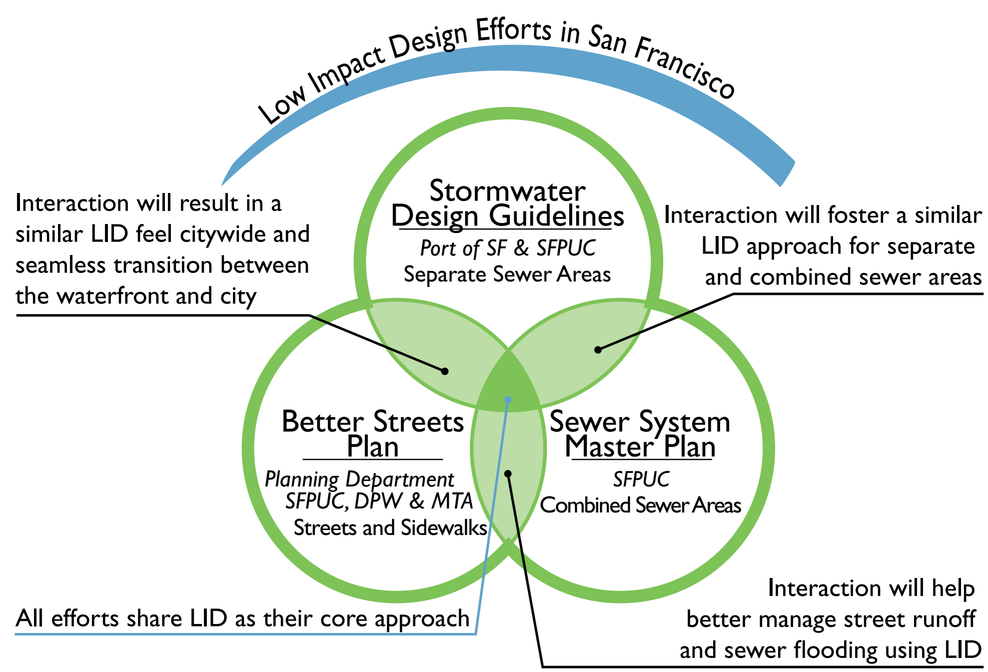


Figure 3. *LID is the common thread linking a number of major planning efforts currently underway in San Francisco.*

A cistern at Mills College in Oakland, CA is a stormwater BMP and a design element. Photo: Ingrid Severson

The Green Building Ordinance is a third initiative that will work in tandem with the *Guidelines*. The ordinance expands the scope of green building standards to apply not only to public buildings but also to private development and redevelopment projects in San Francisco. The task force was charged with creating building requirements that would foster environmentally sensitive design and sustainability in new development projects. As a part of this effort, SFPUC and Port staff developed stormwater management performance standards for new and redevelopment projects over 5,000 square feet. The Ordinance references the *Guidelines* and provides the regulatory authority to implement stormwater management requirements in combined sewer areas.

San Francisco Building Code Requirements

Projects that are implementing the *Guidelines* will also be subject to review by the San Francisco Department of Building Inspection (DBI) or the Port Building Department. Both DBI and the Port administer building codes that include provisions for managing drainage for new construction. Section 306.2 of the San Francisco Plumbing Code and Section 1506.1 of the San Francisco Building Code were amended on June 28, 2005 to allow roofs and other building areas to drain to locations other than the combined sewer. The 2005 amendments anticipated LID strategies such as downspout disconnection and rainwater harvesting, which are described in the *Guidelines*.

They now read as follows:

- **Plumbing Code, Section 306.2:** Roofs, inner courts, vent shafts, light well, or similar areas having rainwater drains shall discharge directly into a building drain or sewer, or to an approved alternate location based on approved geotechnical and engineering designs.
- **Building Code, Section 1506.1:** All storm or casual water from roof areas which total more than 200 square feet shall drain or be conveyed directly to the building drain or storm drain or to an approved alternate location based on approved geo-technical and engineering design. Such drainage shall not be directed to flow onto adjacent property or over public sidewalks. Building projections not exceeding 12 inches in width are exempt from drainage requirements without area limitations.

In the amended codes listed above, "approved alternate location" is the key phrase that allows for downspout disconnection and encompasses all properly designed stormwater management facilities, including rain barrels or cisterns.

In 2008, the SFPUC, DBI, and the Department of Public Health (DPH) signed a Memorandum of Understanding (MOU) for Rainwater Harvesting Systems. The MOU records a technology-based agreement between the three agencies, which concludes that project applicants can safely harvest rainwater and use it for non-potable applications such as toilet flushing, irrigation, and vehicle washing without treating it to potable standards. More detailed specifications and permitting requirements for rainwater harvesting can be found on the "Rainwater Harvesting" fact sheet in Appendix A.

An interior roof drain discharges to a vegetated swale in Emeryville, CA. This properly designed and permitted stormwater facility is an example of an "approved alternate location" for stormwater discharge.

Regulatory Context

Name/Title	Administered By	Summary
FEDERAL REQUIREMENTS		
National Pollutant Discharge Elimination System (NPDES) Phase II General Permit	California Regional Water Quality Control Board (RWQCB)	Requires municipalities to develop programs to control runoff pollution from both new and redevelopment projects. The *Guidelines* provide standards and guidance to implement the requirements of the Phase II Municipal General Permit.
NPDES Industrial Permits	RWQCB	Requires facilities subject to the requirements of the Industrial Permit to implement BMPs to prevent or reduce pollution in stormwater runoff. Newly constructed industrial facilities over 5,000 square feet must implement post-construction controls per requirements of the *Guidelines* .
Federal Clean Water Act 401 Certification	RWQCB	The RWQCB must certify that construction projects taking place in or over federal and state water bodies do not negatively impact water quality. The *Guidelines* will help project proponents comply with post-construction stormwater control requirements often included as conditions of 401 certification.
303(d) Impaired Water Bodies - Clean Water Act - Total Maximum Daily Load (TMDL) Program	RWQCB	San Francisco Bay and other water bodies are impaired by pollutants such as mercury and PCBs. TMDLs require pollutant sources to reduce levels of pollutant loading associated with water quality impairment. Stormwater treatment control selection should consider TMDL pollutant removal.
Secretary of the Interior's Standards for the Treatment of Historic Properties	National Park Service/California State Office of Historic Preservation	In order to qualify for Federal Rehabilitation Tax Credits, construction within designated Historic Districts must avoid or minimize changes that would adversely affect an historic resource's character defining features. Stormwater management measures selected for a given project must comply with these standards as applicable.
Americans with Disabilities Act (ADA) California Code of Regulations Title 24	San Francisco Department of Building Inspection (DBI) San Francisco Department of Public Works (SFDPW)	The ADA establishes requirements for accessibility to places of public accommodation and commercial facilities by individuals with disabilities. Stormwater management measures described in the *Guidelines* must accommodate ADA requirements, including curb ramp standards promulgated through SFDPW Order No. 175,387. Treatment controls located in the public right-of-way must comply with ADA architectural guidelines.
STATE REQUIREMENTS		
California Environmental Quality Act (CEQA)	San Francisco Planning Department	A process to review new and redevelopment projects for potential impacts to the environment and, as necessary, propose mitigation measures to substantially lessen the project's significant environmental effects. The *Guidelines* include measures that will substantially reduce water quality and hydrological impacts associated with new and redevelopment projects.
REGIONAL REQUIREMENTS		
San Francisco Bay Basin Plan	RWQCB	Designates the beneficial uses and water quality objectives designed to protect those beneficial uses for state waters in the San Francisco Bay Region. Stormwater management measures described in the Guidelines promote restoration and maintenance of beneficial uses for waters in and around San Francisco.
San Francisco Bay Sea Port Plan and San Francisco Special Area Plan Maritime Commerce, Land Use and Public Access	San Francisco Bay Conservation and Development Commission (BCDC)	Policies that guide BCDC regulation within 100 feet of the shoreline edge, including most of the Port's piers. Policies are geared to limiting Bay fill, protecting water quality, and encouraging maximum feasible public access that does not impact commercial maritime activities. Wherever practical projects should retain or restore native vegetation buffer zones, rather than hardscape shoreline development. Applicable to waterfront development within 100' of the shoreline. Stormwater management measures described in the *Guidelines* are consistent with BCDC policy goals.

Table 2. *Relevant jurisdictions, codes, and ordinances*

Name/Title	Administered By	Summary
SAN FRANCISCO REQUIREMENTS		
San Francisco Public Works Code	San Francisco Department of Public Works - Bureau of Streets and Mapping (SFDPW-BSM)	SFDPW-BSM permits and approves all work in the public right-of-way, streets and sidewalks (including paper streets). Permits tree-lawns and planting strips. Permits sidewalk, curb and gutter, pavement, or any other facilities in the public right-of-way improvements. Stormwater management measures described in the *Guidelines* must satisfy Public Works Code requirements for design and construction within the public right-of-way.
San Francisco Public Works Code	San Francisco Department of Public Works - Bureau of Hydraulics	San Francisco Department of Public Works - Bureau of Engineering provides technical review on behalf on the San Francisco Public Utilities Commission (SFPUC), and designs and contracts sewer improvements. Stormwater management measures described in the Guidelines must comply with engineering standards administered by San Francisco Department of Public Works - Bureau of Hydraulics.
San Francisco Better Streets Master Plan	Mayor's Office of Greening, San Francisco Planning Department, DPW, Municipal Transportation Agency, and the SFPUC	Guides design and construction within the public right-of -way and streets. Stormwater management measures proposed in the *Guidelines* are consistent with those considered in the *Better Streets Plan* . For design standards applicable to stormwater, the *Guidelines* will take precedence.
Waterfront Land Use Plan - Waterfront Design and Access Element	Port of San Francisco	Guides the physical form of the waterfront revitalization envisioned in the *Port Waterfront Land Use Plan;* provides guidance on public access and waterfront accessibility, planting (both the presence and type of vegetation), protection and preservation of historic resources; and defines distinct geographic areas wherein specific design criteria apply.
Recycled Water Policy	San Francisco Department of Public Health (DPH)	Recycled water must be treated to Title 22 standards, which differ according to the proposed use of the water.
Rainwater Harvesting Policy	Department of Building Inspection (DBI), SFPUC, and the DPH	Rain barrels less than 100 gallons may be installed without a permit if they are used for irrigation and not connected to indoor or outdoor plumbing. Permits must be obtained from DBI for rainwater harvesting systems over 100 gallons that are connected to indoor or outdoor plumbing and are used for irrigation or toilet flushing. Rainwater harvesting systems for indoor uses other than toilet flushing must obtain permits from DBI and DPH.
Greywater Policy	DBI and the DPH	Untreated greywater may be used for subsurface irrigation. For all other uses, greywater must be treated to Title 22 standards, which differ according to the proposed use of the water.
Plumbing and Connections	DBI	The Plumbing Inspection Division (PID) of DBI is responsible for assuring, through permitting and inspection, the proper functioning for installations of drainage, water, gas, and other mechanical systems covered in the Plumbing and Mechanical Codes. These inspections are carried out in buildings that are newly constructed, remodeled, or repaired. Stormwater management measures must be implemented in a manner that satisfies DBI requirements.
San Francisco Planning Code, Article 10	San Francisco Planning Department, Landmarks Preservation Advisory Board and the City Planning Commission	Exterior alterations to San Francisco properties that are designated local landmarks will be reviewed for consistency with requirements set forth in the Secretary of the Interior's Standards for the Treatment of Historic Properties. Stormwater management measures described in the *Guidelines* must comply with Article 10 and the Secretary Standards.
San Francisco Health Code, Article 22A	DPH	The Maher Ordinance regulates construction and post-construction activities for properties constructed on fill materials adjacent to the historic Bay shoreline. Much of the waterfront and other areas in San Francisco are subject to the Maher Ordinance. Soil and groundwater in areas of the San Francisco Waterfront subject to the Maher Ordinance may contain pollutants that preclude the use of stormwater treatment controls using infiltration.

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Boardwalks provide access across waterfront bioretention facilities in Seattle, WA.

San Francisco Context

Before San Francisco developed into the thriving city it is today, it consisted of a diverse range of habitats including oak woodlands, native grasslands, riparian areas, wetlands, and sand dunes. Streams and lakes conveyed and captured rainwater. Wetlands lined the Bay and functioned as natural filtering systems and as buffers from major storms. Rainwater infiltrated into the soil, replenishing groundwater supplies and contributing to stream base flow.

The Urban Watershed

Watershed function

Today, impervious surfaces such as buildings, streets, and parking lots have covered most of the City, preventing rainfall infiltration. Over time, creeks were buried and connected to the sewers, and wetlands were filled. Instead of percolating into soils, runoff now travels over impervious surfaces, mobilizes pollutants like oil and debris, and washes them into the sewer system or receiving water bodies—creeks, lakes, San Francisco Bay, and the Pacific Ocean. During heavy rain events, stormwater runoff can contribute to localized flooding, combined sewer discharges, and the degradation of surface water quality. Moreover, the decrease in infiltration resulting from paved surfaces contributes to groundwater depletion. LID can help to mitigate these adverse effects. With every project contributing incremental improvements, San Francisco can work toward restoring natural hydrologic function in its urban watersheds.

Figure 4. *San Francisco's topography divides the Westside Basins from the Eastside Basins.*

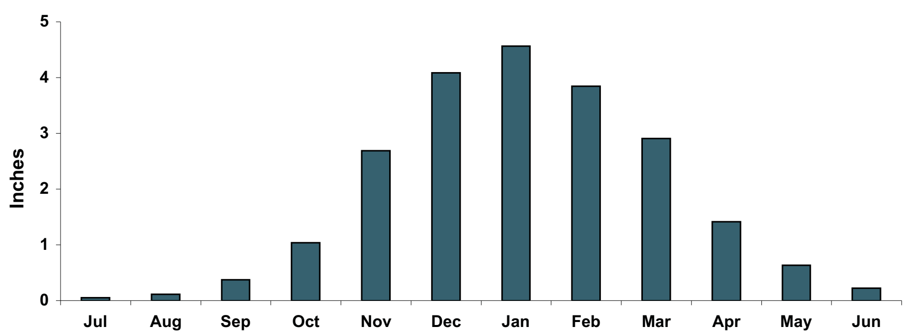


Figure 5. *Average monthly rainfall for San Francisco.*
Source: National Weather Service Gage, Federal Office Building, July 1907 to June 1978

Environment

San Francisco is roughly divided into two major drainages: the eastern and western basins (see Figure 4). These are comprised of eight major sub-basins containing diverse urban neighborhoods with a range of residential, commercial, and industrial land uses, open spaces, and natural areas. Each sub-basin is underlain with unique topography, hydrology, soils, vegetation and water resources that create opportunities and challenges for drainage and stormwater management.

San Francisco has a temperate Mediterranean climate, with dry summers and rainy winters (see Figure 5). In a typical year, San Francisco receives less than an inch total of rain from May through September and an average of 20 inches of rain between November and March. Rainfall is not distributed evenly across the City. It ranges from approximately 22 inches in the south, to 20 inches along the western edge and northeastern quadrant, to 18 inches in the extreme northeast. Like all Mediterranean climates, San Francisco experiences periods of drought punctuated by intense winter rains, often resulting in water scarcity in the summer and flooding in the winters.

The potential for stormwater to infiltrate varies dramatically by location. Infiltration may be limited in areas that have steep slopes, shallow depth to bedrock or to the water table, clay soils, contaminated soils, or are built on bay mud and fill over former creeks and wetlands. However, in many areas of the City, particularly in the western basins, soils are generally sandy and have the potential to provide excellent infiltration rates and pollution removal. Where infiltration is limited, a wide array of stormwater management strategies that do not depend upon infiltration can be implemented.

San Francisco's Stormwater Infrastructure

While the creation of these *Guidelines* is driven primarily by regulatory requirements for the City's separate sewer areas, the majority of San Francisco (90%) is served by a combined sewer system (see Figure 6). The stormwater management goals for areas served by separate storm sewers are different from those for areas served by the combined sewer system. Despite this, many of the fundamental design concepts for stormwater management apply to both areas, and as such, the *Guidelines* can be used as a tool in both the separate and combined sewer areas of San Francisco. Using landscape-based stormwater infrastructure will enhance and diversify the functions of both the separate and combined systems.

Approximately 10% of the City is served by a **separate storm sewer system** or is lacking stormwater infrastructure; in most of these areas stormwater flows directly to receiving waters without treatment. In the separate storm sewer areas, the primary reason for implementing post-construction controls is to improve stormwater quality before it reaches a receiving water body. These controls are aimed at removing specific pollutants of concern and treating what is known as the "first flush". The first flush is the dirtiest runoff, usually generated during the beginning of a rain event; it mobilizes the majority of the pollutants and debris that have accumulated on impervious surfaces since the last rain.

A **combined sewer system** conveys wastewater and stormwater in the same set of pipes. The combined flows receive treatment at wastewater treatment plants before being discharged to the Bay and Ocean. Conventional separate storm sewer systems provide no stormwater treatment, while combined sewer systems treat most urban runoff to secondary standards, including the first flush and most additional stormwater runoff. However, when the capacity of the system is exceeded by large storm events, localized flooding and combined sewer discharges (CSDs) can occur. In the event of a CSD, the system discharges a mixture of partially treated sanitary effluent and stormwater to receiving water bodies. While these discharges are dilute (typically consisting of roughly six percent sewage and 94 percent stormwater), they can cause public health concerns and lead to beach or Bay access closures.

The primary reason for implementing LID measures in a combined sewer system is to reduce and delay the volumes and peak flows of stormwater reaching the sewer system. Volume reductions and peak flow desynchronization can help reduce the number of CSDs, reduce flooding, and protect water quality. Post-construction controls in the combined system can also improve the capacity and efficiency of the City's treatment facilities.

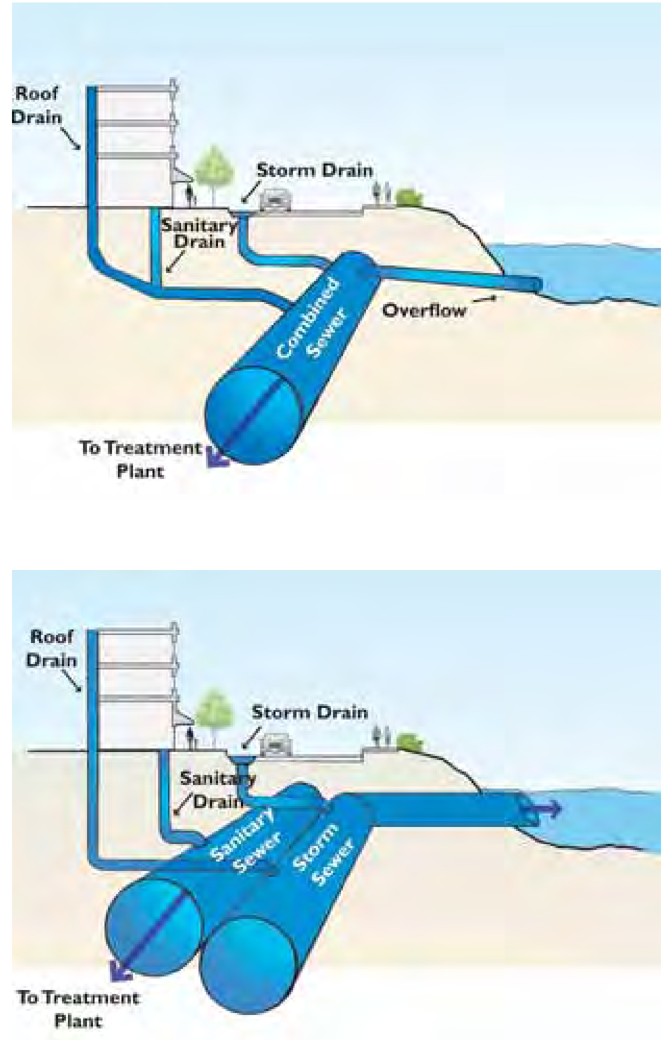


Figure 6. *Combined sewer systems (top) serve 90% of San Francisco. Separate sewer systems (bottom) serve 10%. Image: modified from King County Wastewater Management Division*

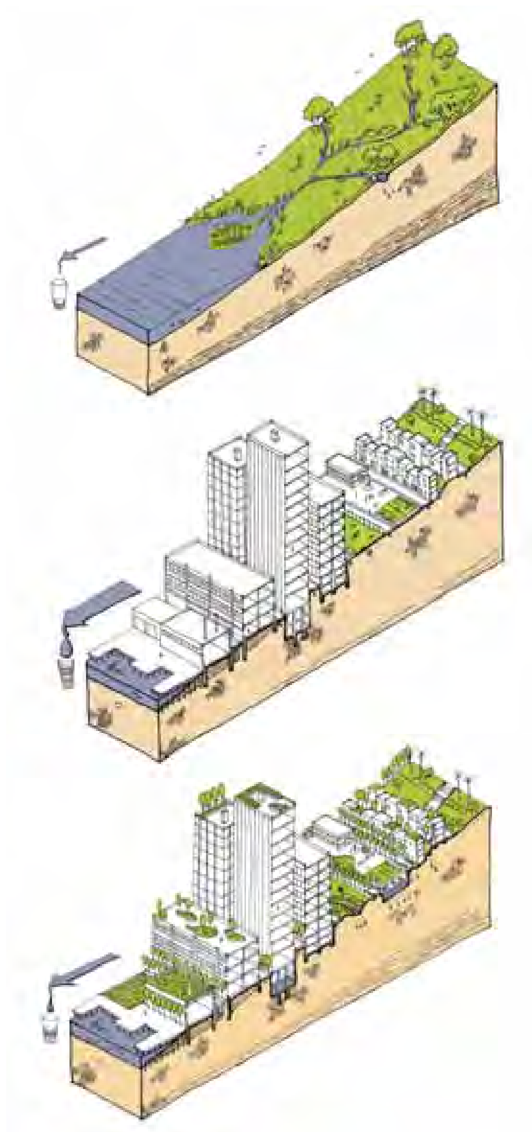


Figure 7. Low Impact Design seeks to reduce runoff and restore hydrologic function through effective site planning, increased permeability, and landscape-based BMPs.

Managing Stormwater in San Francisco

Low Impact Design

To lessen the impacts of urbanization on stormwater quality and peak flows, cities around the world are taking advantage of Low Impact Design (LID), which promotes the use of ecological and landscaped-based systems to manage stormwater. LID aims to mimic pre-development drainage patterns and hydrologic processes by increasing retention, detention, infiltration, and treatment of stormwater runoff at its source. This decentralized approach not only treats stormwater at its source and facilitates the best and highest use of stormwater; it also allows greater adaptability to changing environmental conditions than do centralized conveyance systems.

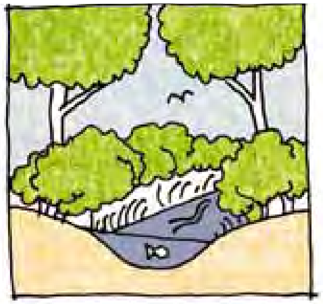
LID strategies direct runoff to BMPs such as flow-through planters, swales and rain gardens. These BMPs capture, filter, and slow stormwater runoff, thereby improving stormwater quality and reducing the quantity of runoff. Strategic placement of BMPs helps to ameliorate the negative water quality and ecosystem impacts of impervious surfaces. LID also emphasizes the integration of stormwater management with urban planning and design and promotes a comprehensive, watershed-based approach to stormwater management.

Figure 7 shows how LID can be incorporated into an urban setting like San Francisco without compromising its character and livability. Vegetated roofs and landscaped areas minimize the amount of stormwater runoff. BMPs are incorporated into the fabric of the city, doubling as recreational areas, wildlife habitat, and landscaping. These measures may increase initial capital costs (approximately 3%), but they bring multiple benefits to the site and the city: not only do they protect water quality and provide open space, they may also decrease downstream stormwater infrastructure costs because they lessen stormwater flows and volumes.

The most effective application of LID is a comprehensive approach that includes *site design*, *source controls*, and *treatment controls*. Careful site design can minimize the impacts of stormwater runoff from the outset. The more that stormwater management is integrated into the design process, the easier it is to create a successful and multi-purpose stormwater management strategy for a given site. The following pages list a set of goals to guide site design.

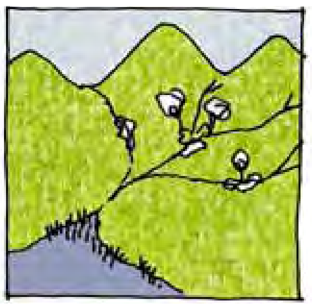
Mint Plaza, San Francisco, CA is an example of how LID can be integrated into an ultra-urban setting. The design includes rain gardens, permeable paving, and a subsurface infiltration gallery.

Figure 8. Site Design Goals



1. Do no harm: preserve and protect existing waterways, wetlands, and vegetation.

Creeks and wetlands are natural drainage features that can define the character and aesthetic value of a site. Moreover, they are already designed to convey and treat stormwater. Trees and ground cover act as natural stormwater management measures. They capture rainwater in their foliage, slow its progress through the landscape, and facilitate its infiltration into the soil.



2. Preserve natural drainage patterns and topography and use them to inform design.

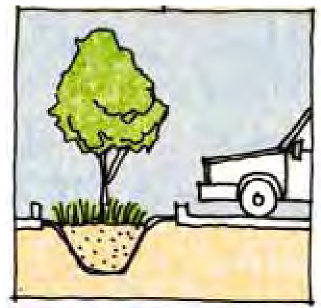
Existing topography and drainage networks can be used as a framework around which to organize development. Changing the topography of a site through grading significantly increases the chances of diminishing water quality by delivering sediment to receiving waters; it also increases project costs.

3. Think of stormwater as a resource, not a waste product.

Stormwater has traditionally been viewed as a nuisance to be eliminated. It is actually an untapped resource that can offset potable water use for irrigation, toilet flushing, cooling towers, and many other applications. It also offers opportunities to create interesting and site-specific designs using water features, rain-irrigated landscapes, and educational elements.

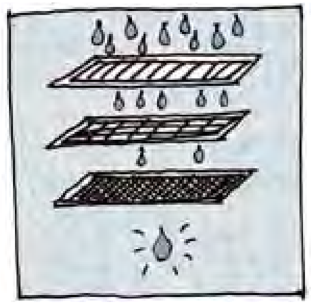
4. Minimize and disconnect impervious surfaces.

Minimizing and disconnecting impervious surfaces allows designers to treat relatively small volumes of runoff from multiple surfaces on a site, rather than treating relatively large volumes of stormwater that have mobilized diverse pollutants from impervious surfaces across an entire site. Disconnecting impervious surfaces and directing runoff to BMPs can be thought of as creating an obstacle course for stormwater; it increases the time needed for runoff to travel from its source to its discharge point, thereby increasing opportunities for treatment, flow reduction, and volume reduction.



5. Treat stormwater at its source.

Treating stormwater pollutants at their source can reduce the need to treat multiple pollutants or higher pollutant loads further downstream in the drainage area. Treating at the source can result in smaller, less costly and more effective stormwater treatment facilities.

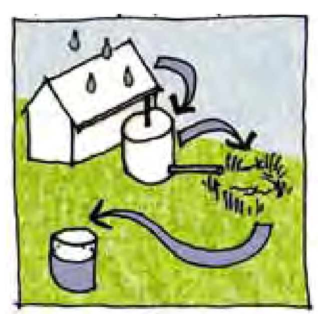


6. Use treatment trains to maximize pollutant removal.

In most scenarios, treatment to the MEP cannot always be achieved with a single BMP. In most cases, a series of linked BMPs called a treatment train must be used to maximize pollutant removal. Like a series of ever-finer sieves, treatment trains clean stormwater by running it through a series of BMPs, each designed to remove specific pollutants, from large pieces of trash, to suspended solids, to dissolved pollutants.

7. Design the flow path of stormwater on a site all the way from first contact to discharge point.

It is important to delineate the path of travel of stormwater from its first surface contact (where it changes from rain to stormwater runoff) to its final discharge point after treatment. All BMPs must have an approved overflow discharge location for storm flows that exceed the design criteria and in case of clogging.



The Ekostaden residential development in Malmo, Sweden, channels all stormwater runoff through BMP treatment features such as bioswales, ponds, and wetlands as shown here.
Photo: Brooke Ray Smith

During the site design process, designers should identify potential sources of stormwater pollution and select appropriate source controls to minimize their impacts. Source controls are stormwater management measures that prevent pollutants from entering stormwater runoff. Source controls can be design measures, such as enclosing trash areas to prevent trash from contacting stormwater; materials choices, such as using non-toxic roofing materials to prevent runoff from entraining pollutants from roof contact; and operational procedures, such as sweeping streets. See page 81 of the *Guidelines* for a description of how to select and locate source controls.

Site design strategies and source control measures minimize the quantity and improve the quality of stormwater runoff from a site. However, it is impossible to eliminate all surfaces that will contribute runoff. Treatment controls must therefore be implemented to accommodate the remaining runoff from the site. Treatment controls are permanent stormwater facilities such as vegetated swales or flow-through planters that are designed to receive and treat runoff from the site. Treatment control BMPs are typically designed to accomplish one or more of the following five stormwater treatment strategies: infiltration, detention, biofiltration, harvesting or retention, or bioretention. Each of these treatment strategies is described in Appendix A. Infiltration is typically the easiest and most cost-effective strategy for managing stormwater but, in areas where this is not feasible, designers can use a combination of the other four strategies. See page 83 of the *Guidelines* for a description of how to select, locate, and size treatment controls.

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Multi-Purpose Design

Low Impact Design can be integrated into the site design process in a way that protects water quality, contributes to the quality of the site design, and meets the stormwater performance measures required by the Port and SFPUC.

LID is the multi-purpose integration of infrastructure, architecture, and landscape and can be a catalyst for design innovation in all three disciplines. LID can integrate water quality protection with improvements to the public realm, create and enhance urban wildlife habitat, promote responsible use of water, and advance environmental education and watershed stewardship.

Traditional urban design goals can also be achieved through the implementation of stormwater BMPs. Stormwater facilities can enhance the aesthetics of the built environment, increase pedestrian safety, calm traffic, make streets and public spaces greener, and provide structure, texture, and identity to the City's streets and other public spaces.

Stormwater BMPs bring designers a diverse palette of paving surfaces, vegetation, and drainage strategies, and also a new purpose that can inform design: to improve water quality and restore ecological function.

Open space is a valuable amenity in San Francisco, now the second densest city in the nation. LID measures can double as **civic spaces**, **open spaces and recreational areas**: a constructed wetland filters stormwater and could be the center of a neighborhood nature

Rain gardens and a creek daylighting project are the centerpieces of open space adjacent to the Headwaters development in Portland, OR.

A community in Germany integrates LID into the parking.

area; a vegetated roof that reduces stormwater discharge can also be a gathering area. At Potsdamer Platz, Berlin, Germany, stormwater management strategies include rainwater harvesting for non-potable uses such as toilet flushing and fire safety, vegetated treatment modules, and water features. Stormwater management forms the centerpiece of this major civic space.

LID can also contribute to San Francisco's **urban ecosystem** by enhancing existing wildlife habitats and creating new ones. San Francisco's trees are concentrated in its parks, not on its streets; the city has roughly 40% fewer street trees per mile than the national average and many of its tree lawns and tree wells have been paved over. Expanding the City's urban forest with careful attention to species selection would simultaneously address stormwater issues, increase wildlife habitat, improve air quality, and create a network of green corridors that would contribute to the aesthetics and health of the City's neighborhoods. Habitat can also be created by implementing stormwater BMPs on the roofs and walls of buildings. In London, England, and Basel, Switzerland, vegetated roofs are being used to provide patches of foraging, breeding, and nesting habitat for endangered wildlife. See Appendix D for a vegetation palette listing climate appropriate plants and their habitat value.

Integrating LID into the **streetscape** yields a more attractive pedestrian realm through the inclusion of vegetated curb extensions, sidewalk planters, street trees, pervious surfaces, and other stormwater BMPs that add attractive, pedestrian-scale details. These elements can simultaneously achieve stormwater management goals and improve streets for pedestrians and local residents by encouraging walking, reducing noise, and calming traffic. They can improve neighborhood aesthetics, safety, quality of life, and even property values. In Vancouver, B.C., Canada, a stormwater management project on Crown Street eliminated curbs, added clustered parking, and designed infiltration areas underneath the parking. The narrow street and clustered parking allows more space to be dedicated to biofiltration areas and plantings, which create a lush and pleasant streetscape.

Stormwater is also a valuable **water resource**. Using stormwater on-site rather than releasing it downstream decreases demand for potable water and can protect receiving waters by reducing runoff rates, volumes, and pollutant loads. Rain barrels and cisterns collect stormwater and store it for later use in irrigation and toilet flushing, uses that unnecessarily burden potable water supplies. Stormwater can even contribute to future potable water supplies, by recharging underground aquifers. In Cambria, California, a two-million gallon cistern beneath an athletic field harvests rainwater from the Cambria

Elementary School site. The water is sufficient for year-round irrigation of the multiple athletic fields.

LID can also be a useful tool for **environmental education** when it is integrated into school curricula, public outreach, or interpretive signs. LID concepts can be presented at many different levels of complexity, from an introduction to watersheds to an explanation of the hydrologic cycle and environmental stewardship. LID concepts touch upon numerous disciplines, including biology, ecology, watershed planning, engineering, design, and resource management. The Eco-Center at Heron's Head Park in the Bayview-Hunters Point neighborhood is an environmental education center for local students of all ages. Educational programs at the Eco-Center focus on habitat conservation and community stewardship. A collaboration between Literacy for Environmental Justice, the Port of San Francisco, and the San Francisco Department of the Environment, the Eco-Center includes a vegetated roof, rainwater harvesting, photovoltaic panels, solar hot water generation, native planting, and other LID features. At the time of writing these *Guidelines*, this project was under construction.

Lastly, LID can help the design and development community achieve **environmental performance measures**, which aim to minimize the environmental impacts of development and provide high quality, healthy environments. In San Francisco, both Leadership in Energy and Environmental Design (LEED®), a green building rating system developed by the U.S. Green Building Council, and the GreenPoint Rated system, a rating system developed by the non-profit Build It Green, are being used to assess the environmental quality of site and building design. In both systems, stormwater management facilities can earn points toward certification.

Environmental Justice

Over the past decade, increased attention has been given to the disproportionate impact of environmental pollution on socio-economically disadvantaged communities. The USEPA defines environmental justice as "the fair treatment of people of all races, cultures and income, regarding the development of environmental laws, regulations and policies." This issue is of concern in many areas of San Francisco, and in particular the Bayview-Hunters Point neighborhood, former home to Hunters Point Shipyard, the only federal Superfund site in San Francisco.

The Bayview-Hunters Point neighborhood contains over 100 brownfield sites. The residents of the primarily African-American neighborhood have borne the environmental and health impacts of these brownfield sites. The *Guidelines* proposes LID measures that can effectively manage stormwater runoff at the Shipyard and other areas of Bayview-Hunters Point, while at the same time improving the quality and safety of neighborhoods by providing attractive landscape features, traffic calming measures, and a safer pedestrian realm.

A vegetated roof and other LID features at the Eco-Center at Heron's Head Park help illustrate sustainable design practices to students in San Francisco's Bayview-Hunters Point neighborhood.

LEED Category	Credits		Points
Sustainable Sites	SS6.1	Stormwater quantity control	1
	SS6.2	Stormwater quality control	1
	SS5.1	Protect or restore habitat	1
	SS5.2	Maximize open space	1
	SS7.1	Urban heat island effect - non-roof	1
	SS7.2	Urban heat island effect – roof	1
Water Efficiency	WE1.1	Water efficient landscaping - reduce by 50%	1
	WE1.2	Water efficient landscaping - no potable water use or no irrigation	1
	WE2	Innovative wastewater technologies	1
	WE3.1	Water use reduction - 20% reduction	1
	WE3.1	Water use reduction - 30% reduction	1
		Total stormwater-related credits	**11**

Table 3. *LEED® credits related to stormwater in LEED-NC® Version 2.2.*

In Southern California, Santa Monica's Main Library used an innovative stormwater management design to help achieve its water-saving goals and receive a LEED Gold rating: a 225,000-gallon cistern under the building stores stormwater for irrigation of both landscaping at the library and adjacent street plantings.

Many of the LEED certification systems include credits that explicitly address stormwater. In LEED for New Construction, these credits are in the Sustainable Sites category (see Table 3). Implementing LID measures such as habitat enhancement, reduction of impervious surfaces,

The Academy of Sciences in Golden Gate Park is targeting LEED Platinum certification and includes a 2.5 acre vegetated roof.
Photo: Rana Creek - Living Architecture

vegetated roofs, and rainwater harvesting can also help project applicants earn credits in other areas.

The GreenPoint Rated system includes many measures that are related to stormwater, although it does not propose any quantitative performance measures for stormwater management (Table 4). Stormwater-related points can be earned in the areas of site design, landscaping, exterior finishing, and innovation in the water category. To be considered GreenPoint Rated, a home must achieve 50 total points, with a minimum number of points in each of the five environmental categories (Community, Energy Efficiency, Indoor Air Quality, Water Conservation and Resource Conservation). Single family projects require at least eight points earned in the water category, while multifamily projects require at least three points earned in the water category. The GreenPoint Rating system specifically encourages rainwater harvesting and water efficient landscaping.

GreenPoint Checklist	Feature		Points (Category)
Multifamily	A.3.a.	Protect soil & existing plants & trees	1 (Community)
	A.7.c.	Specify drought-tolerant California natives, Mediterranean or other appropriate species	1 (Water)
	A.7.d.i.	Mulch all planting beds to a depth of 2 inches or greater as per local ordinance	1 (Water)
	A.7.d.ii.	Amend with 1 inch of compost or as per soil analysis to reach 3.5 % soil organic matter	1 (Water)
	A.7.e.i.	Specify smart (weather-based) irrigation controllers	1 (Water)
	A.7.e.ii.	Specify drip, bubblers, or low-flow sprinklers for all non-turf landscape areas	1 (Water)
	A.7.f.	Group plants by water needs (hydrozones)	1 (Water)
	A.9.	Cool site through permeable paving (minimum of 30% of site)	1 (Community)
	C.12.a.	A portion of the low-slope roof area is covered by a vegetated or "green" roof (25% or greater)	1(Community) 1(Water)
	D.14.b.	Use captured rainwater for landscape irrigation or to flush 5% of toilets and/or urinals	4 (Water)
	F.2.a.	Provide O & M manual to building maintenance staff	1 (Energy)
	F.2.b.	Provide O & M manual to occupants	1 (Energy) 1(Water)
		Total points:	**17**
Single Family	A.1.a.	Protect topsoil from erosion & reuse after construction	1 (Community) 1 (Water)
	A.1.b.	Limit & delineate construction footprint for maximum protection	1 (Water)
	C.1.a.	No invasive species listed by Cal-IPC are planted	1 (Water)
	C.1.c.	75% of plants are California natives or Mediterranean species or other appropriate species	3 (Water)
	C.4.	Plant shade trees	3 (Water)
	C.5.	Group plants by water needs (hydrozoning)	2 (Water)
	C.6.a.	System uses only low-flow drip, bubblers or low-flow sprinklers	2 (Water)
	C.6.b.	System has smart (weather-based) controllers	3 (Water)
	C.7.	Incorporate 2 inches of compost in the top 6-12 inches of soil	3 (Water)
	C.8.	Mulch all planting beds to the greater of 2 inches or local water ordinance requirement	2 (Water)
		Total points:	**22**

Table 4. *GreenPoint Rated credits related to stormwater*

If stormwater is clean enough, it can be used to fill swimming pools.
Photo: Bassin Takis in Paris, KMD Architects

Integrating LID into San Francisco's Urban Landscape

The illustrations on the following pages show how LID can be integrated into San Francisco's diverse land uses to both protect water quality and contribute to the character of a given location. The figures illustrate stormwater management strategies appropriate for each of the following land uses:

- High-density Residential
- Low-density Residential
- Mixed Use
- Industrial
- Open Space and Natural Areas
- Piers over Water
- Former Shipyards

The figures are not meant to provide a comprehensive list of stormwater design solutions that are possible in San Francisco. Rather, they offer ideas and examples of the benefits that result from the implementation of multi-purpose LID.

A creek daylighting project in Zurich, Switzerland protects and improves water quality, by keeping it out of the sewer, and transforms the streetscape.


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Figure 9. High-density Residential

In San Francisco, high-density residential development is classified as 40 or more living units per acre. Some defining characteristics of high-density residential are zero-lot line development, reduced, public open space, and high levels of imperviousness. In this context, the greatest opportunities for stormwater management reside in replacing impervious surfaces with pervious surfaces and adding green space to roofs and interior courtyards. Ample roof space with relatively low pollutant loads provides opportunities for eco-roofs and rainwater harvesting. Interior courtyards can accommodate landscape-based BMPs, permeable paving, and subsurface treatment or capture systems. Sidewalks and streets adjacent to high-density residential development are often the nearest public open spaces available to residents. As such, they are ideal places to site stormwater management BMPs that also improve streetscape aesthetics and provide wildlife habitat, such as biofiltration areas, street trees, green walls, and bioretention bulbouts. All of these measures help to manage stormwater runoff; they also reduce the volumes of stormwater generated by the site in the first place.

1. Downspout Discharges to Vegetated Roof to Reduce Runoff
2. Vegetated Roof to Reduce Runoff
3. Green Wall to Slow Runoff
4. Downspout Connected to Dry Well
5. PermeablePaving in Pedestrian Areas
6. Rain Garden for Bio-Infiltration
7. Bio-Retention Planter with Curb Cuts
8. Downspout Connected to Large-Scale Cistern for Rainwater Harvesting

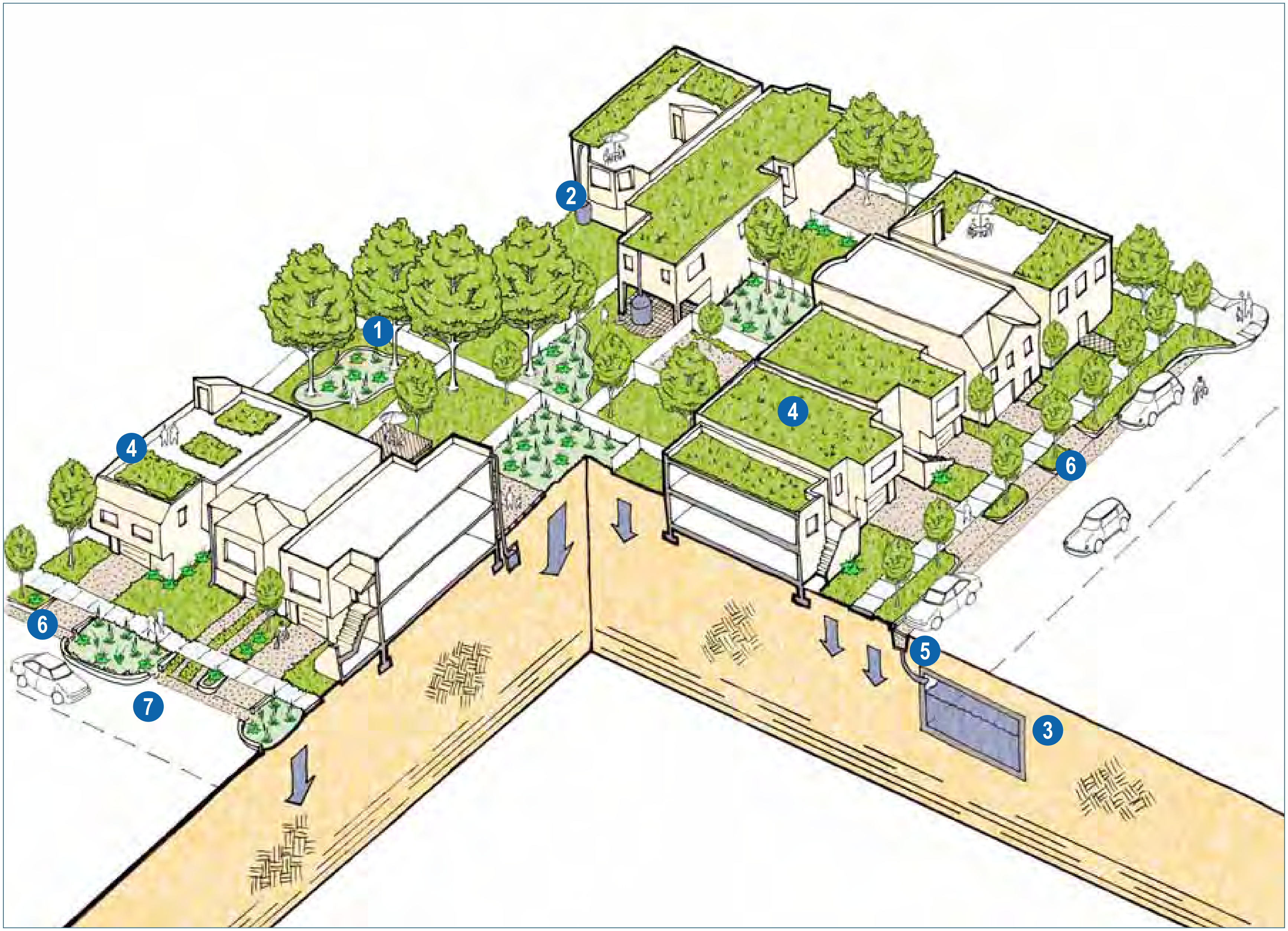
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Figure 10. Low-density Residential

In San Francisco, low-density residential development refers to 24 living units per acre or fewer. Low-density residential parcels typically include open space in the form of yards and setbacks, wider sidewalks than those found in high-density residential, and rooftops that are more likely to be under the control of a single owner. Low-density residential parcels therefore tend to both generate less stormwater and have more space in which to manage stormwater than high-density areas. Diverse parcel sizes and shapes, along with variability in building footprints, provide opportunities for site-specific stormwater management designs.

1. Rain Garden for Bio-Infiltration
2. Downspout Connected to a Rain Barrel
3. Cistern to Store Rainwater for Irrigation
4. Vegetated Roof to Reduce Runoff
5. Infiltration Trench
6. Permeable Paving
7. Bio-Retention Planter with Curb Cuts

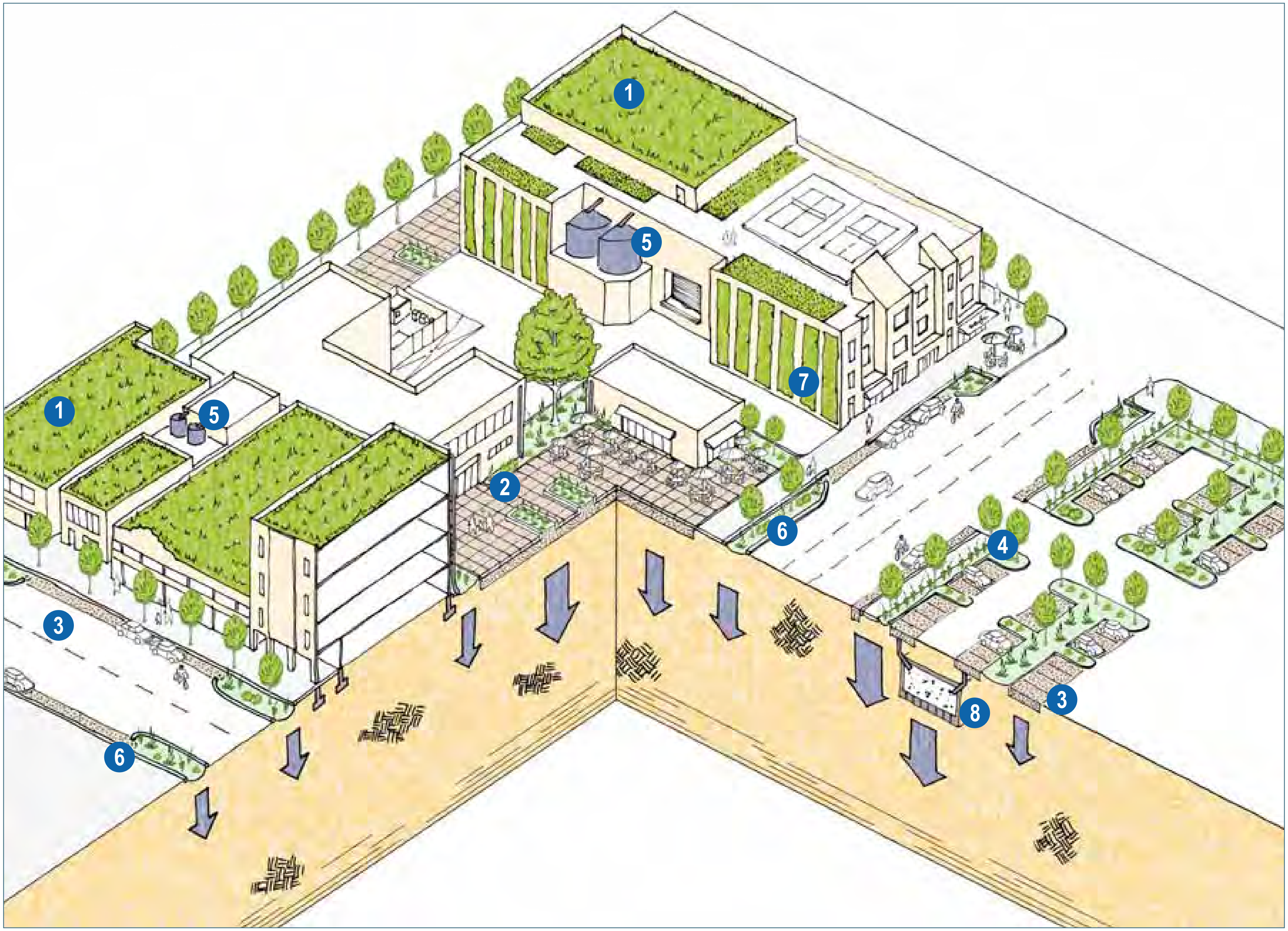
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Figure 11. Mixed Use

Many new, redevelopment, and infill projects in San Francisco include mixed-use areas. Mixed use development fosters a high level of activity throughout the day, resulting in an active public realm. Roofs, public plazas, setbacks, parking lots, and the public right-of-way are all spaces that can double as LID measures that improve the quality of the public realm and achieve stormwater management goals. Of these spaces, roofs generally have the lowest pollutant loads while streets have the highest. The commercial elements of mixed use development sometimes require special attention. For example, restaurants and light industrial activities will need to implement source controls targeting grease, litter, and other food wastes.

1. Vegetated Roofs to Reduce Runoff
2. Permeable Paving in Pedestrian Areas
3. Permeable Paving in Parking Areas
4. Swales in Parking Lots
5. Cistern to Store Rainwater for Toilet Flushing
6. Bio-Retention Planter with Curb Cuts
7. Green Wall to Slow Runoff
8. Dry Well

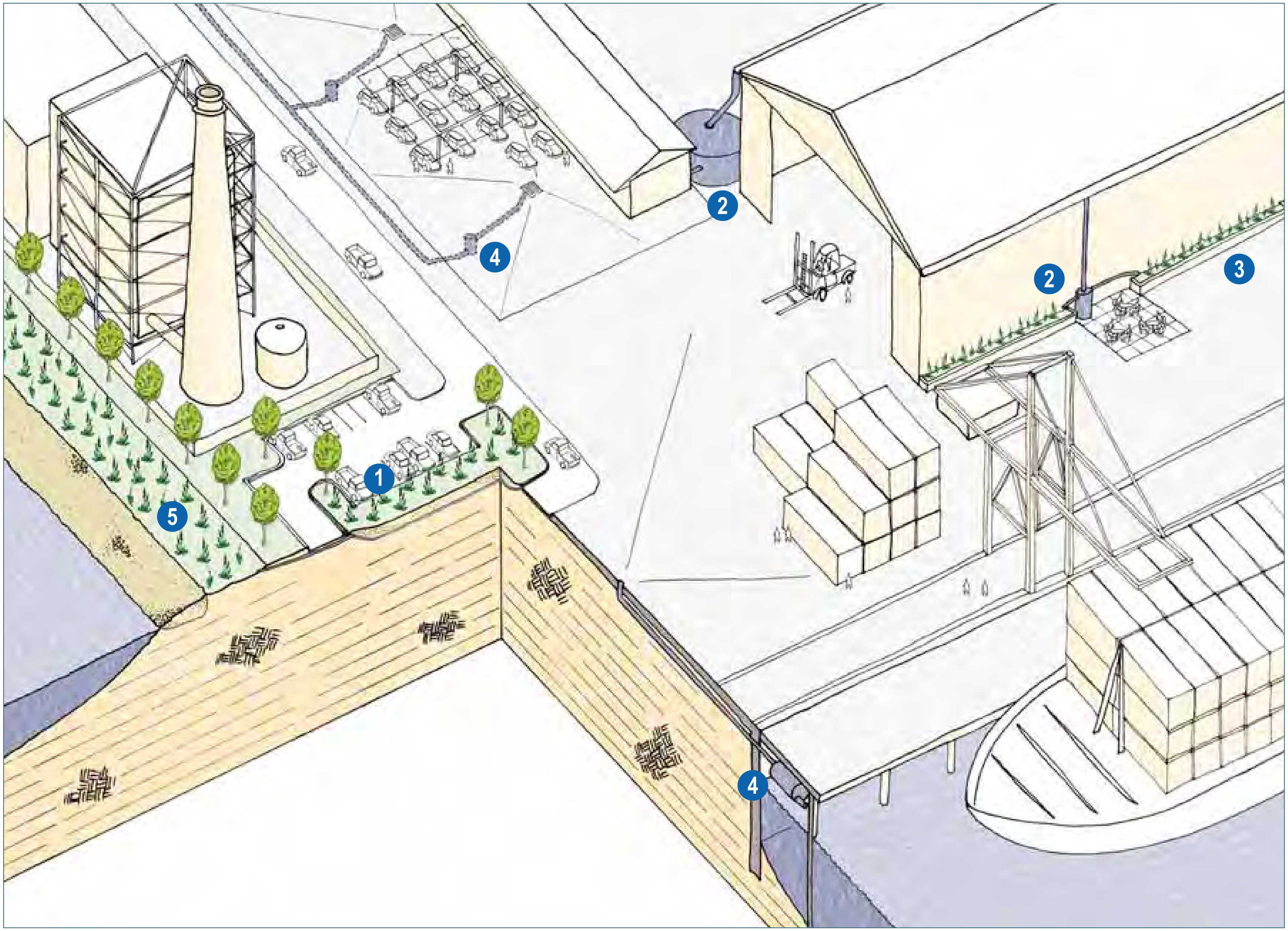
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Figure 12. Industrial

Industrial land uses in San Francisco are concentrated in the Bayside watersheds. Because industrial areas often contain potentially polluting activities coupled with large impervious areas, treating stormwater on-site in these areas is essential. Industrial land use is generally characterized by large, low-density structures that provide ample space for treatment measures. Stormwater management strategies in industrial areas can serve not only to protect water quality but also to provide high quality rest areas for workers, act as a buffer for adjacent land uses, and maintain public access to waterfront open space where appropriate. Pollutants associated with industrial activities – chemical waste storage, for example – require special source control strategies such as hydraulic isolation and treatment in areas where polluting activities occur.

1. Swales in Parking Lots
2. Cisterns to Store Rainwater for Vehicle Washing
3. Flow-through Planters to Improve Water Quality
4. Vortex/Swirl Separator or Media Filter
5. Vegetated Buffer Strip

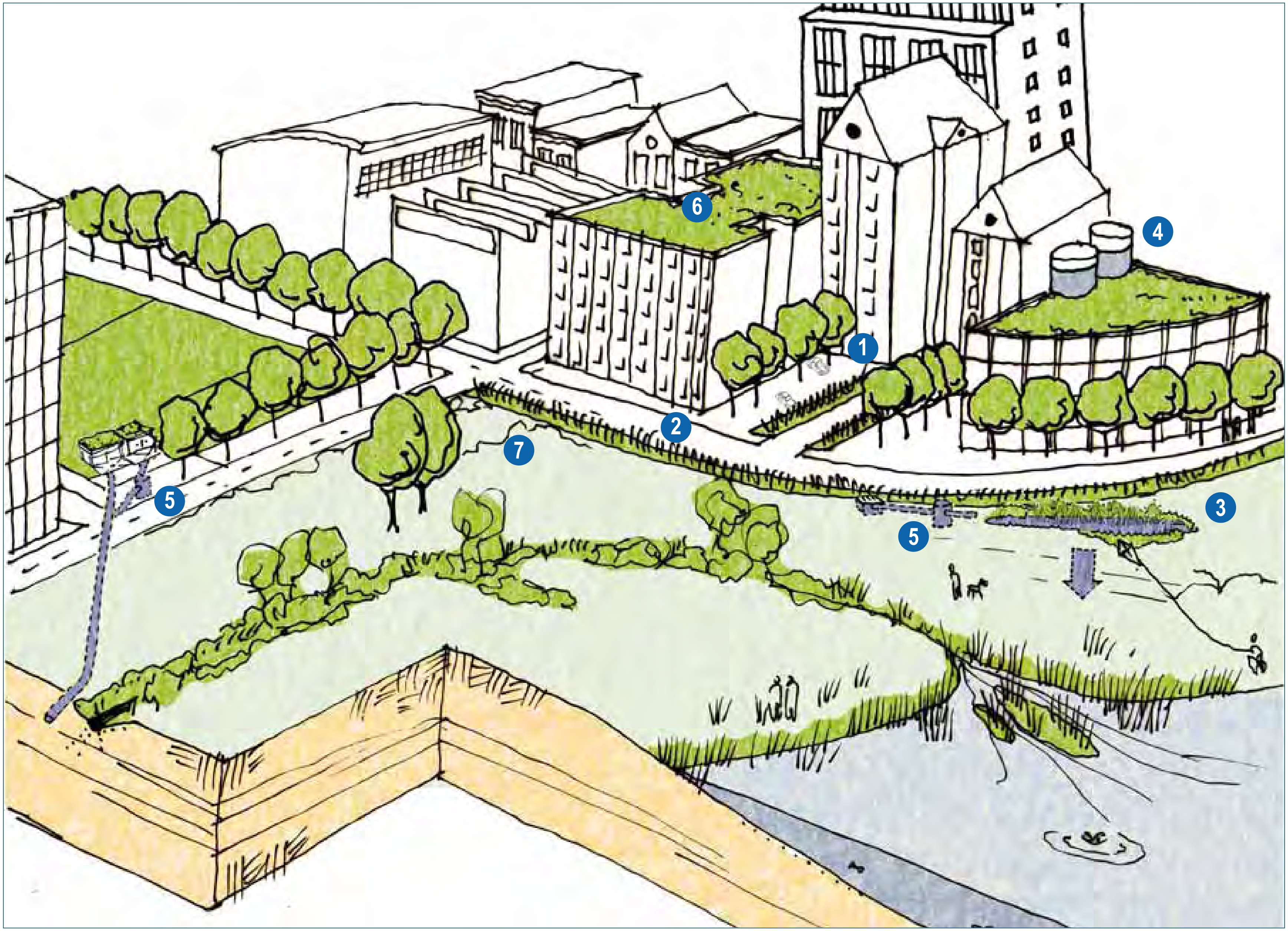
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Figure 13. Open Space

San Francisco's open spaces provide space for passive and active recreation, wildlife habitat, and environmental education. Open space areas also contribute to air and water quality protection. Some open space areas, most notably Lake Merced, include water bodies whose health and function depend upon protection from adjacent polluting activities. To that end, stormwater BMPs can be sited on less sensitive open spaces to protect the more sensitive core areas. Open spaces can often accommodate larger stormwater treatment trains that integrate stormwater management with other ecological functions. Because of this, stormwater management in open spaces can make significant contributions toward restoring natural hydrology and ecosystem health. Open spaces that are opportunity sites for LID include parks, recreational areas, school playfields, and natural areas.

1. Swales in Parking Lots and Roadways
2. Swales to Buffer Open Space from Development
3. Constructed Wetlands to Buffer Open Space from Development
4. Cistern to Store Rainwater for Irrigation
5. Street Drains to Wetland via Swirl Separator; Trash Area Drains to Sewer via Swirl Separator
6. Vegetated Roof to Reduce Runoff
7. Vegetated Slope to Reduce Erosion/Sedimentation

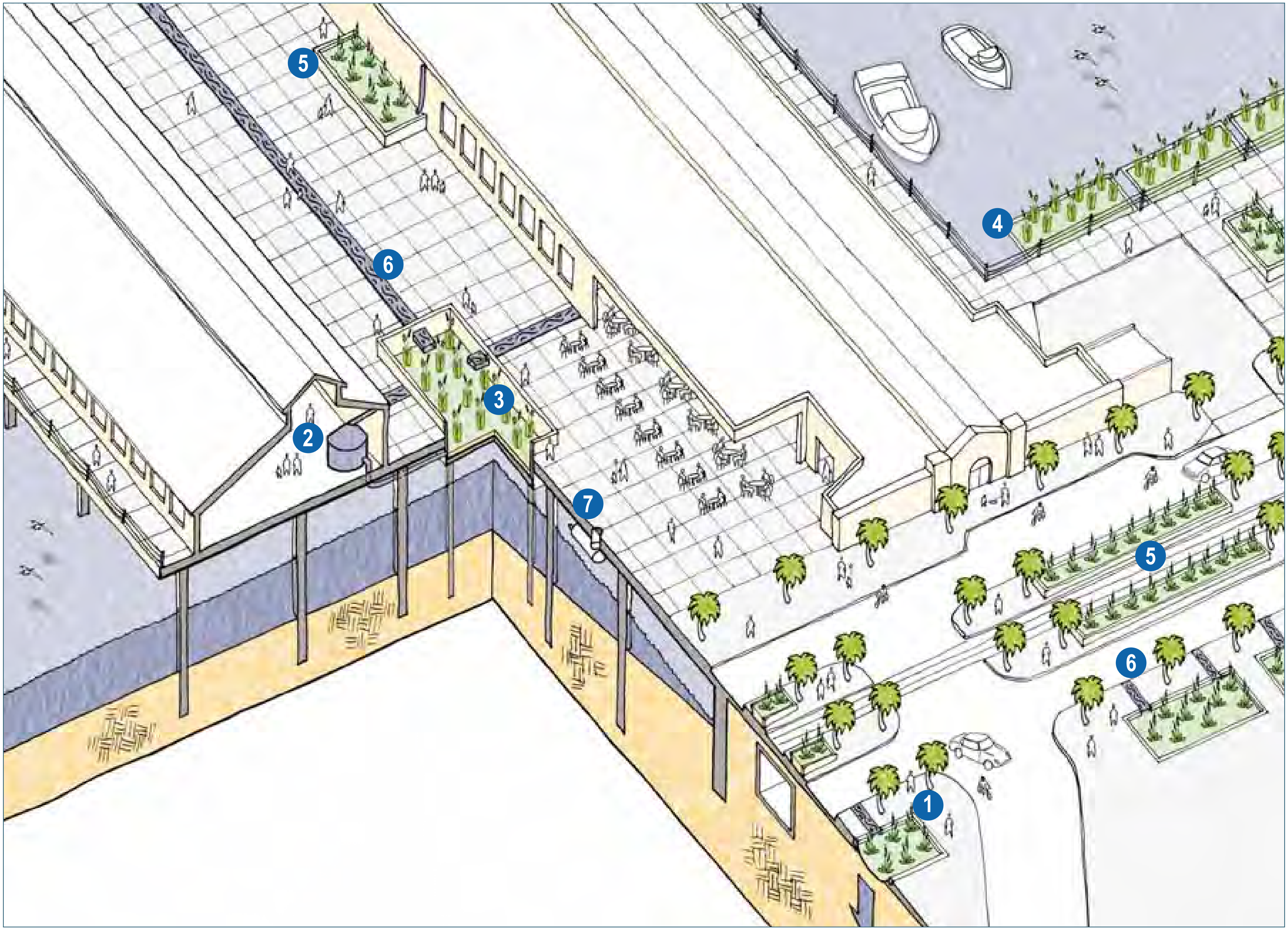
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Figure 14. Piers Over Water

Piers over water are common along San Francisco's waterfront. They are frequently the site of redevelopment projects seeking to adaptively reuse attractive and unique historic properties. Development on piers over water includes a wide variety of land uses, including commercial, recreational, industrial, and maritime uses. Because runoff from piers over water often flows directly to the Bay without the benefit of dedicated conveyance structures, stormwater management on piers over water requires creative infrastructure solutions. Limited space, cultural and historic preservation requirements, and public access goals all impose additional design constraints. The transition between piers and streetscape may provide opportunities for landscape-based stormwater management strategies that may not be feasible on the piers themselves. In some cases, media filtration devices may be the only feasible option for certain aspects of pier redevelopment.

1. Rain Gardens in the Streetscape
2. Cistern for Rainwater Harvesting
3. Detention Pond
4. Vegetated Pontoons for Biofiltration*
5. Above Ground Planter for Biofiltration
6. Trench Drains for Conveyance
7. Vortex/Swirl Separator or Media Filter

* See the Emerging Technologies factsheet in Appendix C for more about vegetated pontoons.

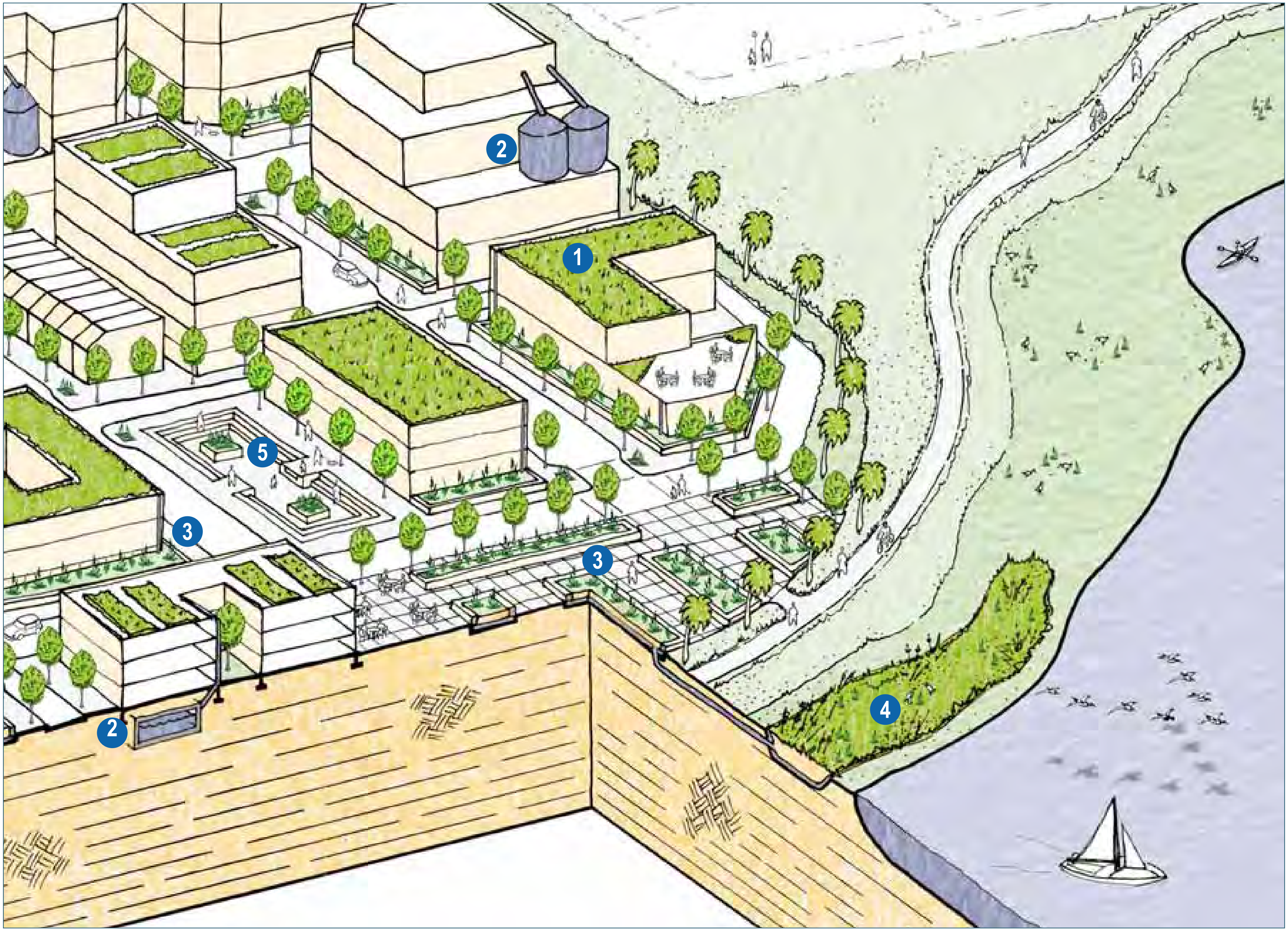
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Figure 15. Former Shipyards

A number of San Francisco's redevelopment areas are former shipyards. Former shipyards have a variety of challenging conditions associated with them, such as a high water table, uncompacted fill, and legacy pollutants from historic shipyard activities. Historic pollution can limit the feasibility of certain LID measures, and those LID measures that are implemented will often require engineered liners to prevent mobilization of subsurface contaminants. Despite these challenges, redevelopment of former shipyards offers significant opportunities for innovative and comprehensive stormwater management because it often requires building new infrastructure systems.

1. Vegetated Roofs to Reduce Runoff
2. Cisterns to Harvest Rainwater for Heating and Cooling
3. Rain Gardens for Biofiltration
4. Constructed Wetland to Buffer Water from Urban Development
5. Urban Stormwater Plaza/Detention Pond

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Port Plan Approval

To ensure consistent implementation of LID in new and redevelopment projects in San Francisco's separate sewer areas, the Port requires all projects disturbing 5,000 square feet or more to comply with stormwater performance measures in order to gain plan approval.

Project applicants subject to these *Guidelines* will be required to complete a Stormwater Control Plan (SCP) to demonstrate that they have met San Francisco's stormwater requirements. The requirements are performance-based and are very similar to those used in other Bay Area Cities. The stormwater performance measures for projects served by separate storm sewer systems under Port jurisdiction require the capture and treatment of:

- The flow of stormwater runoff resulting from a rain event equal to at least 0.2 inch per hour intensity; **or**
- Eighty percent or more of the annual stormwater runoff volume, determined from unit basin storage volume curves for San Francisco.

Project applicants developing or redeveloping properties subject to these performance measures must complete a SCP for project approval. The SCP will allow the Port, the SFPUC, and the Planning Department to certify compliance with these requirements. The contents of the SCP are described in the next section, and a SCP template is provided in Appendix C.

Project applicants must also ensure compliance with other stormwater regulations that may apply to their project. For instance, construction sites greater than 1 acre are generally required to seek coverage under the *California Statewide General Permit for Stormwater Discharges Associated with Construction Activities*. Specific types of commercial and industrial operations must seek coverage under the *California Statewide General Permit for Stormwater Discharges Associated with Industrial Activities.*

Port Requirement

All qualifying projects in the separate storm sewer area that disturb 5,000 square feet or more of the ground plane are required to capture and treat rainfall from a 0.2-inch per hour event **or** eighty percent or more of the annual stormwater runoff volume, determined from unit basin storage volume curves for San Francisco. Disturbed area includes any movement of earth, or a change in the existing soil cover or the existing topography. Land disturbing activities include, but are not limited to, clearing, grading, filling, excavation, or addition or replacement of impervious surface.

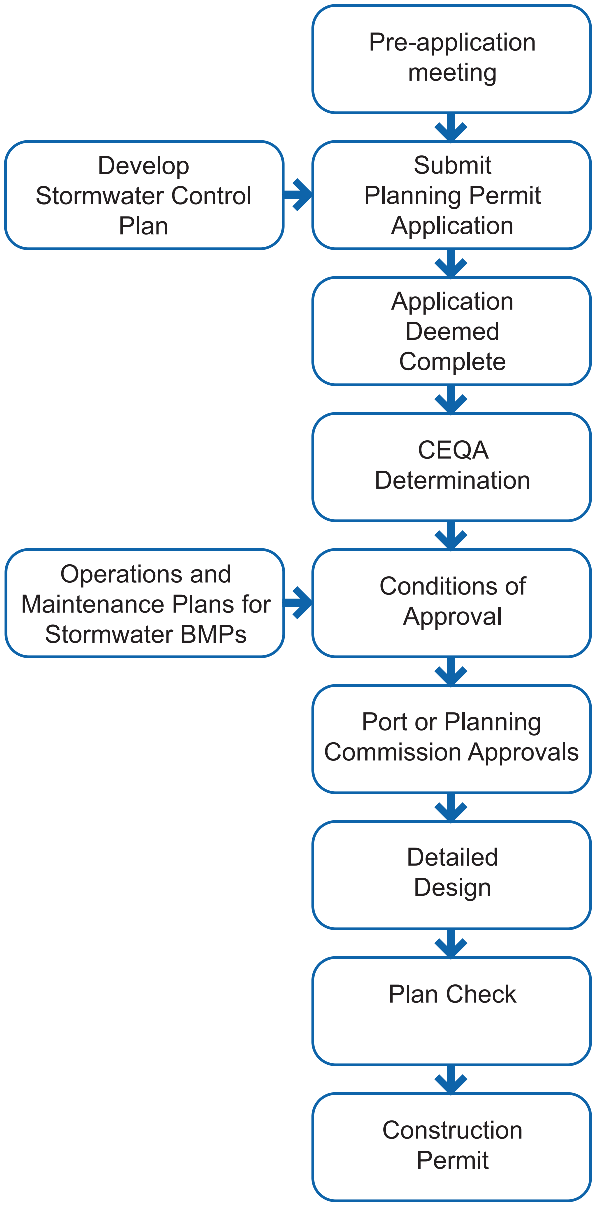

Figure 16. *The SCP submittal and plan approval process.*

The Development Review Process

The Port has integrated SCP review into its existing development review processes. A simplified diagram for a typical development review process is shown in Figure 16.

The SCP must be submitted along with the development application for Planning Review. Planning Department staff will often request that applicants provide a preliminary site layout, preliminary landscaping plan, elevation drawings, or other illustrations for review at a pre-submittal meeting. Project applicants will also discuss their preliminary SCP at the pre-submittal meeting. At this stage project applicants should bring a drainage plan with proposed locations for BMPs.

CEQA

Most projects subject to the requirements of these *Guidelines* will also require some level of CEQA review. The California Environmental Quality Act (CEQA) environmental review imposes both procedural and substantive requirements for environmental protection. CEQA requires local jurisdictions to identify and evaluate the environmental impacts of their actions, including zoning decisions and discretionary land-use approvals. The CEQA process provides decision-makers and members of the public with information about potentially adverse environmental impacts and requires implementation of feasible alternatives and mitigation measures in order to reduce those impacts.

CEQA is intended to minimize the environmental impacts of development activities, which is consistent with the objectives of these *Guidelines*. The basic purposes of CEQA are to:

- Inform decision-makers and the public about the potential significant environmental effects of proposed activities.
- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

The CEQA Initial Study Checklist

The Phase II General Permit requires local municipalities to evaluate water quality effects and identify appropriate mitigation measures when conducting environmental review of proposed projects. This effort can be integrated into the completion of the CEQA Initial Study Checklist. The CEQA Initial Study Checklist is used to determine whether a given project will have significant impacts on the environment.

The San Francisco Planning Department's Initial Study Checklist contains questions that link potentially significant project impacts to requirements under the CWA and the California Water Code:

- Question 14.a: **"Would the project violate any water quality standards or waste discharge requirements?"** This question evaluates a project's compliance with water quality standards and considers the project's potential effect on water bodies on the Section 303(d) list.
- Question 14.d: **"Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?"** This question investigates the potential effects of increased runoff peak flows and durations.
- Question 14.e: **"Would the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial new sources of polluted runoff?"** This question evaluates the potential impacts of pollutants in runoff and increased stormwater flows to the collection system.
- Question 14.f: **"Would the project otherwise substantially degrade water quality?"** This question is the most tightly linked to the *Guidelines*. The intent of these *Guidelines* is to ensure that projects do not degrade water quality.

Port, SFPUC, and City Planning staff will work with project applicants to ensure that the CEQA Initial Study Checklist clearly articulates potential impacts that the project may have on the quantity and quality of stormwater runoff. BMPs required by the *Guidelines* will reduce stormwater impacts by controlling sources of pollution, reducing site imperviousness, and providing for treatment facilities that retain, detain, or treat runoff.

The CEQA process is generally administered in several steps:

1. Review of the CEQA checklist to determine the appropriate level of review.

2. Issuance of a Categorical Exemption for projects exempt from CEQA review.

3. Preparation of an Initial Study to characterize the environmental effects of the project.

4. Preparation of an Environmental Impact Report (EIR) or Negative Declaration.

In cases where a higher level of environmental review is required for project approval, such as a Mitigated Negative Declaration or an EIR, the CEQA process may require the consideration of project alternatives. Because the final project configuration is uncertain, it may not be possible to complete a SCP prior to CEQA approval. In such cases, a preliminary SCP would be required to be completed once the project configuration is finalized. The SCP must be completed and approved before the applicant begins final design drawings for the project.

If CEQA approval for a project includes mitigation measures, project applicants will be required to participate in a mitigation monitoring and reporting program (MMRP). CEQA requires the MMRP to ensure compliance with adopted mitigation measures during project implementation. The MMRP specifies the required actions and monitoring that are required for each mitigation measure recommended in the EIR. The requirements for the construction and maintenance of stormwater BMPs described in the SCP can be used in the MMRP for EIRs and Mitigated Negative Declarations.

The San Francisco Planning Department prepares CEQA documents for proposed City projects. If the CEQA analysis determines that a project would have a significant or potentially significant impact on hydrology and water quality, then the project would be required to administer mitigation measures that would reduce the impact to less than significant, or the City would need to make Findings of Overriding Considerations.

Project applicants must meet the stormwater performance measures described in these *Guidelines* to avoid negative impacts to water quality. By doing so, they may avoid triggering CEQA mitigation requirements. Projects receiving a Categorical Exemption or Negative Declaration under CEQA are still required to submit a complete SCP in order to gain project approval.

Multi-Parcel Projects

While compliance with the *Guidelines* is required for all new and redevelopment projects greater than 5,000 square feet, master-planned and multi-parcel projects offer the greatest opportunity for regional LID elements (i.e., stormwater facilities serving more than one parcel) such as treatment wetlands, water features, and wet ponds. The Port and SFPUC will work with project applicants who are proposing large projects to develop a comprehensive Stormwater Control Plan (SCP) that integrates stormwater management approaches across multiple parcels.

Requirements for a comprehensive SCP and associated Operations and Maintenance Plan will follow the methodology for preparation of an SCP, as discussed in later sections of the *Guidelines*. During CEQA review for large projects, greater emphasis will be placed on the relationship between overall stormwater infrastructure development and the development of specific parcels. Please contact Port staff to initiate this process.

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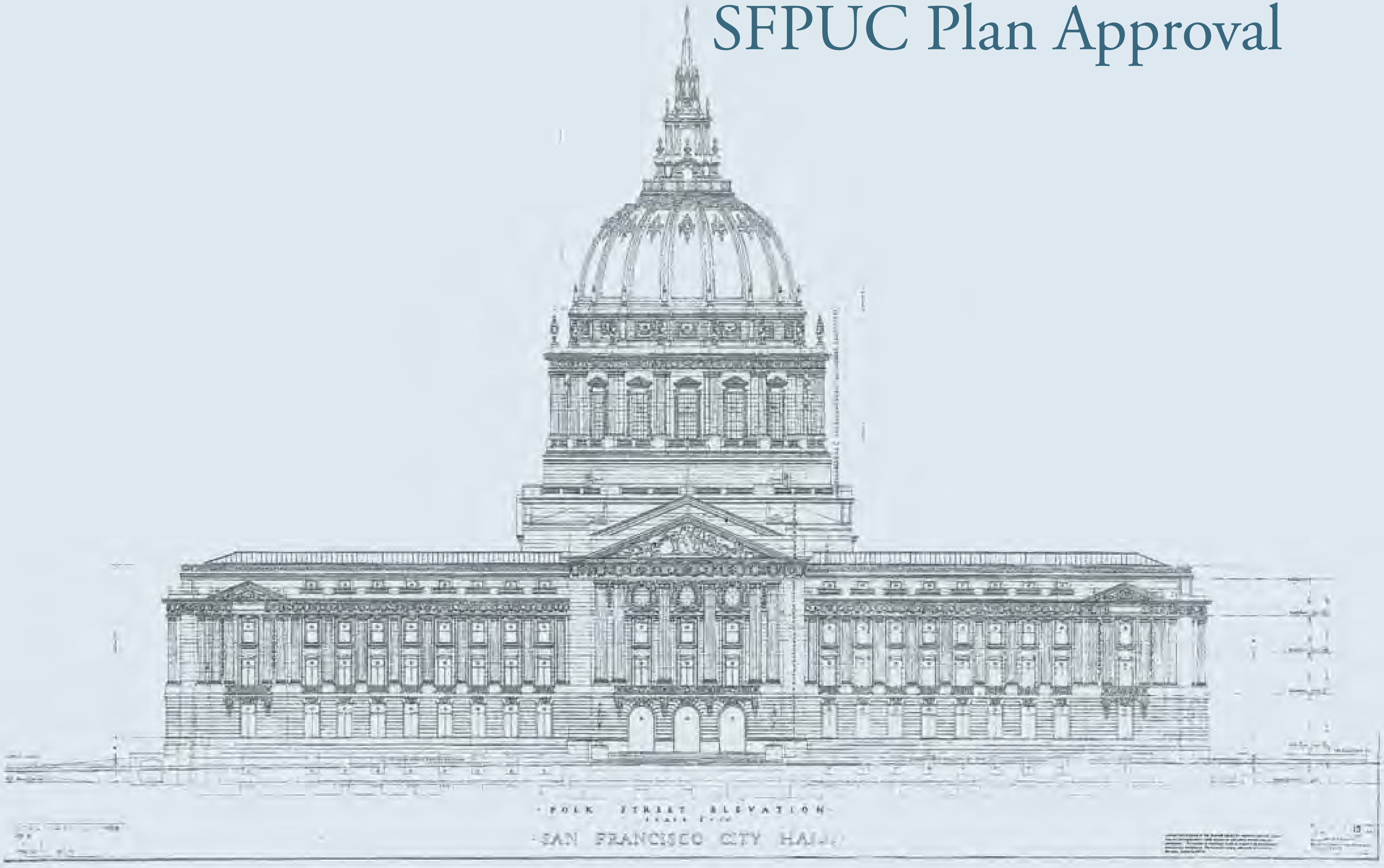
SFPUC Plan Approval



To ensure consistent implementation of LID in new and redevelopment projects in San Francisco, the SFPUC requires all projects disturbing 5,000 square feet or more to comply with stormwater performance measures in order to gain plan approval.

In separate sewer areas under SFPUC jurisdiction, applicants proposing new or redevelopment projects that either a) disturb 5,000 square feet or more of the ground plane, or b) are subject to San Francisco's Green Building Ordinance, are required to:

- Capture and treat the rainfall from a design storm of 0.75 inch using acceptable best management practices (BMPs); and
- Complete a Stormwater Control Plan (SCP) demonstrating how the project will capture and treat rainfall from the 0.75-inch design storm.

This performance measure is equivalent to LEED Sustainable Sites Credit 6.2 titled "Stormwater Design: Quality Control." The rainfall depth of 0.75 inch is the LEED-based performance measure for semi-arid watersheds.

In combined sewer areas under SFPUC jurisdiction, applicants will be required to reduce the flow rate and volume of stormwater going into the combined system by achieving LEED Sustainable Sites Credit 6.1 titled "Stormwater Design: Quantity Control."

The SCP requirement will allow the SFPUC, the Department of Building Inspection (DBI), and the Planning Department to verify compliance with stormwater requirements. The *Guidelines* chapter entitled, "The Stormwater Control Plan," describes the required contents of a SCP and also provides sizing instructions for stormwater treatment BMPs to comply with this requirement. A SCP template is provided in Appendix C.

SFPUC Requirement

Developments or redevelopments disturbing 5,000 square feet or more of the ground surface are required to manage stormwater on-site. Land disturbing activities include, but are not limited to, clearing, grading, filling, excavation, or addition or replacement of impervious surface.

In separate sewer areas, applicants must achieve LEED SS6.2 and demonstrate compliance in a SCP.

In combined sewer areas, applicants must achieve LEED SS6.1 and demonstrate compliance in a SCP.

How does LEED Credit SS6.2 compare to the General Permit requirements?

San Francisco's GBO adopts performance measures drawn from LEED, a nationally-recognized standard. Analysis indicates that the performance measure listed in LEED 6.2 is roughly equivalent to the performance measures listed in the General Permit, with LEED 6.2 being slightly more stringent (by about 2%). The proposal to use LEED-based performance measures was approved by the RWQCB on December 19, 2008.

GBO Project Thresholds

Midsize Residential
(5+ units and < 75 feet height to highest occupied floor)

High-Rise Residential
(5+ units and > or = 75 feet height to highest occupied floor)

Mid-Size Commercial Office Building of a B Occupancy
(>5,000 SF and <25,000 SF)

New Large Commercial Office Building of a B Occupancy
(>25,000 SF)

Table 5. *Projects required to achieve stormwater points under the Green Buliding Ordinance*

The Green Building Ordinance

On November 3, 2008, the City of San Francisco's Building Code was amended to include Chapter 13C, "Green Building Requirements," known as the Green Building Ordinance (GBO). The code requires certain types of new and redevelopment projects constructed in San Francisco to meet green building standards developed by San Francisco's Green Building Task Force. Many of the standards are based on LEED, a green building rating system developed by the United States Green Building Council (USGBC). Projects that fall into one of four building categories listed in Table 5 must comply with the GBO by obtaining specified levels of LEED certification. For the full text of the GBO, go to http://www.sfenvironment.org/downloads/library/sf_green_building_ordinance_2008.pdf.

The GBO requires projects to obtain LEED's Sustainable Sites credit entitled "Stormwater Design: Quantity Control" (SS6.1) or "Stormwater Design: Quality Control" (SS6.2), depending on whether the site is in a separate or combined sewer area.

For the full text of Credits SS6.1 and SS6.2, see pages 75-87 of the "LEED for New Construction and Major Renovation Reference Guide, Version 2.2."

The GBO refers to both LEED and these *Guidelines* in Section 1304C.0.3:

Stormwater management shall meet the "Best Management Practices" and "Stormwater Design Guidelines" of the San Francisco Public Utilities Commission, and shall meet or exceed the applicable LEED SS 6.1 and 6.2 guidelines.

The applicable LEED credit for separate sewer areas is SS6.2. while the applicable LEED credit for combined sewer areas is SS6.1. SFPUC staff is currently in the process of modeling the impacts of SS6.1 on the combined sewer area and developing calculators for SS6.1. Until this modeling is completed, applicants with questions about projects in the combined sewer should contact SFPUC staff for direction.

Projects subject to stormwater requirements under the GBO that do not disturb 5,000 square feet of the ground surface must achieve LEED Certification and achieve either LEED SS6.1 or LEED SS6.2, but need not submit a Stormwater Control Plan. Only projects disturbing 5,000 square feet or more need to submit a SCP.

The Development Review Process

The SFPUC has integrated the review of SCPs with the City's development review process. All projects disturbing 5,000 square feet or more must submit a SCP. A diagram showing how the SCP fits into a typical development review process is shown in Figure 17.

Project applicants must also ensure compliance with all stormwater regulations that may apply to their projects. For instance, construction sites greater than 1 acre are generally required to seek coverage under the California Statewide General Permit for Stormwater Discharges Associated with Construction Activities. Specific types of commercial and industrial operations must seek coverage under the California Statewide General Permit for Stormwater Discharges Associated with Industrial Activities.

Permit applicants that are also subject to the GBO will be required to receive third-party verification by the Green Building Certification Institute (GBCI), USGBC's official accreditation and certification body; or by the project's Green Building Compliance Professional of Record. The building permit application must include a complete LEED checklist, as stipulated in Administrative Bulletin for Chapter 13C (AB-093), which outlines administrative procedures for meeting green building requirements (see http://www.sfgov.org/site/dbi_index.asp?id=89703). The LEED Version 2.2 checklist includes Credits SS6.1 and SS6.2, and applicants must indicate their intent to comply in order to receive a building permit.

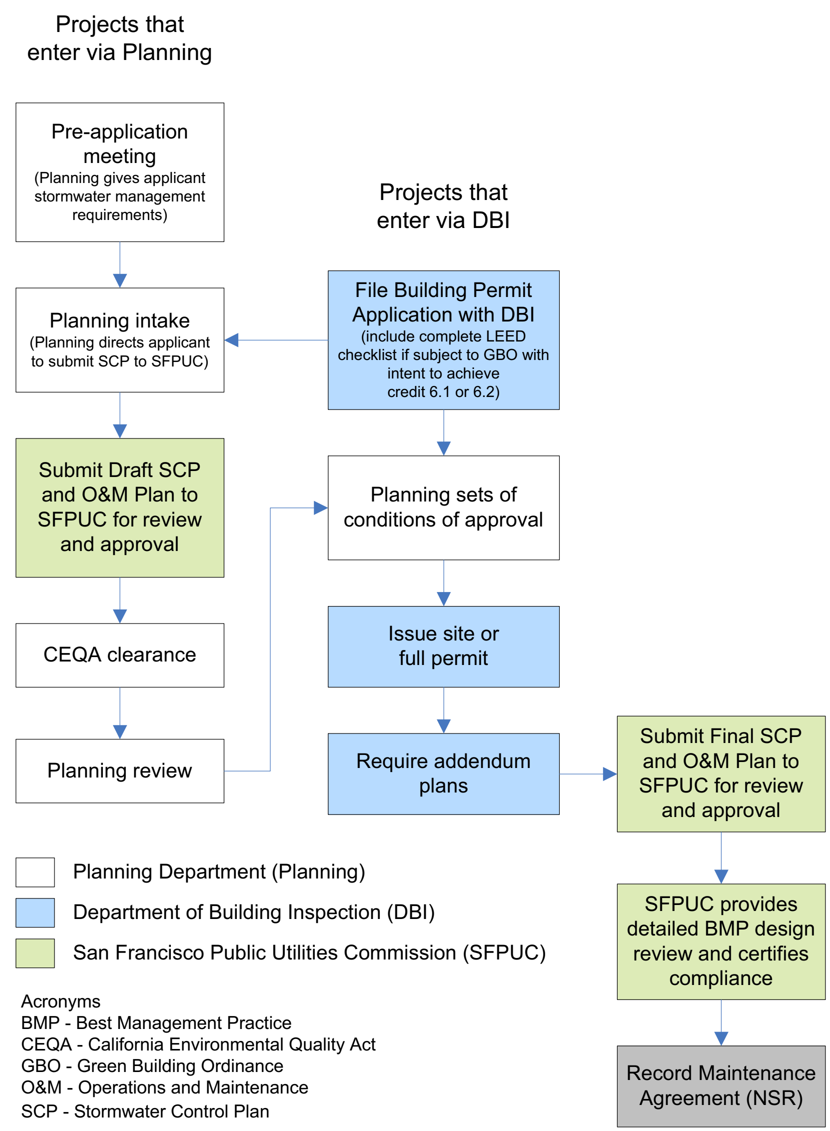


Figure 17*. The Stormwater Control Plan submittal and approval process*

LID measures like the stormwater wetland in Portland's Tanner Springs Park treat polluted street runoff, thereby minimizing negative impacts to water quality.

References and Resources

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The Western Harbor, located in Malmo, Sweden, conveys and treats stormwater by implementing both parcel and block-scale surface systems that direct runoff to vegetation and ponds, which double as amenities throughout the neighborhood. Habitat value is enhanced through the use of various vegetation types.
Photo: Andres Power

Inspection & Enforcement

The SFPUC and the Port require periodic inspections to ensure that BMPs are properly maintained and continue to provide effective stormwater treatment.

Once stormwater management facilities are incorporated into new development and redevelopment projects, the SFPUC and Port require periodic inspections to ensure that they are properly maintained and continue to provide effective stormwater treatment. There are three types of inspections under this operation and maintenance verification program: post-construction building permit inspections, annual self-certification inspections conducted by the property owner, and tri-annual inspections conducted by the Port or the SFPUC, depending on who has jurisdiction on the site. The Port and the SFPUC will also inspect BMPs in response to complaints or emergencies. If maintenance requirements identified through inspections are not completed in accordance with the protocols described in this chapter, the SFPUC or the Port will enact enforcement procedures.

Inspections

Post-construction inspections

The Port or the SFPUC will inspect stormwater BMPs upon completion of construction. These inspections will be based on a standardized inspection checklist. Inspection staff will confirm that stormwater facilities are built in conformance with approved plans.

If there are issues that require follow-up, the Port or the SFPUC will send the property owner a notice stating what corrective action needs to be taken and the timeframe for corrective action. The deadline will be between 24 hours and 30 days from the date of the notice, depending on the severity of the problem. The property owner is responsible for correcting these issues and scheduling a follow-up inspection by the Port or the SFPUC. If the issues are rectified by the time of the follow-up inspection, the Certificate of Occupancy will be issued. A diagram showing the post-construction inspection process is shown in Figure 18.

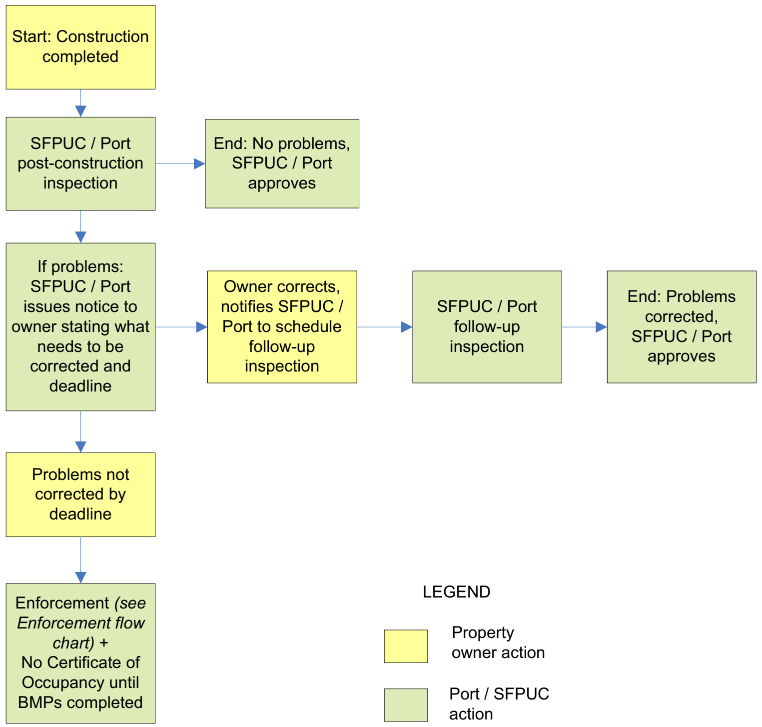


Figure 18. *Post-construction inspections.*

Annual self-certification

Once BMPs are successfully built, the Port or the SFPUC will send self-certification inspection reminders to property owners at all sites with stormwater BMPs. The reminder will include a submittal deadline and a blank self-certification checklist. The property owner will perform the self-certification inspection and digitally submit the completed checklist and maintenance logs from that year to the SFPUC Collection System Division or to the Port. With this submittal, the property owner will propose either approval or maintenance they will perform if there are outstanding issues that have not been resolved by the submittal date. The Port or the SFPUC will either approve the submittal and renew the certificate of compliance or contact the property owner to schedule an inspection.

If a Port or SFPUC inspection is necessary, the property owner must be present and provide annual maintenance logs. If the issues are rectified by the time of the inspection, the certificate of compliance will be renewed.

For sites at which the property owner does not submit self-certification documents, the Port or the SFPUC will send a notice stating that the deadline has passed and will contact the property owner to schedule an inspection. The notice will include a fee to cover the cost of the inspection plus a penalty. If the inspection indicates that there no maintenance issues requiring follow-up action, the certificate of compliance will be renewed. A diagram showing the annual self-certification process is shown in Figure 19.

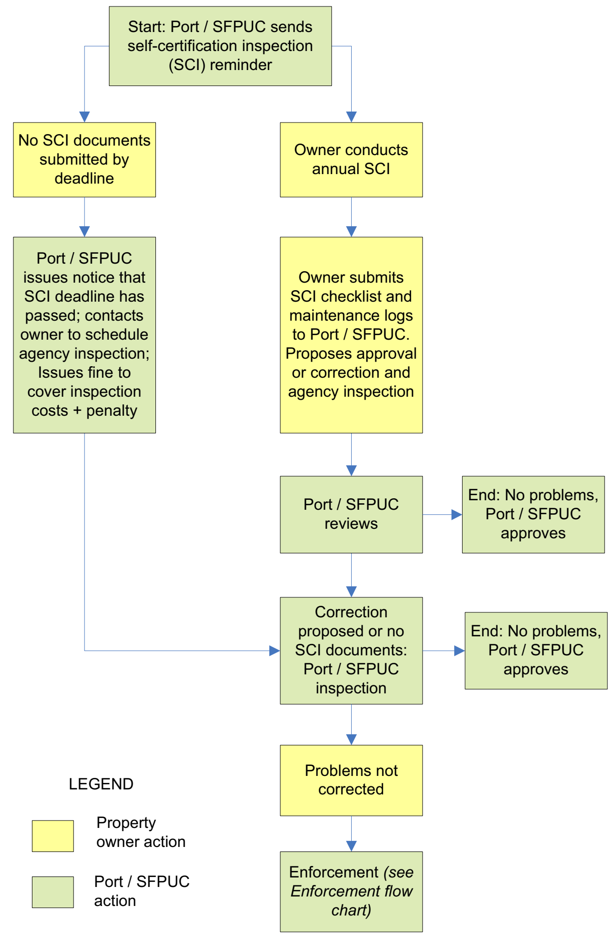


Figure 19. Annual self-certification inspections.

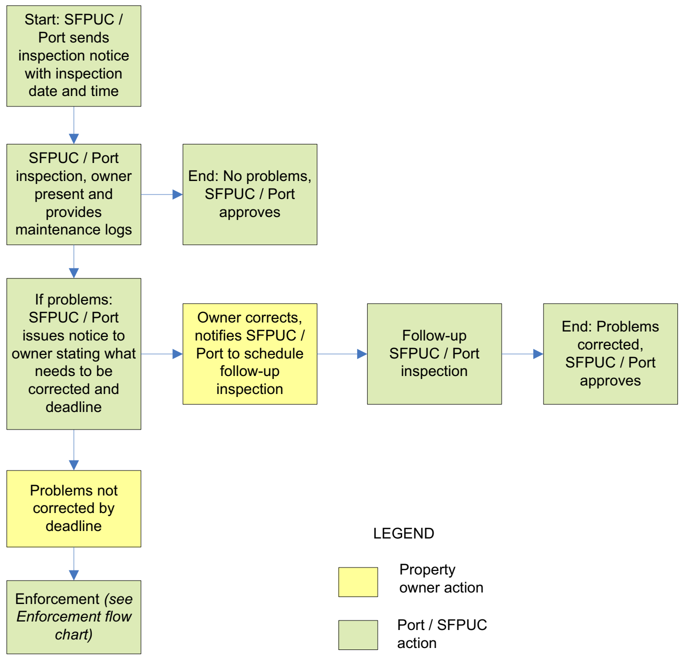


Figure 20. *Tri-annual Port / SFPUC inspections.*

Tri-annual Port / SFPUC inspections

Every third year, the Port or the SFPUC will inspect stormwater BMPs. The agency with jurisdiction on the project site will send inspection notices to property owners at sites due for inspection. The notice will include a proposed inspection date and time and a phone number to call should the proposed date not work for the property owner. The property owner must be present and provide annual maintenance logs. If the inspection indicates that there no maintenance issues requiring follow-up action, the certificate of compliance will be renewed.

If there are issues that require follow-up, the Port or the SFPUC will send the property owner a notice stating what corrective action needs to be taken and the deadline. The deadline will be between 24 hours and 30 days from the date of the notice, depending on the severity of the problem. The property owner is responsible for rectifying the issues and scheduling a follow-up inspection by the Port or the SFPUC within the time allotted. If the inspection indicates that the issues are rectified, the certificate of compliance will be renewed. A diagram showing the tri-annual Port or SFPUC inspection process is shown in Figure 20.

Enforcement

For all three types of inspections, if the property owner is unresponsive or if maintenance issues are not rectified by prescribed deadlines, the Port or the SFPUC will carry out an enforcement action. If an enforcement action becomes necessary, the Port or the SFPUC will issue a warning with a 15-day deadline for the property owner to take corrective action and schedule a follow-up inspection. The warning will include a fee to cover the cost of the inspection plus a penalty. If the inspection indicates that maintenance issues requiring follow-up action have been rectified, the annual certificate of compliance will be renewed. If there are outstanding issues requiring maintenance action or if the owner is unresponsive, the Port or the SFPUC will issue a notice of violation stating that the property owner will be fined. Fines will be levied based upon Article 4.1 of the San Francisco Public Works Code.

If the issues have not been rectified by the end of 25 days, the Port or the SFPUC will perform the required maintenance and will bill the owner for the fine plus the cost of the work. If the owner does not pay the fine and the bill within 30 days, the Port or the SFPUC have the option to initiate lien proceedings against the property. A diagram showing the enforcement process is shown in Figure 21.

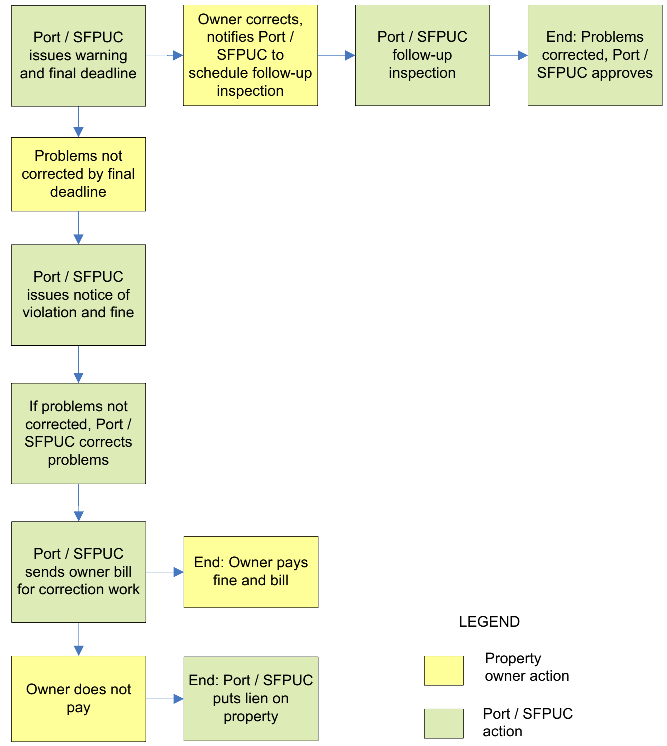
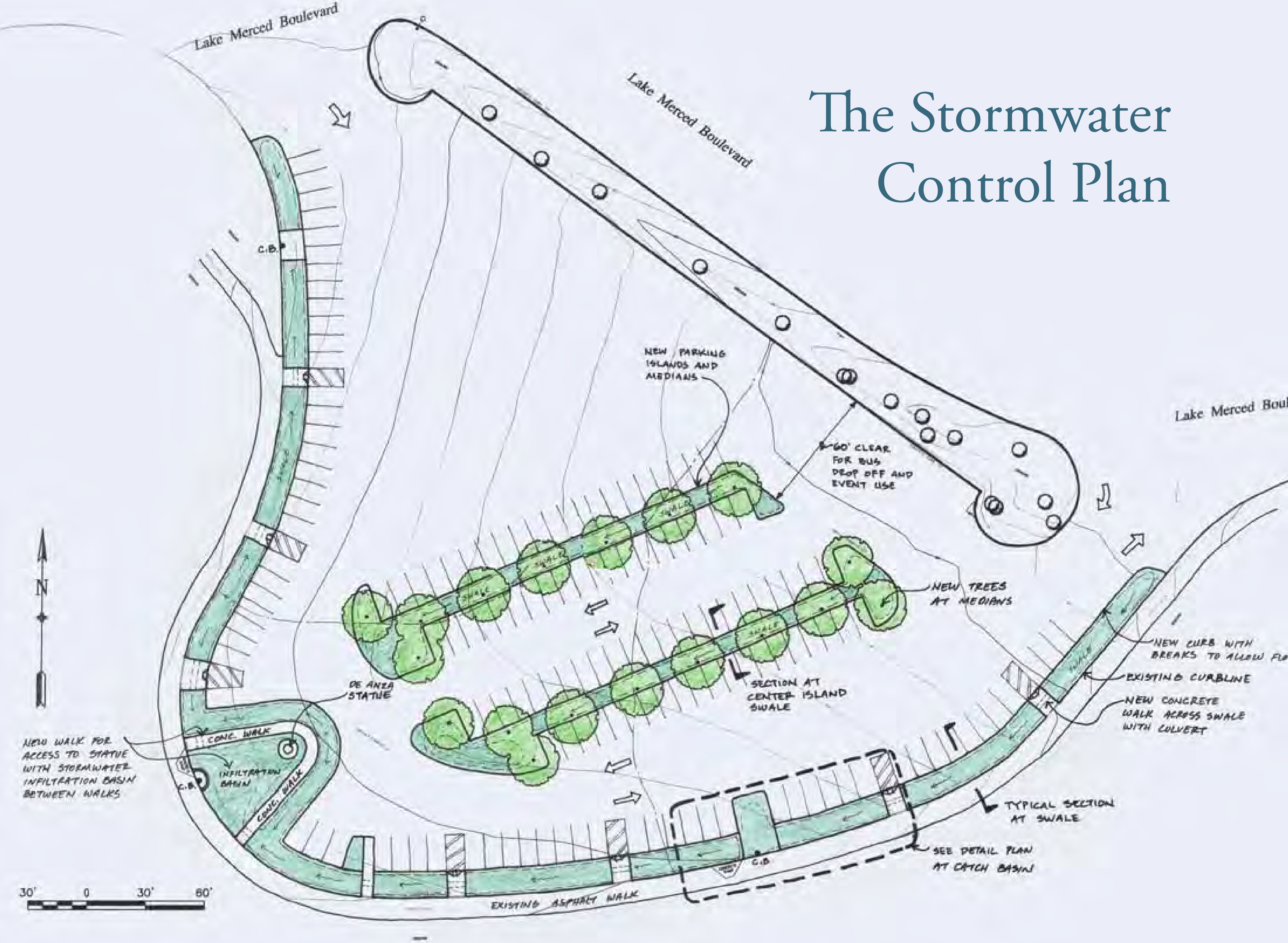


Figure 21. *Enforcement.*

The Stormwater Control Plan



The Port and SFPUC require submittal of a Stormwater Control Plan (SCP) with every development application for discretionary planning approval in San Francisco for all projects disturbing 5,000 square feet or more of the ground plane.

The Port and SFPUC require the submission of a Stormwater Control Plan (SCP). The SCP will allow the Port, the SFPUC, and the Planning Department to review projects that are subject to the *Guidelines* and ensure compliance with them. SCPs must be reviewed and stamped by a California licensed landscape architect, architect, or engineer.

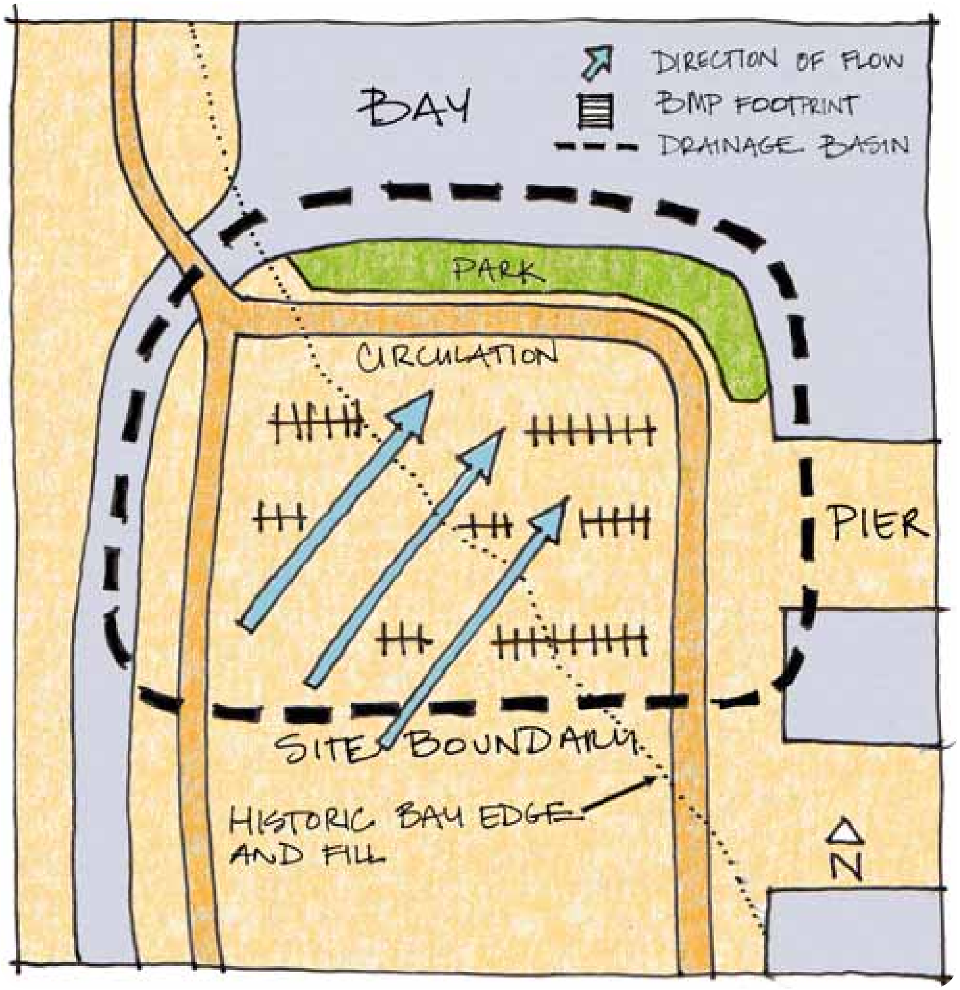
Project applicants must complete each of the following elements in their SCPs to be eligible for project approval:

1. Characterize existing site conditions
2. Identify design and development goals
3. Develop a site plan
4. Develop a site design
5. Select and locate source controls
6. Select and locate treatment BMPs
7. Size treatment BMPs
8. Check against design goals and modify as necessary
9. Develop an operations and maintenance plan
10. Compile the Stormwater Control Plan

Although the elements of the SCP are presented as a series of steps, in practice they should be iterative. For example, although site design comes before BMP sizing in the SCP checklist, BMP sizing results may require designers to make changes to the original site design. The following section provides an overview of each element of the SCP, illustrated by a conceptual drawing. An example of a completed SCP is included in Appendix C.

Requirement

The Stormwater Control Plan (SCP) must be reviewed and stamped by a licensed landscape architect, architect, or engineer.



Step 1

Characterize existing conditions

The stormwater management approach available to a given site is largely dictated by existing site conditions. Soil types, topography and drainage, vegetation types, wildlife habitat, proximity to receiving waters, existing structures, adjacent land uses, and historical and cultural features are all factors that project proponents should consider prior to initiating design of stormwater BMPs. A comprehensive checklist of site conditions that should be evaluated during the site analysis phase can be found in the SCP (Appendix C).

Jurisdictional concerns can influence a site as much as physical conditions. For example, parcels within 100 feet of the San Francisco Bay shoreline are subject to San Francisco Bay Conservation and Development Commission (BCDC) policies governing public access, circulation, and landscaping. Alterations to structures along most of the San Francisco Northern Waterfront are subject to the requirements of a National Historic Register District. Some properties may have deed restrictions establishing requirements for the management of residual soil and groundwater pollution. Port, SFPUC, and City Planning staff will work with project applicants to identify jurisdictional issues that are relevant to the site.

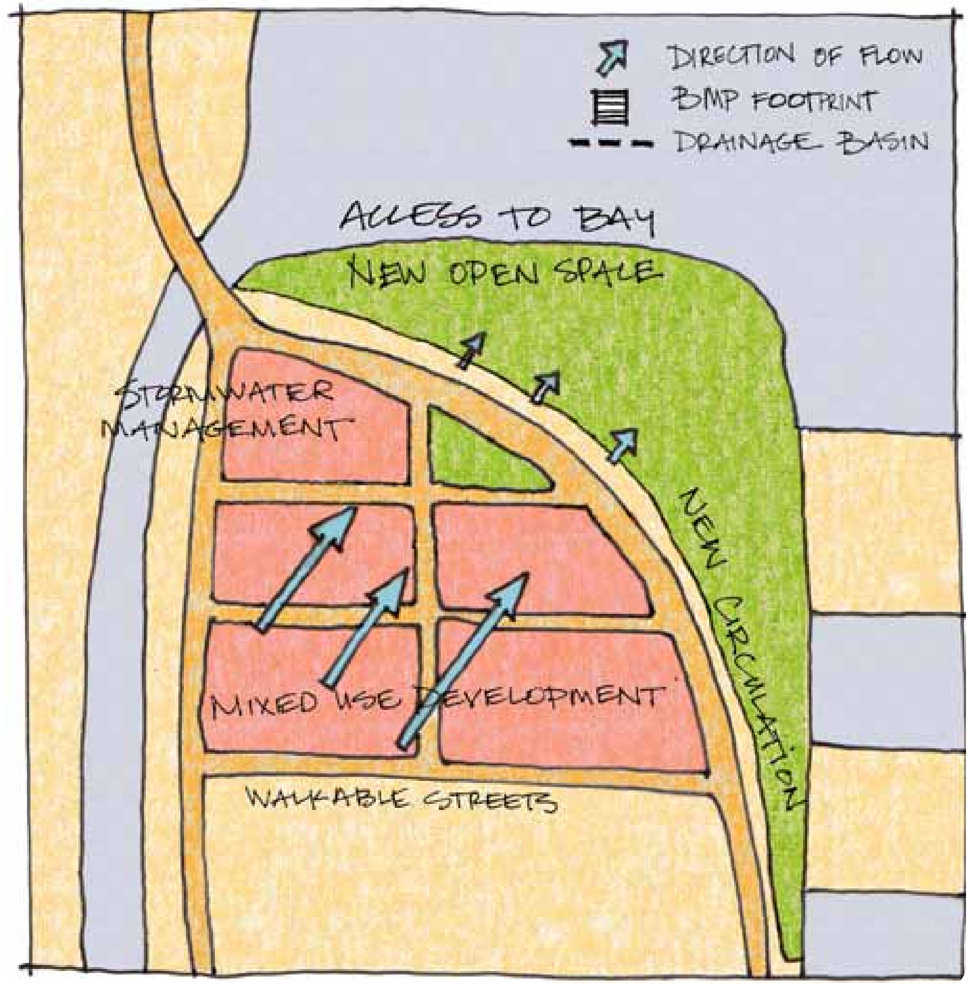
Characterizing existing conditions helps to define the opportunities and constraints that will shape the site design. Opportunities include existing drainage patterns and vegetation, oddly configured or otherwise unbuildable parcels, easements, and landscape amenities, including open spaces that can serve as locations for BMPs. Differences in elevation across the site and existing low-lying areas present opportunities to implement BMPs that reduce or eliminate the need for pumping or other mechanical conveyance, a savings in both installation and long-term operation costs.

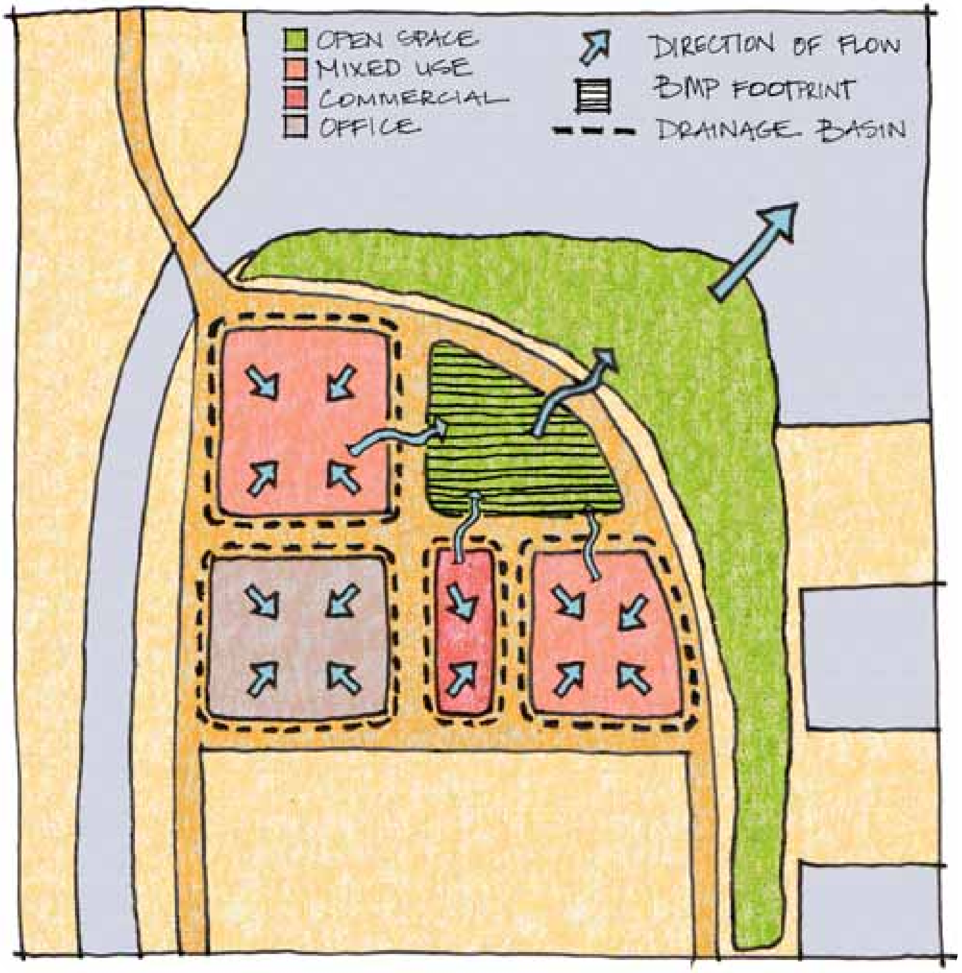
Constraints might include impermeable soils, a high water table, contaminated soils, geotechnical instability, existing utilities, and historic and cultural resources. Site-specific percolation tests and other geotechnical investigations by a certified engineer will be needed to ensure the most effective design solutions.

Step 2

Identify design and development goals

Every project applicant will begin the design process with a set of goals that will impact stormwater management requirements for the site. The program, density, and intensity of land use on a site present both opportunities and constraints for stormwater management. A project applicant intending to build a mixed-use development with high-density housing in the Bayview-Hunters Point neighborhood will approach the design process differently from a project applicant seeking to develop an industrial facility on a waterfront pier. The former might use stormwater to define the character of the public realm and create water features in community open spaces. The latter might use stormwater in cooling towers and wash-down areas to offset potable water use.





Step 3

Develop a site plan

Using the evaluation of existing conditions, along with the design and development goals, project applicants can begin to see how their project will integrate with or alter the hydrology of the site. The site plan should delineate the proposed land uses and major post-development drainage basins and should show, at the conceptual level, how water will move across the site.

Step 4

Develop a site design

Page 28 of this document introduced seven goals to guide the integration of stormwater management into site design. This section identifies strategies to achieve each goal.

Goal 1: Preserve and protect creeks, wetlands, and existing vegetation and other wildlife habitat.

- Incorporate creeks, wetlands, and existing vegetation into the site design (See Appendix D for appropriate vegetation).
- Develop setbacks that protect creeks, wetlands, and sensitive wildlife habitats and also provide usable open space for the public.
- Concentrate development in already developed areas.

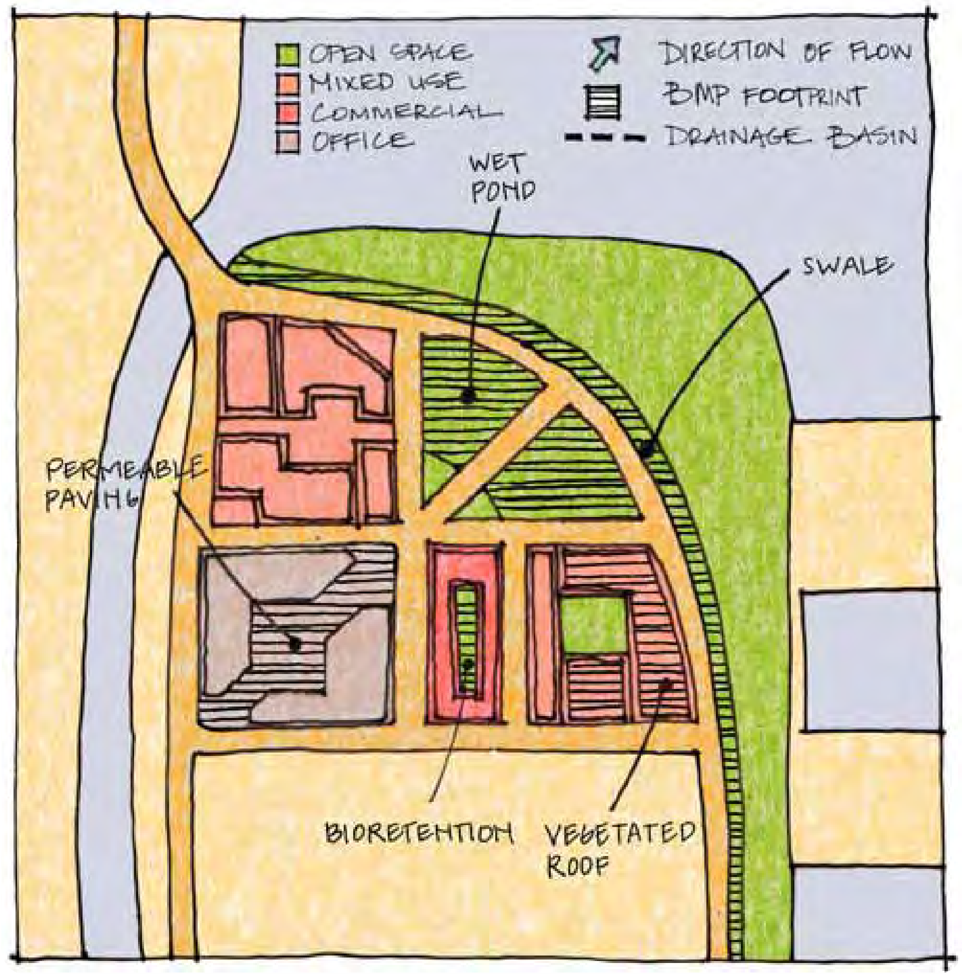
- Encourage high-density, transit-accessible development.
- Encourage clean-up and reuse of brownfield sites.
- Look at each site as an opportunity to protect, enhance, or create wildlife habitat.

Goal 2: Preserve natural drainage patterns and topography and incorporate them into site design.

- Daylight historic watercourses and make them a central element of site design.
- Design stormwater BMPs to take advantage of existing slopes and drainage paths.
- Minimize re-grading and soil impacts.
- Prioritize the use of infiltration-based BMPs where soils, groundwater, and geology allow.

Goal 3: Minimize and disconnect impervious surfaces.

- Design compact, multi-story structures, as allowed by applicable zoning regulations.
- Cluster buildings to reduce the length of streets and driveways, minimize land disturbance, and protect natural areas.
- Design narrow streets and driveways, as allowed by the local jurisdiction.
- Use landscape and permeable paving materials rather than traditional hardscape. Plazas, sidewalks, driveways, streets, parking areas, and patios can be constructed from materials such as crushed aggregate, decomposed granite, turf block, unit pavers, porous asphalt, or pervious concrete.
- Install vegetated roofs to reduce runoff from buildings.
- Minimize parking lot footprints and impacts by building structured parking with alternative roof uses and designing compact parking spaces and space-efficient circulation patterns.



Stormwater treatment facilities enhance public spaces in Portland's South Waterfront redevelopment area.

From the Site to the City

LID is implemented site by site, but each site should be considered in the context of its watershed-wide goals. Over time, incremental improvements will add up to long-term water quality protection for the Bay and Ocean, the restoration of hydrologic function in San Francisco's watersheds, and city-wide greening.

- Drain runoff from impervious areas to pervious areas. In cases where infiltration is not appropriate, landscape features can serve as treatment and conveyance structures and can be fitted with an underdrain to allow for discharge to the municipal storm sewer system or receiving waters.

Goal 4: Design the flow path of stormwater on a site all the way from the first contact to the discharge point.

- Identify the location where stormwater will first enter a site. For example, the first point of contact is often a roof. How will the water travel from the roof to a BMP? In the event that the BMP overflows, where will it discharge?
- Identify an approved discharge location (downstream conveyance system, another BMP or receiving water body) to accommodate flows beyond the capacity of each BMP.
- Design and clearly identify an overflow conveyance system to accommodate flows beyond the BMP's treatment capacity and up to a 100-year storm. All BMPs must have an approved discharge location.

Goal 5: Treat stormwater as a resource, not a waste product.

- Capture stormwater for irrigation, toilet flushing, cooling towers, vehicle wash-down areas, and other non-potable applications.
- Design multi-purpose BMPs that not only manage stormwater but also improve streetscape and public space design.
- Use stormwater for design inspiration.
- Incorporate environmental education and interpretation into LID where appropriate.

Goal 6: Treat stormwater at its source.

- Identify pollutants of concern and their sources early in the design process and install source control measures where appropriate.
- Aim for ubiquitous infiltration of stormwater on site.
- Place treatment BMPs as close to the source of runoff as possible.

Goal 7: Use treatment trains to address a broad array of pollutants.

- Combine stormwater BMPs that target different pollutants to create a treatment train. This strategy ensures higher levels of treatment and reduces the required size of each BMP in the treatment train.
- Pretreatment BMPs, such as sediment forebays, help reduce maintenance costs and improve the overall performance of stormwater BMPs.

Step 5

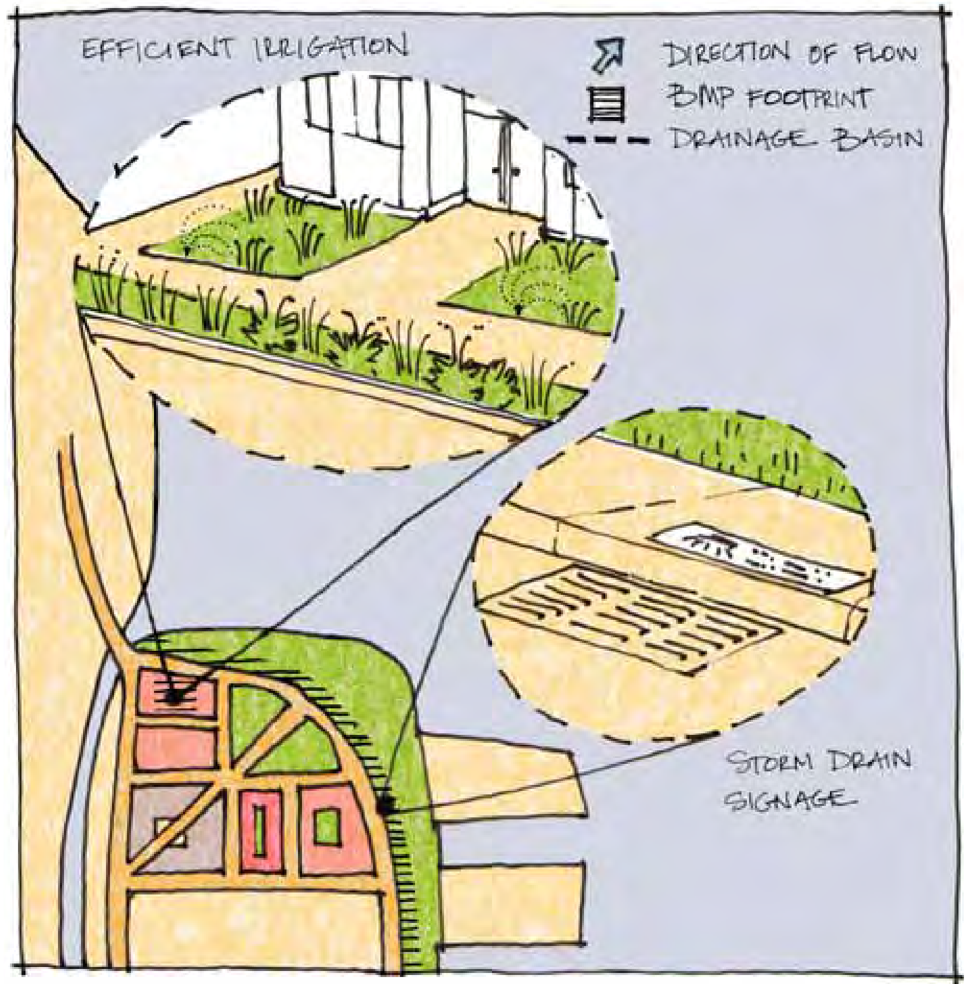
Select and locate source controls

Everyday activities such as recycling, trash disposal, and vehicle and equipment washing generate pollutants such as trash, sediments, oil and grease, nutrients, pesticides, and metals that can be mobilized by stormwater runoff and carried to receiving waters. These pollutants can be minimized by applying source control BMPs. Source control BMPs prevent pollutant generation and discharge by controlling pollution at its source, or, at a minimum, limiting pollutant exposure to stormwater.

Source control BMPs include both structural features and operational practices. Typical structural source control BMPs involve covering, berming, or hydraulically isolating a potential pollutant source area.

Operational source control measures include routine pavement sweeping and substituting traditional materials with those that are less toxic; for example, replacing traditional anodized chain link fencing with vinyl coated fencing.

Specific requirements for land uses and activities that will need to implement source control measures are found in Attachment 4 of the Phase II General Permit (http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/final_attachment4.pdf). The Fact Sheets (Appendix A) include a list of resources for source control measures. Form A of the SCP (Appendix C) guides the project proponent through the source control BMP selection process.



Source Control Requirement

The following uses and activities are required to implement specific source control measures as specified in Attachment 4 of the Phase II General Permit (http://www.waterboards.ca.gov/water_issues/programs/stormwater/docs/final_attachment4.pdf):

- 100,000 sq. ft. commercial developments
- Restaurants
- Retail gasoline outlets
- Automotive repair shops
- Parking lots

A drain adjacent to a trash compactor is connected to the sanitary sewer system. A concrete berm surrounding the trash storage area hydraulically isolates stormwater runoff in this area from the rest of the site.

Hydraulic Isolation

Hydraulic isolation is the practice of separating one drainage area from surrounding areas such that fluids cannot pass between them. This can be done using grading or constructed barriers. Hydraulic isolation allows designers to treat runoff and waste from the isolated area according to the specific pollutants found there. In some cases, hydraulically isolated areas can be connected to the sanitary sewer system rather than the storm sewer system.

Vehicle wash racks and trash compactor areas are examples of areas that can be hydraulically isolated to protect surrounding areas from the soap, grease, oil, sediments, trash and other pollutants associated with those activities.

Integrated Pest Management

Integrated Pest Management (IPM) is an ecological approach to suppressing pests. IPM uses information on the life cycle of pests, along with multiple pest control techniques, to keep pests at acceptable levels in an economical and environmentally safe way. IPM focuses on monitoring and preventing pests and using low-risk pest control techniques. Because pest problems are often symptomatic of ecological imbalances, the goal is to plan and manage ecosystems to prevent organisms from becoming pests in the first place. This means developing landscape plans that focus on the use of native or Mediterranean plant species suited to San Francisco's climate and soil conditions (Appendix D). IPM principles help to reduce or eliminate the use of pesticides; thereby reducing the risk that stormwater runoff will mobilize pesticides and carry them to collection systems or receiving water bodies.

Step 6

Select and Locate Treatment BMPs

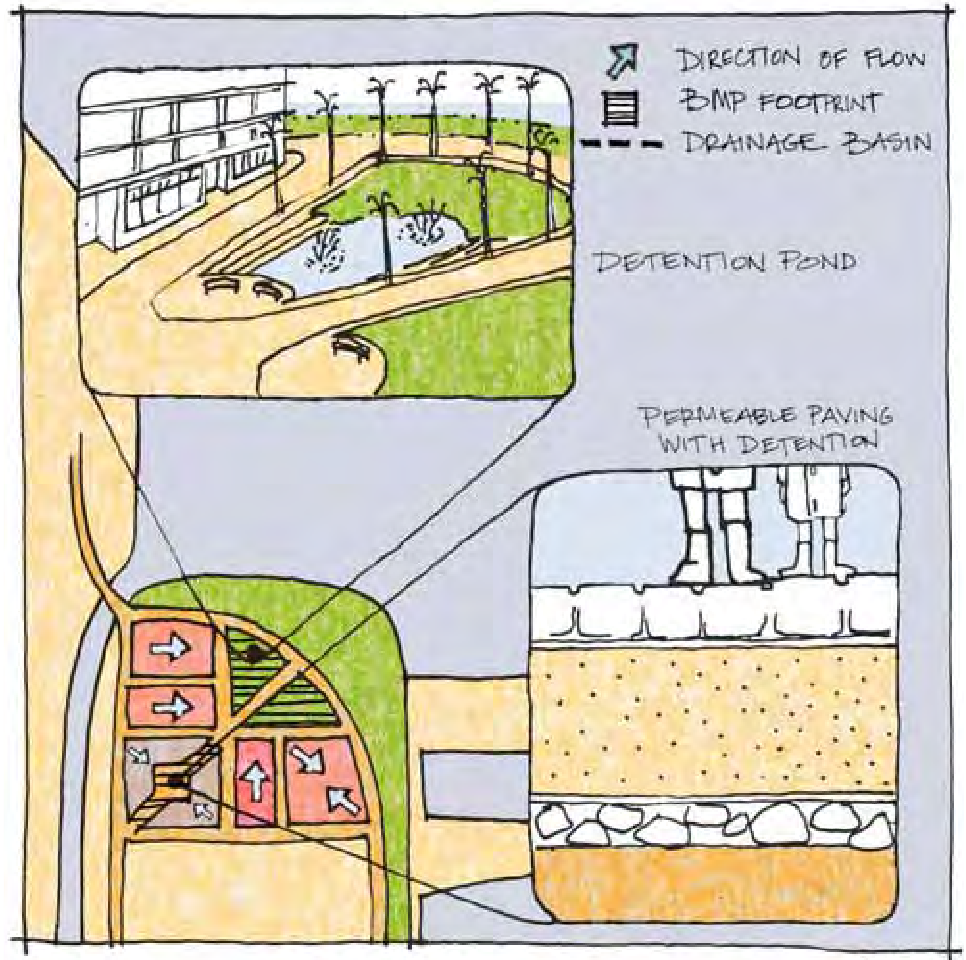
Site design and source control make significant contributions to effective stormwater management. But achieving treatment to the MEP also requires the implementation of treatment control BMPs. The selection of stormwater treatment BMPs is guided by existing site conditions, design and development goals, and the pollutants of concern for the site.

The two-step BMP selection process outlined here will help project applicants to identify a suite of site-specific treatment BMPs. The first step is to use the BMP Decision Tree (see Figure 22), to identify BMPs that are suitable for a given site. The second step is to narrow the list of suitable BMPs to the ones that target the pollutants of concern that have been identified for a given site.

The BMP Decision Tree

The BMP Decision Tree will help project applicants use site-specific information to select the BMPs that are most appropriate given the conditions at their site. BMPs that are not suitable will be eliminated from consideration.

The BMP Decision Tree prompts the project applicant to consider specific site characteristics that affect BMP design. The answers narrow the field of appropriate BMPs. On-site percolation tests and geotechnical investigations must be done during the site analysis to determine whether infiltration-based BMPs are feasible for the site (for instance, is there adequate depth to groundwater, which for most sites will be 10 feet). However, infiltration-



El Monte Sagrado Spa in Taos, New Mexico uses wetlands to treat stormwater so that it can be used to fill spa pools.

Permeable pavement can be integrated into a variety of hardscapes such as roads and sidewalks, plazas, terraces and patios.

based BMPs need not always be eliminated based upon this information. Rather, a modified design solution can make a BMP feasible. Vegetated swales can be used for stormwater treatment in areas with poor infiltration or contaminated soils provided that they are lined with an impermeable liner, underdrained, and constructed with clean import soil. See the BMP Fact Sheets in Appendix A for information on liners and underdrains.

Steep slopes can limit the range of appropriate BMPs for a given site because they can cause high flow rates and instability. Terracing the site is one design solution that could allow the implementation of slope-dependent BMPs on a steep site. Check dams can also be used to mitigate problems caused by steep slopes.

After all of the information has been evaluated, the BMP Decision Tree will indicate one of three outcomes for a given site:

- All BMPs are feasible;
- A subset of BMPs is feasible for unconditional implementation; or
- A subset of BMPs is feasible with conditions.

The resulting list of BMPs can then be evaluated for their effectiveness in treating the pollutants of concern for the project. Project applicants should include the results of the Decision Tree process in their SCP.

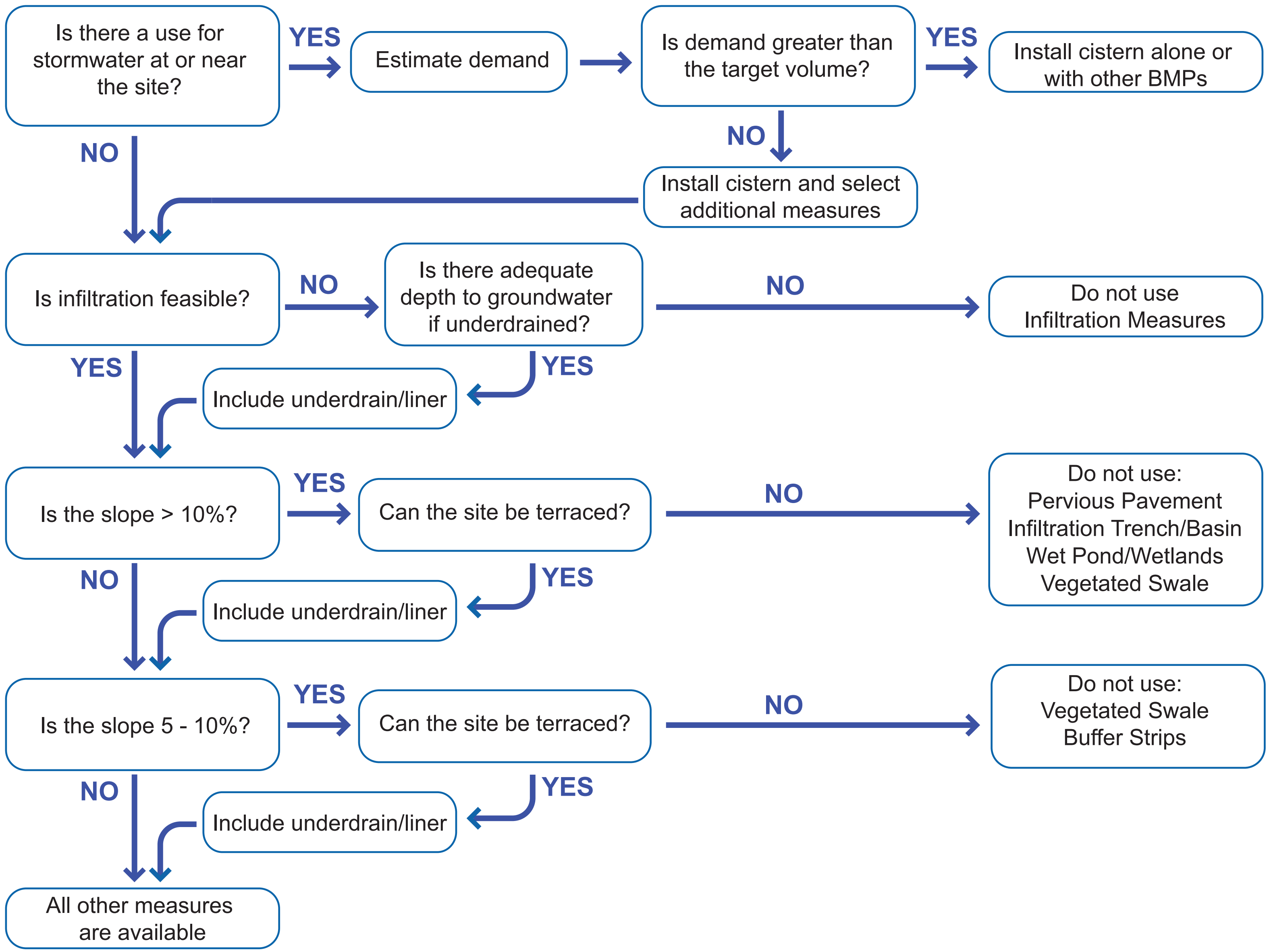


Figure 22. *Stormwater BMP Decision Tree*

Weirs (top) and cascades (bottom) make street-side bioretention possible on steep slopes in Seattle, WA.

Match BMPs with Pollutants of Concern

Table 6 includes a list of pollutants typically found in stormwater runoff and their association with common San Francisco land uses. Project applicants can use the table to screen for likely pollutants of concern, but identifying the specific commercial and industrial activities proposed for a site provides a better indication of which pollutants to target. For example, a restaurant would need to include BMPs to prevent oil and grease from contacting stormwater, and roadways in any project bring up concerns about metals, oil and grease, and sediments.

After project applicants consult Table 6 to anticipate the pollutants of concern for their proposed land uses, they can use Table 7 to identify BMPs that both treat pollutants of concern and are deemed appropriate for the physical site conditions by the BMP Decision Tree. To learn more about each BMP listed in the table, see the BMP Fact Sheets in Appendix A.

Land Use Type	Metals	Sediments	Trash	Oil and Grease	Organics	Nutrients
High Density Residential	•	•	•	•		•
Low Density Residential	•	•	•	•		•
Mixed Use	•	•	•	•	•	•
Light Industrial	•	•	•	•		
Heavy Industrial	•	•	•	•	•	
Open Space		•	•		•	•
Piers Over Water	•	•	•			
Former Shipyards	•	•	•	•	•	•

Table 6. *Typical pollutants associated with common San Francisco land uses*

Treatment Control		Metals	Sediments	Trash	Oil and Grease	Bacteria	Organics	Nutrients
Infiltration								
	Dry Well	●			●	●	●	●
	Infiltration Basin	●	○p	○p	●	●	●	●
	Infiltration Trench	●	○p	○p	●	●	●	●
	Permeable Pavement	◒	●p	○p	○	◒	◒	●
Detention								
	Constructed Wetland	●	●p	○p	●	●	●	◒
	Detention Pond	◒	◒p	○p	◒	◒	◒	○
	Detention Vault	○	◒	○	◒	○	○	○
	Wet Pond	●	●p	○p	●	●	●	◒
Bioretention								
	Flow-through Planter	●	●p	○p	●	●	●	◒
	Rain Garden	●	●p	●p	●	●	●	●
Biofiltration								
	Vegetated Buffer Strip	●	●p	◒p	◒	○	◒	○
	Vegetated Swale	◒	◒	○	◒	○	◒	○
	Media Filter	●	●p	●p	●	●	●	●
	Sand Filter	●	●	●	●	●	◒	◒
	Vegetated Rock Filter	◒	●p	○p	●	◒	●	●
	Swirl Separator	○	●	●	◒	○	○	○
	Water Quality Inlet	○	◒	◒	◒	○	○	○
	Drain Insert	◒	◒	●	◒	○	○	○
Retention								
	Rainwater Harvesting*							

○ Low ◒ Moderate ● High p Requires Pre-treatment

Rainwater Harvesting does not provide stormwater treatment. However, it prevents polluted stormwater from reaching receiving water bodies.

Table 7. *BMPs that capture or treat pollutants typically found in stormwater runoff.*

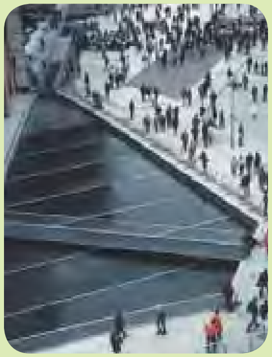
Treatment Trains

A single treatment BMP may not adequately treat the entire range of pollutants from its contributing watershed, especially in large developments involving diverse activities. For example, some treatment BMPs are designed to remove fine suspended sediment but may not be able to remove dissolved metals. Because of this, a combination of several BMPs in succession may be needed to treat all of the pollutants on a given site.

A combination of BMPs, constructed in a series to target specific pollutants, is called a treatment train. Treatment trains not only improve water quality, they also improve the long-term efficiency and reduce the maintenance requirements for each treatment BMP involved in the train. Heavy sediments and trash can negatively impact BMP performance, thus silt traps and sediment forebays are commonly used as a first step in the treatment process. In the same way that pre-rinsing dirty dishes increases the efficacy and efficiency of a dishwasher, removing sediment prior to infiltration of stormwater will improve the long-term capacity of the underlying soils to infiltrate water by preventing sediment from clogging pore spaces that allow the movement of water through the soil.

Common treatment train configurations include:

- Silt trap → Swale → Wetland
- Cistern → Rain garden
- Retention basin → Sand filter
- Vegetated strip → Infiltration trench

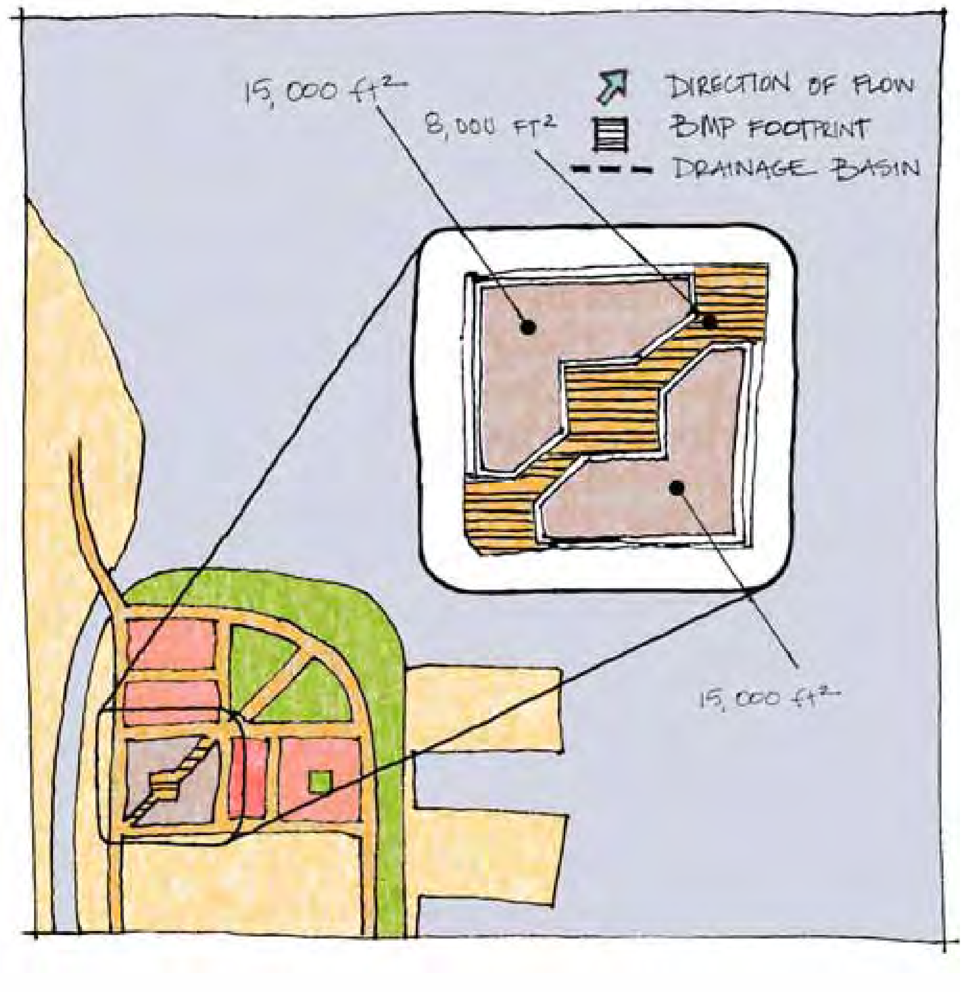


Case Study: Berlin Treatment Train

The design for Potsdamer Platz, one of Berlin's most important public squares, includes a stormwater treatment train that uses multiple stormwater management strategies (indoor use, storage, biofiltration, and outdoor use) to control both the quality and the volume of stormwater on-site. The roofs of the development, some of which are vegetated roofs and some of which are traditional, harvest rainwater to be used in the buildings for toilet flushing and irrigation. During large storm events, five underground cisterns store rainwater and then release it slowly into a series of pools and planted 'biotopes' for filtration. In the summer months, additional filters can be added to remove algae. Treated rainwater then flows through a very popular outdoor waterscape where employees and visitors gather. Like San Francisco, Berlin has an average annual rainfall of 21 inches.

Treatment Train Principles

- Think of each element in a treatment train as a separate functional unit.
- Before adding additional elements to a treatment train, analyze their performance relative to previous BMPs in the train. If the expected water quality benefits are limited, the increase in cost may outweigh the benefits.
- Do not alter or remove design measures used to reduce the size of stormwater treatment measures without a corresponding resizing of associated stormwater treatment BMPs, otherwise the capacity of the BMPs will be exceeded.



Step 7

Size Treatment BMPs

After selecting a suite of treatment BMPs that are appropriate for the site conditions and target the pollutants of concern, project applicants will need to size these BMPs to achieve the required stormwater performance standards. This section explains how to size treatment BMPs, but project applicants can also use the automated electronic sizing spreadsheets provided in Appendix B, which can also be found on the SFPUC and Port websites at www.sfwater.org and www.sfport.com. While the Port and SFPUC do not require the use of the sizing spreadsheets for BMP design, project applicants must complete Table 1 of the electronic sizing spreadsheet in Appendix B to document drainage parcels and design flow rates and volumes. This information is required in the SCP.

The performance measures discussed in this section aim to protect the water quality of receiving water bodies. They meet all regulatory requirements and are the foundation of the BMP sizing spreadsheet. For information about how the performance measures were developed, please see the resources at the end of this section.

A rain garden at Glencoe Elementary in Portland, Oregon reduces stormwater flows to Portland's collection system.

Treatment Control		Sizing Design Criteria: Flow-based	Sizing Design Criteria: Volume-based
Infiltration	Dry Well		•
	Infiltration Basin		•
	Infiltration Trench		•
	Permeable Pavement		•
Detention	Constructed Wetland		•
	Detention Pond		•
	Detention Vault		•
	Wet Pond		•
Bioretention	Flow-through Planter	•	
	Rain Garden	•	• (if infiltrating)
Biofiltration	Vegetated Buffer Strip	•	
	Vegetated Swale	•	
	Media Filter	•	
	Sand Filter	•	
	Vegetated Rock Filter	•	
	Swirl Separator	•	
	Water Quality Inlet	•	
	Drain Insert	•	
Retention	Rainwater Harvesting		•

Table 8. *Treatment control measures and sizing methods*

Port Requirements

Stormwater performance measures for areas in the separate sewers operated by the Port require the capture and treatment of:

(a) The flow of stormwater runoff resulting from a rain event equal to at least 0.2 inch per hour intensity; or

(b) Eighty percent or more of the annual stormwater runoff volume, determined from unit basin storage volume capture curves for San Francisco (see Figure 23).

Performance measure (a) should be used for sizing flow-based BMPs, such as vegetated swales or flow-through planters. These are BMPs whose primary mode of pollutant removal depends on the flow rate of runoff through the BMP. Performance measure (b) should be used for sizing volume-based BMPs, such as infiltration basins or detention basins. These are BMPs whose primary mode of

Requirement

The Port's stormwater performance measures for areas served by separate storm sewers require the capture and treatment of:

(a) The **flow** of stormwater runoff resulting from a rain event equal to at least 0.2 inch per hour intensity; **or**

(b) Eighty percent or more of the annual stormwater runoff **volume** determined from design rainfall capture curves for San Francisco. The maximum drawn-down time for stormwater captured during a rain event is 48 hours.

pollutant removal depends on the volumetric capacity of the BMP. These performance measures are adapted from the General Permit.

Project applicants should determine which sizing criteria apply to each BMP and size the facility accordingly. Many BMPs can be designed to attain both flow-based and volume-based stormwater management goals, but they are most often categorized as one or the other (see Table 8).

Flow-based Sizing

The recommended method for hydraulically sizing flow-based treatment BMPs is the Uniform Intensity Approach and is used in conjunction with the Rational Method for estimating stormwater flows. It is also described in the CASQA 2003 Stormwater Best Management Practice Handbook New Development and Redevelopment. Automated electronic sizing spreadsheets can be found at www.sfwater.org and www.sfport.com, and are described in Appendix B. The Rational Method is used as follows:

1. **Identify each drainage management area on the site.** A drainage management area is a discrete area or subwatershed. The runoff from each drainage management area will drain its own treatment control BMP(s). The steps below should be applied to each drainage management area.

2. **Determine the area in acres (A)** of the drainage management area that drains to the proposed BMP(s).

3. **Assign a Runoff Coefficient**, or C-factor, to each land surface in the drainage management area. The C-factor describes the percentage of runoff generated by different types of surfaces during rain events. Surfaces that produce higher volumes of runoff, such as concrete, have relatively higher C-factors, while surfaces that produce lower volumes of runoff, such as landscaped areas, have relatively lower C-factors. Table 9 lists established C-factor values for each land surface.

4. **Calculate the Composite C-factor (C)**, a weighted average of all the C-factors for all the surfaces in the drainage management area. Multiply each C-factor by the area of the surface it applies to. Add the results and divide by the total site area.

Flow-Based Sizing

The Rational Method: Q=CiA

Where:

Q = flow in ft^3/second

C = composite runoff coefficient (composite C-factor)

i = rainfall intensity in inch/hour (0.2 inch/hr recommended)

A = drainage area in acres

Type of Surface	*Typical Range*	*Recommended Value*
Asphalt	*0.7 - 0.95*	*0.8*
Concrete	*0.8 - 0.95*	*0.9*
Brick	*0.7 - 0.85*	*0.8*
Roofs	*0.75 - 0.9*	*0.85*
Pervious Concrete	*0.1 - 0.3*	*0.2*
Pervious Asphalt	*0.1 - 0.3*	*0.2*
Paving Stones	*0.1 - 0.7*	*0.4*
Grass Pavers/Turf Blocks	*0.15 - 0.6*	*0.35*
Lawns and Grass:		
sandy soil, slope <2%	*0.05 - 0.1*	*0.08*
sandy soil, slope >7%	*0.15 - 0.2*	*0.17*
heavy soil, slope <2%	*0.13 - 0.17*	*0.15*
heavy soil, slope >7%	*0.25 - 0.35*	*0.3*
Landscaping	*0.15 - 0.3*	*0.2*
Crushed Aggregate	*0.15 - 0.3*	*0.25*

Table 9. *Typical runoff coefficients*

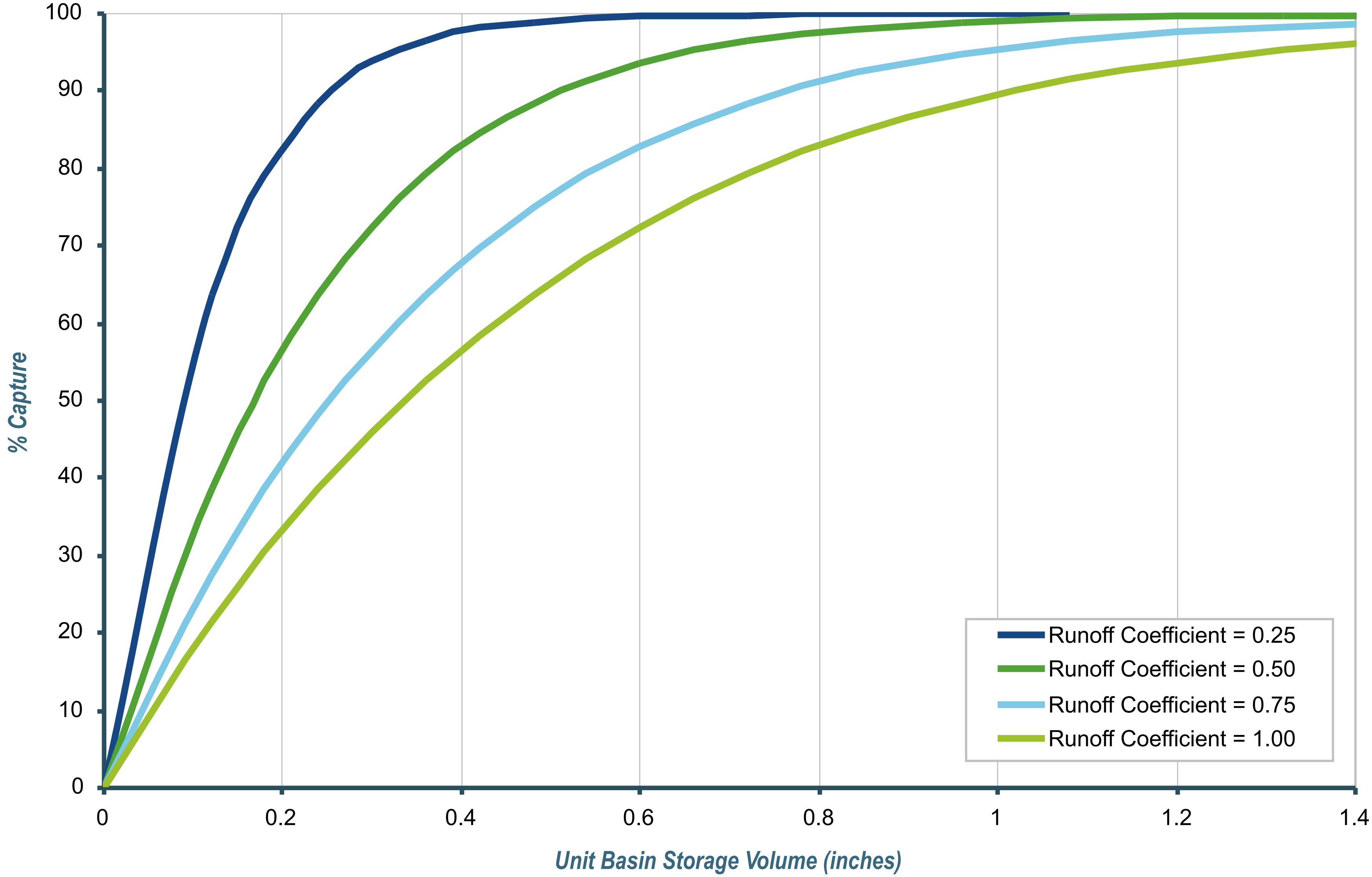


Figure 23. *Composite runoff coefficients and unit basin storage volume for 80 percent capture with 48-hour drawdown*

5. **Use a design rainfall intensity (i) of 0.2 inch per hour**. This intensity represents twice the 85th percentile hourly depth, which can be derived by ranking the hourly depth of rainfall from storms over the period of record. The General Permit specifies that, for water quality protection, the design rainfall intensity be equal to or greater than twice the 85th percentile hourly depth.

Q = CiA yields the design flow rate **(Q)**, in cubic feet per second, that a BMP must accommodate to meet the performance measures. For more information on sizing flow-based treatment BMPs, see the Fact Sheets in Appendix A and the sizing spreadsheets in Appendix B.

Volume-based Sizing

The recommended method for hydraulically sizing volume-based stormwater treatment BMPs is based upon a goal of 80% annual stormwater volume capture within a 48-hour draw-down period. This method is further described in CASQA's 2003 Stormwater Best Management Practice Handbook New Development and Redevelopment, which is available at www.cabmphandbooks.com.

The following steps explain how to calculate each variable.

1. **Identify each drainage management area on the site.** A drainage management area is a discrete area or subwatershed. The runoff from each drainage management area will drain its own treatment control BMP(s). The steps below should be applied to each drainage management area.

2. **Determine the area in acres (A)** of the drainage management area that drains to the proposed BMP.

3. **Calculate the Composite C-factor** for the drainage management area using the method described in steps 3 and 4 of the flow-based sizing section.

4. **Use the composite C-factor** to interpolate a Unit Basin Storage Volume value (in inches) from the unit basin storage volume curves in Figure 23. Interpolate between the reference C values as necessary to determine a Unit Basin Storage value. A 48-hour draw-down time is recommended, unless soils at the site are coarse.

Volume-Based Sizing

BMP Capture Volume =
BMP Drainage Area x **Unit Basin Storage Volume**

Where:

BMP Capture Volume = the volume of water that the BMP must capture to achieve compliance with the volume-based performance measures.

BMP Drainage Area = the contributing drainage area for the BMP.

Unit Basin Storage Volume = the depth of rainfall, in inches, that is related to a percentage of annual runoff capture. It is determined for various runoff coefficients from historical rainfall records.

Rainwater harvesting is a volume-based BMP that can be used to collect water for various types of industrial operations, resulting in reduced utility costs.

5. **Calculate the BMP Capture Volume** by multiplying the **BMP Drainage Management Area** by the **Unit Basin Storage Volume**. Convert to cubic feet for easy interpretation.

The BMP Capture Volume is the volume needed to meet regulatory standards for stormwater treatment. This or a larger volume must be used for BMP design. The BMP Capture Volume must be recorded and submitted in the SCP. The BMP Fact Sheets in Appendix A and sizing spreadsheets in Appendix B also contain information pertinent to sizing volume-based treatment BMPs.

SFPUC Requirements

Stormwater performance measures for areas in the separate sewers under the jurisdiction of the SFPUC require the capture and treatment of rainfall from a 0.75-inch design storm, which is equivalent to LEED Sustainable Sites Credit 6.2.

To meet the SFPUC performance measure and earn LEED Credit SS6.2, use the following calculation:

V = CAd, where **V** = Volume of water in cubic feet, **A** = size of the drainage management area in square feet, **C** = runoff coefficient, and **d** = rainfall depth in inches.

1. **Determine the area in square feet (A)** of the drainage management area, also known as a subwatershed, that drains to the proposed BMP.

2. **Calculate the Composite C-factor (C)** for the drainage management area using the method described in steps 3 and 4 of the flow-based sizing section.

3. **Use 0.75 inch as the design rainfall depth (d)** for the facility. This design rainfall depth corresponds to LEED Credit SS6.2 for semi-arid watersheds.

5. **Calculate the Volume** by multiplying **C**, **A**, and **d**. Divide by 12 to convert to cubic feet. The maximum allowable draw-down time is 48 hours.

The BMP must capture a volume of water equal to or greater than the volume calculated using the equation above to meet regulatory standards for stormwater treatment. The volume that the BMP will capture must be recorded and submitted in the SCP. The

BMP Sizing

V=CAd

Where:

V = volume in ft^3

C = composite runoff coefficient (composite C-factor)

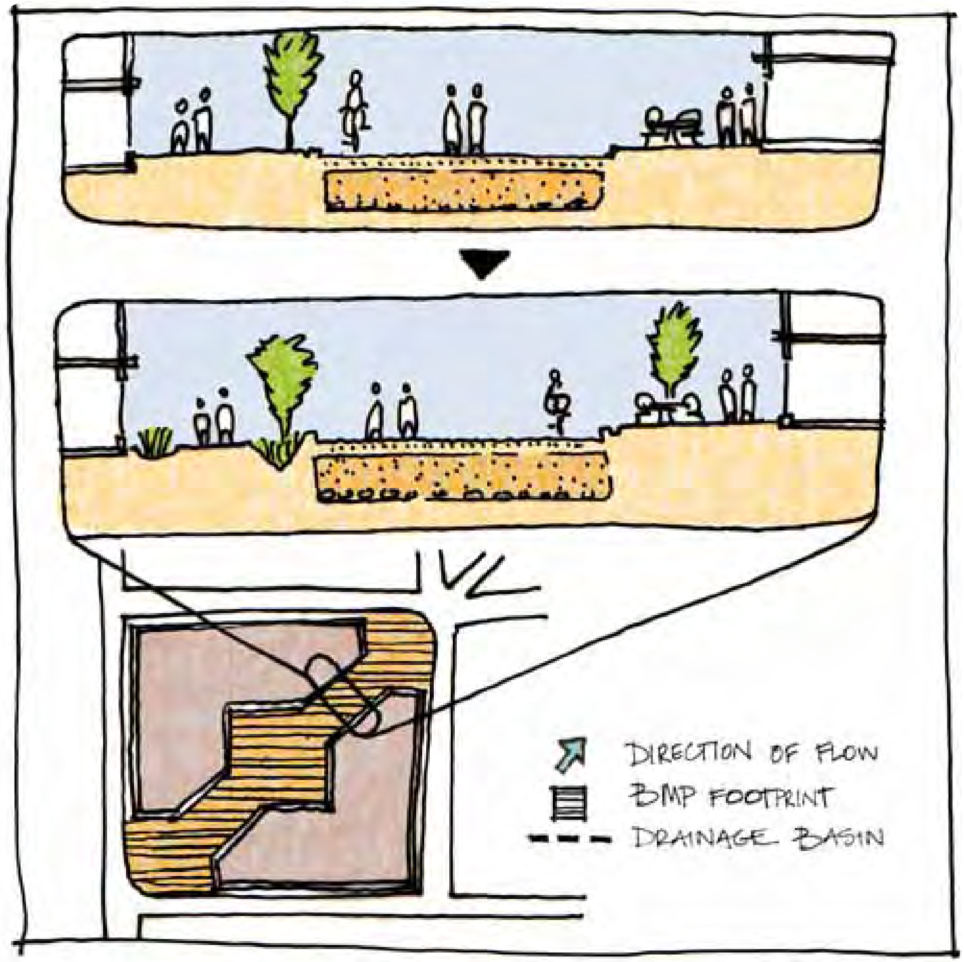
A = drainage area in square feet

d = design rainfall depth in inches

(use 0.75 inch)

"BMP Fact Sheets" in Appendix A and the sizing spreadsheets in Appendix B also contain information pertinent to sizing volume-based treatment BMPs.

Project applicants in combined sewer areas under SFPUC jurisdiction must achieve LEED SS6.1 to reduce the flow and volume of stormwater into the collection system. SFPUC staff is in the process of creating additional guidance for achieving SS6.1. In the meantime project applicants are encouraged to consult *LEED for New Construction Version 2.2* and contact Urban Watershed Management Program staff if necessary.

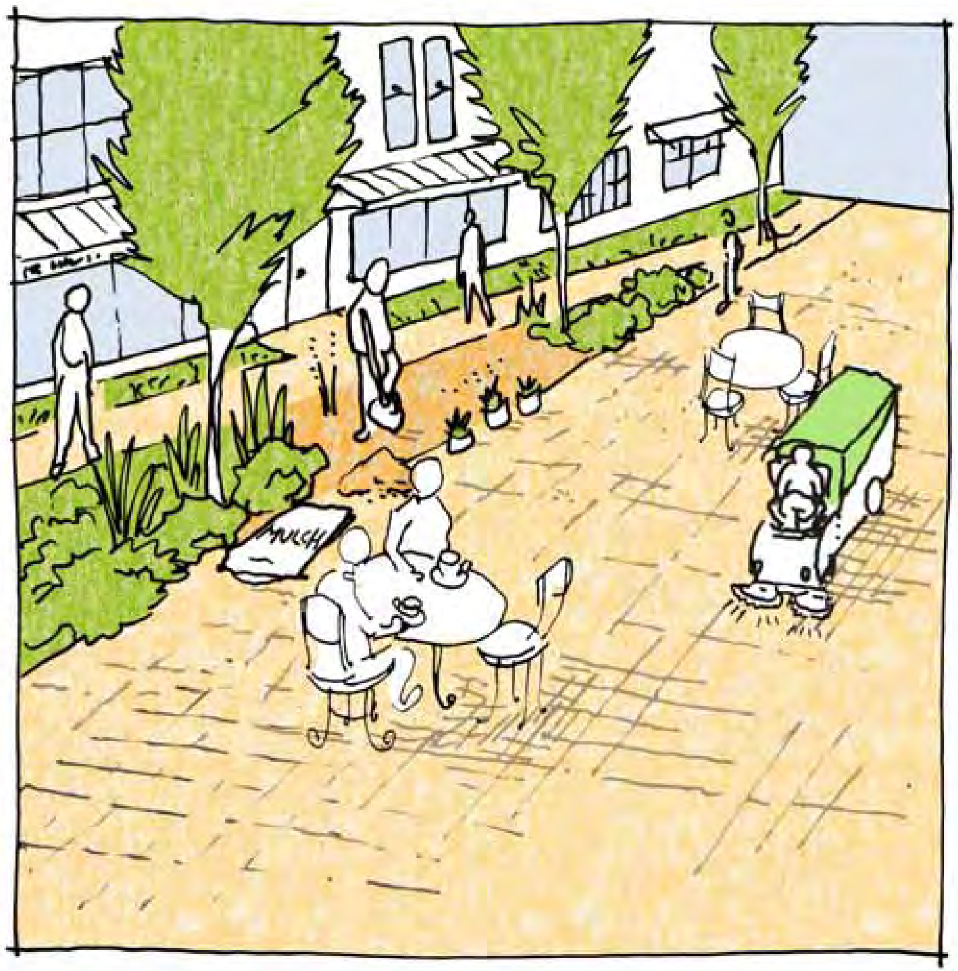


Step 8

Check against Design Goals and Modify if Necessary

After site design, source control, BMP selection, and BMP sizing are completed, project applicants should review the original design goals and evaluate whether they have been achieved. If not, an iterative design process that may include BMP relocation or resizing can ensure that the project achieves its design and development goals and complies with stormwater treatment requirements.

At this stage in the design process, there is a general understanding of how the runoff will move across the site, source control measures have been identified and located, treatment controls have been selected based on site conditions and pollutants of concern, and target water quality volumes and flow rates have been calculated. The next task is to locate and size the actual treatment controls. Sizing tools for each treatment control are



included with the Fact Sheets in Appendix B, and are available electronically at www.sfwater.org and www.sfport.com.

Step 9

Develop an Operations and Maintenance Plan

Treatment and control facilities must be regularly maintained to ensure that they continue to provide effective treatment and do not harbor mosquitoes, cause flooding, or otherwise create a nuisance. Improper maintenance is one of the most common reasons for BMP underperformance and failure.

The General Permit requires that project applicants provide verification of maintenance provisions "through such means as may be appropriate, including, but not limited to legal agreements, covenants, CEQA mitigation requirements and/or Conditional Use Permits." Stormwater facilities installed as part of new development or redevelopment projects will be incorporated into both the Port's and SFPUC's operation and maintenance verification program. An operations and maintenance plan is a required element of the SCP. To develop an operations and maintenance program for new facilities, follow these steps:

1. **Identify who will own or have operational responsibility** for the facility. In the case of Port facilities, operational responsibility will be assigned through lease and development agreements. In the case of privately owned facilities regulated by the SFPUC the property owner will be responsible for operations and maintenance.

2. **Identify applicable maintenance requirements** for each stormwater control at the facility and list the requirements into the SCP. The SCP must identify any title transfers, lease provisions, or maintenance agreements that will be executed before construction is complete.
3. **Develop an Operations and Maintenance Plan** (O&M Plan) for the site incorporating detailed requirements for each treatment and control BMP at the facility. The O&M Plan must be submitted before the building permit is finalized and a certificate of occupancy is issued. Any necessary agreements must be executed concurrent with submittal of the O&M Plan.
4. **Maintain the facilities** from the time of construction until ownership or lease is formally transferred.
5. **Formally transfer** operation and maintenance responsibilities to any new owner, occupant or lessee. **The transfer will require the new owner, occupant, or lessee to maintain facilities in perpetuity and comply with Port and SFPUC self-inspection, reporting, and verification requirements.**

Mulching is an important part of BMP maintenance.

Designing to Minimize Maintenance

Streamlined maintenance and maximized performance can be achieved by considering the following design features:

- Use pretreatment systems to remove coarse sediment and litter, particularly for infiltration systems. Pretreatment systems can also reduce the velocity of flows entering the treatment BMP, reducing wear on the BMP and extending its useful life.
- Use deeper rooted vegetation in conjunction with infiltration BMPs. Good root structure helps to maintain soil porosity and reduces the maintenance needs of the BMP. For a list of recommended vegetation species, see Appendix D.
- Whenever possible, select BMPs that do not require slow-release control structures. Such structures can clog and require periodic inspection and maintenance.
- Stormwater facilities that are above-ground are more likely to be visible and therefore receive maintenance.

Regular inspections are required in order to maintain the effectiveness of treatment control BMPs. Inspection and maintenance activities can be divided into two functions:

1. Scheduled routine inspection and maintenance, and
2. Non-routine repair and maintenance.

Routine inspection can reveal potential problems with BMP operations and help to ensure the highest level of pollutant removal. Routine maintenance refers to activities performed on a regular basis to keep the BMP in good working order. These activities are generally not complicated (sediment removal, landscape work, etc.) and can be performed by most facility maintenance staff. Typical maintenance activities are described in each of the BMP Fact Sheets included in Appendix A.

Step 10

Compile the Stormwater Control Plan

A Stormwater Control Plan (SCP) with exhibits – as described in the SCP template (Appendix C) – must be submitted to the Port or SFPUC as part of the planning approval process. The completed SCP must include the following information:

- Information on Project Owner/Developer and Design Team
- Project location
- Project description
- A site plan showing proposed project
- Any soils or geotechnical reports necessary to complete stormwater design
- Site analysis for locating and sizing BMPs
- A site drainage plan showing direction of stormwater flow to the point where it enters the storm sewer system or receiving waters
- Stormwater sizing calculations
- A post-construction O&M Plan
- Refer to Appendix C for a template of an SCP.

References and Resources

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San Francisco Stormwater Design Guidelines
November 2009 Version - Updates and errata will be published as necessary

*"Water is the most critical resource issue of our lifetime and our children's lifetime.
The health of our waters is the principal measure of how we live on the land."*
- Luna Leopold

SEAL OF THE CITY AND COUNTY OF SAN FRANCISCO

PORT OF SAN FRANCISCO

SFPUC
Water
Wastewater
Power

Law Offices of
THOMAS N. LIPPE, APC

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San Francisco, California 94105

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Email: Lippelaw@sonic.net

EXHIBITS 5-13

To Mission Bay Alliance Comment Letter dated July 24, 2015

Re: Hydrology, Water Quality and Biological Impacts - Comments on Draft Subsequent Environmental Impact Report for the Event Center and Mixed Use Development at Mission Bay Blocks 29-32 (Warriors Arena Project); San Francisco Planning Department Case No. 2014.1441E; State Clearinghouse No. 2014112045

EXHIBIT 5

http://www.epa.gov/pcbsincaulk/
Last updated on 2/21/2014

Polychlorinated Biphenyls (PCBs)

PCBs in Caulk in Older Buildings

You will need Adobe Reader to view some of the files on this page. See EPA's PDF page to learn more.

Page Contents

Overview

In recent years, EPA has learned that caulk containing potentially harmful polychlorinated biphenyls (PCBs) was used in many buildings, including schools, in the 1950s through the 1970s. Most schools and buildings built after 1979 do not contain PCBs in caulk. On September 25, 2009, EPA announced new guidance for school administrators and building managers with important information about managing PCBs in caulk and tools to help minimize possible exposure. Through EPA PCB Regional Coordinators, the Agency will also assist communities in identifying potential problems and, if necessary, developing plans for PCB testing and removal.

For more information:

- PCBs in Caulk Fact Sheet (PDF) (2 pp, 26 KB)
- PCBs In Caulk Frequent Questions (PDF) (14 pp, 101 KB)

The EPA is conducting research to address several unresolved scientific questions that must be better understood to assess the magnitude of the problem of PCBs in caulk and identify the best long-term solutions. For example, the link between the concentrations of PCBs in caulk and PCBs in the air or dust is not well understood. The Agency is doing research to determine the sources and levels of PCBs in schools and to evaluate different strategies to reduce exposures. The results of this research will be used to provide further guidance to schools and building owners as they develop and implement long-term solutions. Read more about Research on PCBs in Caulk.

EPA has calculated prudent public health levels that maintain PCB exposures below the "reference dose" – the amount of PCB exposure that EPA does not believe will cause harm. Read Public Health Levels for PCBs in Indoor School Air || PDF version (2 pp, 14 KB)

Background

Caulk is a flexible material used to seal gaps to make windows, door frames, masonry and joints in buildings and other structures watertight or airtight. At one time caulk was manufactured to contain PCBs because PCBs imparted flexibility.

First Step: Take Steps to Minimize Exposure

PCBs in Caulk Hotline

For additional information call 1-888-835-5372

Highlights

PCB Guidance Reinterpretation

Important Resources

- Find your EPA Regional PCB Coordinator
- Preventing Exposure to PCBs in Caulking Material (PDF) (4 pp, 1.1 MB) || en Español (PDF) (4 pp, 2.7 MB)
- General information on PCBs in older schools and buildings (PDF) (1 pg, 162 KB)
- Schools checklist (PDF) (1 pg, 414 KB)
- Contractors Handling PCBs in Caulk During Renovation HTML || PDF (4 pp, 1.9MB) || PDF en Español (4 pp, 1.8 MB)
- PCBs in School Research
- Public Health Levels for PCBs in Indoor School Air (PDF) (2 pp, 14 KB)
- Steps to Safe Renovation and Abatement of Buildings That Have PCB-Containing Caulk

Although this is a serious issue, the potential presence of PCBs in schools and buildings should not be a cause for alarm. If your school or building was built or renovated between 1950 and 1979, there are several steps schools can take to reduce potential exposure until it can be determined with certainty if PCBs are present in caulk used in the building and any contaminated caulk can be removed. One of the most important steps is to minimize the potential for PCBs to be present in the indoor air. Indoor air levels of PCBs within a school can be reduced by ensuring that the ventilation system is operating as designed, and to repair or improve the system if it is not.

Many old lighting systems contain ballasts manufactured with PCBs. These PCBs can get into the air if the ballast fails or ruptures. Replacement of old lighting systems with new, energy efficient systems will eliminate a potential source of PCBs.

Other steps include:

- Clean frequently to reduce dust and residue inside buildings.
- Use a wet or damp cloth or mop to clean surfaces.
- Use vacuums with high-efficiency particulate air (HEPA) filters.
- Do not sweep with dry brooms; minimize the use of dusters.
- Wash children's hands with soap and water often, particularly before eating.
- Wash children's toys often.
- Wash hands with soap and water after cleaning, and before eating or drinking.

EPA also has developed an informational brochure to provide the general public with important information on PCBs in building caulk, Preventing Exposure to PCBs in Caulking Material || PDF version (4 pp, 2.7 MB) || en Español (PDF) (4 pp, 2.7 MB), EPA Publication EPA-747-F-09-005.

Testing

Air

If school administrators and building owners are concerned about potential PCBs in the caulk, they should consider testing to determine if PCBs are present in the air. If testing reveals PCB levels above the levels EPA has determined to be safe, schools should attempt to identify any potential sources of PCBs that may be present in the building, including testing samples of caulk and looking for other potential PCB sources (e.g., old transformers, capacitors, or fluorescent light ballasts that might still be present at the school).

If elevated levels of PCBs are found in the air, schools should also have the ventilation system evaluated to determine if it is contaminated with PCBs. Although the ventilation system is unlikely to be an original source of PCB contamination, it may have been contaminated before other sources of PCBs were removed from the school and may contribute to elevated air levels of PCBs. Contaminated ventilation systems should be carefully cleaned. Ideally, such cleaning should be planned in concert with removal of any sources of PCBs that are found to avoid re-contamination of the system.

During the search for potential sources, schools should be especially vigilant in implementing practices to minimize exposures and should retest to determine whether those practices are reducing PCB air levels. It is important to note that interior surfaces and settled dust can absorb PCBs from contaminated air, and these "secondary sources" can emit PCBs after the primary source is removed. Therefore, a remediation plan should consider the potential effects for these secondary sources on indoor air quality.

Other Sources, Including Caulk

Should those practices not reduce exposure, caulk and other known sources of PCBs (e.g., paints, floor and ceiling tiles) should be removed as soon as practicable. Please note that you cannot tell if caulk has PCBs by looking at it. While it is possible that PCBs could be released into the environment through the cracking or flaking of caulk, EPA believes the old caulk that is still flexible or is in visibly good condition could be a significant source of PCBs into the air. The only way to be sure that caulk has PCBs is to have a professional test the caulk.

Where schools or other buildings were constructed or renovated between 1950 and 1979, EPA recommends that PCB-containing caulk be removed during planned renovations and repairs (when replacing windows, doors, roofs, ventilation, etc.).

Based on EPA's Office of Research and Development's (ORD) laboratory research, encapsulation was found to be most effective for interior surfaces that contain low levels of PCBs (i.e. several hundred parts per million). Depending on the PCB reduction goal, the performance of the encapsulant, and the conditions of the building, the upper limit of the PCB concentration for successful encapsulation may vary. Therefore, post-encapsulation monitoring is an essential part of the encapsulation process. Building owners should consult EPA's research on this issue for more specifics. Encapsulation may be useful for the reduction of emissions from secondary sources such as contaminated building materials under and around PCB-containing caulk or paint that has been removed. Encapsulation was not found to be effective in reducing emissions from sources that have a high PCB content (for example caulk) for more than a short period of time. Because each site will present unique circumstances, please consult your EPA PCB Regional Coordinator regarding the application of encapsulation measures on a case by case basis. It is critically important to assure that PCBs are not released to air during replacement or repair of caulk in affected buildings. Assessment of the ventilation system for potential contamination, proper cleaning when required, and isolation of the system to prevent further contamination are also important.

Test Methods

For determining the presence of PCBs in indoor air, EPA has two approved methods:

- Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Compendium Method TO-4A (high air volume) (PDF) (53 pp, 665 KB)
- Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Compendium Method TO-10A (low air volume) (PDF) (37 pp, 288 KB)

EPA recommends that caulk suspected to contain PCBs be tested directly for the presence of PCBs and removed if PCBs are present at significant levels. The PCB regulations provide appropriate methods for testing. More information on these procedures can be found at:

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846
- Wipe Sampling (PDF) (31 pp, 86K)

Contact EPA's Toxic Substances Control Act (TSCA) Hotline at 1-888-835-5372 or the EPA PCB Regional Coordinator for your state for assistance.

Schools Information Kit

A Schools Information Kit provides information for parents, students and staff about PCBs in caulk, including:

- General information on PCBs in older schools and buildings || PDF version (1 pg, 564 KB) || en Español (PDF) (1 pg, 517 KB)
- Schools checklist || PDF version (1 pg, 416 KB) || en Español (PDF) (1 pg, 221 KB)

Information for Contractors Working in Older Buildings

Read Contractors Handling PCBs in Caulk During Renovation, EPA's guidance to contractors and maintenance personnel working in older buildings that may contain PCB-contaminated caulk.

Read EPA's Steps to Safe Renovation and Abatement of Buildings that Have PCB-Containing Caulk.

Additional Information

Additional EPA brochures and fact sheets on best practices for addressing PCBs in caulk:

- Fact Sheet: Testing for PCBs in Buildings
- Fact Sheet: Interim Measures for Reducing Risk and Taking Action to Reduce Exposures
- Fact Sheet: Removal and Clean-Up of PCBs in Caulk and PCB-Contaminated Soil and Building Materials

- Fact Sheet: Disposal Options for PCBs in Caulk and PCB-Contaminated Soil and Building Materials

Where Can I Get More Information?

For more information on how to properly test for and address PCBs in caulk, call the EPA's Toxic Substances Control Act (TSCA) Hotline at 1-888-835-5372 or contact the EPA PCB Regional Coordinator for your state.

EXHIBIT 6

Search

Home About Us » About the Estuary » Our Projects » Estuary NEWS » Watershed Network »

PCBs in Caulk Project

PCBs–polychlorinated biphenyls–are a probable human carcinogen and may be causing reproductive failure in birds and affecting immune response in harbor seals in the Estuary. SFEP's PCBs in Caulk Project was created to address potential impacts of polychlorinated biphenyls (PCBs) in caulks and sealants released into stormwater runoff during demolition or remodeling projects in the San Francisco Bay Area. The project is assisting the implementation of the Total Maximum Daily Load (TMDL) for PCBs in San Francisco Bay. The PCBs TMDL includes a plan for reducing PCBs loads that is implemented through permits, including the Municipal Regional National Pollutant Discharge Elimination System (NPDES) Permit for Stormwater (MRP). In the first five-year permit term, starting in 2009, stormwater Permittees are required to investigate the costs, effectiveness, and technical feasibility of several categories of potential PCBs control measures. The PCBs in Caulk Project focused on one such category of potential PCBs controls: measures to minimize the release of PCBs in caulks and sealants to stormwater runoff during demolition or remodeling projects.

The grant-funded PCBs in Caulk Project concluded at the end of 2011.

UPDATE: EPA Proposes Reinterpretation PCBs in Caulk Regulations

Since the SFEP PCBs in Caulk materials were published, EPA issued a notice of proposed rulemaking soliciting comment on how PCBs in caulk were treated under EPA regulations. After consideration of those comments, EPA has proposed a reinterpretation of what materials are considered PCB bulk product waste versus PCB remediation waste. See fuller information at http://www.epa.gov/epawaste/hazard/tsd/pcbs/pubs/caulk/reinterpret.htm

Final Report on PCBs in Bay Area Buildings – Sampling Results and Estimate of Loadings to SF Bay

- Report: Estimated Stock in Currently Standing Buildings and Releases to Stormwater during Renovation and Demolition by San Francisco Estuary

Our Projects

- Our Projects
- Habitat Restoration
- Fish & Wildlife Recovery
- Water Quality Improvement
- Watershed Management
- Stewardship

Project Map

About Us

- The Partnership
- Executive Council
- Implementation Committee
- Friends of the Estuary
- Staff
- Press & Media Resources
- Strategic Plan
- Contact Us

Institute (SFEI), 2011.

- Supporting documents:

1. Calculations of mass estimates
2. Calculations of demolition and renovation releases

Model Regulatory Program

Disclaimer: To the extent that Permittees will be required in future permits to control PCBs in caulks and sealants released during building demolition or remodeling, these documents are intended to assist in complying with such requirements. **At the time of publication (2011), municipalities are not required to implement the BMPs or Model Implementation Process.**

- Best Management Practices to control PCBs in caulk at demolition or renovation.
- Model Implementation Process to incorporate requirement to use BMPs into municipal demolition permitting process. This document breaks new ground as the first known attempt to create a potential regional regulatory process to manage PCBs in caulks and sealants to protect water quality. It also leaves many issues for potential future implementers to address, compiled in Appendix A of this document on Obstacles, Challenges, and Future Needs.
- Training Strategy to train and deploy municipal staff, such as hazardous material or building inspectors, to ensure proper implementation of the BMPs and compliance with the program. This is a supplement to the MIP.

  - *The BMPs, MIP, and Training Strategy were authored by Larry Walker Associates, Inc., Geosyntec Inc., and TDC Environmental, LLC in November, 2011.*

- Technical Memorandum on existing regulatory controls and policies related to managing wastes and hazardous materials during building demolition and/or remodeling programs.

  - *Please see also the Resources section at the bottom of this page for additional related materials.*

Workshop Held 7/26/11 to Test New Regulatory Process Adding PCB Control to Demolition Permitting

Who: Municipal staff with responsibility for demolition permitting
When: Tuesday, July 26, 1:00pm to 5:00pm
Where: Menlo Parks Arrillaga Family Recreation Center, 700 Alma Street (Juniper Room) Workshop invitation

Requests for Participation in Sampling and Implementation Trial Elements of the Project

Request for Participation – Sampling Element
Request for Participation – Implementation Trials Element (for municipalities)
Request for Participation – Implementation Trials Element (for non-municipal agencies and organizations)

2nd Stakeholder Meeting, October 26, 2010, Oakland

The project's second stakeholder meeting provided an opportunity to review a draft management procedure for PCBs in caulk at demolition/renovation. The authors described and solicited feedback on draft Best Management Practices, an implementation guide, and training materials. Discussion centered on the theme: "how would these documents work for your agency?"

Physical meeting location: 1515 Clay Street in Oakland, Room 1411 with call-in available.
Materials:
Meeting Invite Flyer and Agenda
Presentation 1 (SFEP Overview)
Presentation 2 (LWA and Geosyntec)

1st Stakeholder Meeting, July 15, 2010, Oakland

A team of municipalities, scientists, and stormwater quality managers are developing a process to manage PCBs in caulk. The management process is intended to protect San Francisco Bay from PCBs in caulk released when buildings are demolished or renovated. Developing best management practices (BMPs) and a process to implement those BMPs is required under the new municipal stormwater permit.

This stakeholder meeting introduced the project and identify opportunities to provide feedback into the development of the BMPs and implementation process. We are seeking input from a variety of sectors which may find this project relevant, including: Construction/demolition managers, contractors, building industry associations; Air/water/waste regulators; Public health and safety; Environmental remediation specialists; Municipal permitting, community development, public works departments; and Building managers or facilities managers.

The meeting was held at Joseph P. Bort MetroCenter Auditorium, 101-8th Street, Oakland (Lake Merritt BART) on Thursday, July 15 from 1-4pm.
SFEP presentation, Details of Grant Support
LWA presentation, Developing a Process to Manage PCBs in Caulk During Building Demolition/Renovation in the Bay Area

Invite Flyer

CLOSED: RFP for PCBs in Caulk BMPs Development

The RFP was posted March 4, 2010, and closed April 2 at 5:00pm. The San Francisco Estuary Partnership (SFEP), a project of the Association of Bay Area Governments (ABAG), a joint powers agency, formed under California Government Code Sections 6500, et seq., invites qualified organizations (such as a consultant or team of consultants) to respond to this Request for Proposals (RFP) for developing Best Management Practices (BMPs) to reduce or prevent discharge of polychlorinated biphenyls (PCBs) from release during building demolition/remodeling, as part of the PCBs in Caulk project managed by SFEP. This project is funded by the State Revolving Fund under the American Recovery and Reinvestment Act of 2009 (ARRA) and is subject to federal stimulus terms and conditions. Proposals were due April 2, 2010 at 5:00pm.

Archive of RFP-related materials

- RFP posted March 4, 2010
- Proposal/references forms in Word
- ABAG/ARRA contract provisions

Resources

- Cleaning up PCBs in San Francisco Bay, a fact sheet by the San Francisco Regional Water Quality Control Board
- PCBs in Caulk Project Request for Participation (2009)
  - Overall Project Fact Sheet (2008)
  - Sampling Methods Fact Sheet (2008)
- Clean Estuary Partnership memo 7/16/2007, Re: First Phase Support Information for PCB Portion of Taking Action for Clean Water Grant
- This project is required under the San Francisco Regional Water Board's Municipal Regional Stormwater NPDES Permit (MRP), section C.12.b.
  - Section C.12.b alone or with background material (Water Board's PCBs Fact Sheet)
  - Full MRP (section C.12.b is on page 95).
- EPA's PCBs in Caulk in Older Buildings page
- Treatment technology to extract and destroy PCBs (powerpoint by Tom Krug, Geosyntec)

San Francisco Estuary Partnership
1515 Clay Street, Suite 1400

Association of

Oakland, CA 94612
(510) 622-2304

Bay Area Governments

Contact Us | Site Map | Site Design

EXHIBIT 7

Polychlorinated Biphenyls (PCBs)

National Information

PCBs in Caulk in Older Buildings

PCBs in Caulk Hotline
For additional information call
1-888-835-5372

PCB Transformers

What is a PCB Transformer?

A PCB Transformer is a transformer that contains PCBs at concentrations greater than 500 parts per million (ppm). Polychlorinated biphenyls (PCBs) were used in electrical transformers because of their useful quality as being a fire retardant. These transformers were manufactured between 1929 and 1977. The majority of these PCB Transformers were installed in apartments, residential and commercial buildings, industrial facilities, campuses, and shopping centers constructed before 1978. If your facility currently uses or plans to dispose of a PCB Transformer you should be aware that the United States Environmental Protection Agency (EPA) regulates the use, storage and disposal of PCB Transformers. PCB-Contaminated Transformers containing between 50 and 499 ppm PCBs are also subject to EPA's regulations.

Do You Own a PCB Transformer?

Generally, a transformer will have a nameplate attached to one side of the unit indicating the trade name of the dielectric fluid, the approximate weight in pounds, and the amount of fluid, usually in gallons.
Since PCBs were marketed under different trade names, the nameplate on a PCB Transformer may not carry the specific term "PCBs". Trade names for PCBs could include:

- Abestol, Aroclor, Askarel, Chlophen
- Chlorextol, DK, EEC-18, Fenclor
- Inerteen, Kennechlor, No-Flamol, Phenoclor
- Pyralene, Pyranol, Saf-T-Kuhl, Solvol
- Non-Flammable Liquid

If the nameplate says "PCBs" or any of the names on the above list, then the transformer most likely contains PCBs in concentrations of between 600,000 and 700,000 ppm. Should your transformer's nameplate not carry any of the above labels, or if the label is missing or illegible, your utility company may be able to tell you if the transformer contains PCBs. Otherwise the only way to be certain is to test the electrical fluid.

PCB Transformer Regulations

Certain requirements have been established to assist the owners or operators in the use of PCB Transformers. These regulations can be found in Title 40 of the Code of Federal Regulations (40 C.F.R.), Part 761. If you are the owner or operator of a commercial building, you have a special responsibility to reduce the potential threat of a fire in or near a PCB Transformer. A commercial building is a non-industrial building - such as an apartment house, school, train station, hospital, or store - which is typically accessible to the general public. These requirements for PCB Transformers currently in use include

Use:

- Certain PCB Transformers must be equipped with enhanced electrical protection or removed from service (40 C.F.R. § 761.30 (a)(1)(iv));
- All PCB Transformers must be registered with fire response personnel (40 C.F.R. § 761.30 (a)(1)(vi));
- PCB Transformers in use in or near commercial buildings must be registered with the building owners (40 C.F.R. § 761.30 (a)(1)(vii));
- Combustible materials must not be stored within a PCB Transformer enclosure or within 5 meters of a PCB Transformer enclosure or PCB Transformer (40 C.F.R. § 761.30 (a)(1)(viii));
- Visual inspections of each PCB Transformer must be conducted quarterly (40 C.F.R. § 761.30 (a)(1)(ix));
- Visual inspections must be conducted daily if the PCB Transformer is leaking and corrective measures must be taken immediately (40 C.F.R. § 761.30 (a)(1)(x)).

Labels:

- Proper PCB identification labels must be affixed to the access to the transformers and also the transformer itself (40 C.F.R. § 761.40 (a)).

Recordkeeping:

- Records of inspections and maintenance must be maintained (40 C.F.R. § 761.30 (a)(1)(xii));
- Annual documents and annual document logs describing the inventory and disposition of PCB Transformers and other PCB Equipment must be kept (40 C.F.R. § 761.180 (a)).
- **All records for inspections and annual documents must be retained for a minimum of three (3) years after the last PCB Item has been disposed of.**

Storage and Disposal

PCB Transformers removed from service can be temporarily stored up to 30 days on pallets while incorporating inspection safeguards. Otherwise, PCB Transformers that are stored for disposal in an area that meets the requirements of 40 C.F.R. § 761.65(b) must be disposed of within a year.

Spills

If a PCB spill occurs in your facility, you should report the spill within 24 hours to the **EPA Region 3 Emergency Response Section (215-814-3255) and the National Response Center (800-424-8802)**. Immediately take control measures for the spread of the spill by damming or libbing the leak, using absorbent materials, and cordon off the area. Once a spill is contained, cleanup must be initiated within 48 hours of the spill. For more information concerning the PCB spill cleanup requirements, see EPA's PCB Spill Cleanup Policy at 40 C.F.R. § 761.120 and the Requirements for PCB Spill Cleanup at 40 C.F.R. § 761.125.

The above information contains only a partial summary of the PCB Regulations. Please refer to the full text of the Code of Federal Regulations (C.F.R.) at 40 C.F.R. Part 761 to determine which requirements apply to your circumstances.

Additional Reference Materials Related to PCBs:

- PCB Information Package
- PCBs in Fluorescent Light Fixtures
- Decontamination Levels for PCB Cleanup
- Verification of PCB Spill Cleanup by Sampling and Analysis
- The Toxics Substances Control Act
- Guidance on Remedial Actions for Superfund Sites with PCB Contamination
- PCB Transformers and the Risk of Fire

Further Information

For further information regarding the use, storage and disposal of PCB Transformers, please contact the EPA, Region 3, Land and Chemicals Division at (215) 814-2177, (215) 814-2151 or in WV or VA call (304)231-0501.

- Toxic Substances Control Act (TSCA) Hotline: 202-554-1404
- EPA Region 3 Customer Hotline: 800-438-2474
- EPA, Region 3, Land and Chemicals Division: (215) 814-2177, 2151 or (304) 231-0501
- E-mail to:Kelly Bunker (bunker.kelly@epa.gov) or Craig Yussen (yussen.craig@epa.gov)

Back to top

Serious Health Concerns

There are a number of adverse health effects associated with this chemical. Tests on animals show that PCBs can harm reproduction and growth, and can cause skin lesions and tumors. When PCB fluid is partially burned-as it may be in a transformer fire-the PCB fluid produces by-products, which include polychlorinated dibenzo dioxin and polychlorinated dibenzo furans , that are much more toxic than the PCBs themselves. Tests on rats show that furans can cause anemia and other blood problems. Dioxin is associated with a number of health risks, and has been shown to cause cancer of the liver, mouth, adrenal gland, and lungs in laboratory animals.

For further information regarding the disposal of PCB ballasts, please contact the EPA, Region 3, Land and Chemicals Division at (215)814-2177 or (215) 814-2165.

EXHIBIT 8

Contractors: Handling PCBs in Caulk During Renovation

This brochure is meant to provide contractors, parents, teachers, and school administrators a general overview of the practices a contractor should consider when conducting the renovation of a building that has polychlorinated biphenyl (PCB)-containing caulk. PCBs were not added to caulk after 1979. Therefore, in general, schools built after 1979 do not contain PCBs in caulk.

Contractors play an important role in protecting public health by helping prevent exposure to toxic PCBs. Ordinary renovation and maintenance activities involving the removal of PCB-containing caulk and the surrounding contaminated substrate (brick, masonry, cinder block, wood, etc.) can create dust that contains PCBs which can expose children and adults. PCBs have been demonstrated to cause a variety of adverse health effects, including cancer in animals. PCBs have also been shown to cause a number of serious non-cancer health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system, and other health effects.

Consider Testing the Air in Buildings Built Between 1950 and 1979 to Determine Whether Your School or Building May Have PCBs

If school administrators and building owners are concerned about exposure to PCBs and wish to supplement the steps recommended in this brochure, EPA recommends testing to determine if PCB levels in the air exceed EPA's suggested public health levels. If testing reveals levels above the suggested public health levels, school and building operators should be especially vigilant in implementing and monitoring practices to minimize exposures. If PCBs are found in the air, EPA will assist in developing a plan to reduce exposure and manage the caulk. You cannot tell if caulk has PCBs by looking at it. EPA believes the old caulk that is still flexible or is in visibly good condition may be a significant source of PCBs into the air. The only way to be sure that caulk has PCBs is to have a professional test the caulk. Your EPA Regional PCB Coordinator can direct you to a PCB testing lab.

Take Site-Specific Protective Measures

- Be in compliance with occupational protection regulations for contractors (PDF) (2 pp, 286K).
- Protect building occupants and passersby by containing the work area to prevent PCB-containing caulk dust from getting into the surrounding environment.
- Determine disposal options based on concentration and type of material.
- Place an encapsulant underneath the new caulk/sealant (since PCBs in the adjoining material can move into the new caulk/sealant). Use replacement caulk/sealant that is free of environmental hazards.

A pilot renovation project may be warranted to verify whether the renovation goals can be met. It will allow you to compare methods, tools, and protective measures to get specific information about their effectiveness and cost.

Before Starting the Job, Consider the Types of Tools and Machinery for Removing Caulk

- Manual tools are recommended for soft flexible caulk:
  - Advantages: no dust and no heat
  - Disadvantages: labor intensive and slow
- Electromechanical tools are recommended for hardened/brittle caulk:
  - Advantages: faster, less labor intensive
  - Disadvantages: generate heat (which can volatilize the PCBs) and dust, requiring added protective measures. Also must consider the potential abrasive effects on sensitive adjoining structures (e.g., wood and metal).
- EPA recommends removing as much of the old caulk as possible, since any residual caulk left in place can contaminate any new caulk or sealant that is applied.

Notify Interested Parties and Plan for Emergencies

- Communicate the goals, type, and length of projects and specific behavior rules to the affected groups (PTA, school principal, etc.).

- Have an emergency contact list (hospitals, police, etc.).
- Ensure workers are properly trained.
- Prevent unauthorized persons from entering the site.

Take General Protective Measures

- Ensure workers are properly trained.
- Choose the method that minimizes the amount of dust generated.
- Choose methods that protect workers, building users, passersby, and the surroundings of the restoration project.
- Use proper containers to hold removed caulk.
- Use gloves and skin protection.
- Use eye goggles.
- Do not smoke, drink, or eat in the work area.
- Wash hands prior to breaks.
- In dusty work areas, have showers available and separate changing areas so that dust on clothing is not brought home.
- If working with solvents, provide respirators.

Interior Areas

- Cover work areas with plastic.
- Use signs to keep residents and pets out of the work area.
- Remove furniture and belongings, or cover them securely with heavy plastic sheeting.
- Use heavy plastic sheeting to cover floors and other fixed surfaces like large appliances in the work area.
- Improve ventilation and add exhaust fans. Close and seal the ventilation system in the work area and, if necessary, turn off forced-air heating and air-conditioning systems.
- Regularly clean the work area with an industrial (HEPA) vacuum and by wet mopping.
- Properly dispose of personal protective equipment and cleaning material.

Exterior Areas

- Mark off the work areas to keep non-workers away.
- Cover the ground.
- Enclose scaffolding.
- Cover the ground and plants with heavy plastic sheeting.
- Close windows and doors near the work area.
- Move or cover play areas near the work area.

Leave the Work Area Clean

On a daily basis you should:

- Put trash and debris in heavy-duty plastic bags.
- Wrap waste building components, such as windows and doors, in heavy plastic sheeting and tape shut.
- Ensure everything, including tools, equipment, and even workers, are free of dust and debris before leaving the work area.
- HEPA vacuum the work area.
- Remember, you do not want to bring PCB dust home and expose your family.
- Remind residents to stay out of the work area. When the job is complete, you should also:
    - Remove the plastic sheeting carefully, mist with water, fold dirty side in, tape shut, and dispose of it.
    - HEPA vacuum all surfaces, including walls.
    - Wash the work area with a general purpose cleaner.
    - Check your work carefully for dust because hazardous amounts may be minute and not easily visible. If you see any dust or debris, then re-clean the area.

Dispose of Renovation Waste Materials that Contain PCBs in Compliance with the Toxic Substances Control Act (TSCA)

- PCB-containing caulk is considered *PCB bulk product waste* if the concentration of PCBs in the caulk is greater than or equal to (=) 50 parts per million (ppm).
- Surrounding building materials to which PCB caulk is still attached may be disposed of as a PCB bulk product waste, if there is no source of PCB contamination other than the caulk. This could apply in situations such as demolition and disposal of entire buildings, walls, etc. (Note: if your abatement plan states that you intend to dispose of the PCB caulk and any contaminated building materials together, you may dispose of all the materials as a PCB bulk product waste, even if the

PCB caulk becomes separated from the adjacent contaminated building materials during remediation. EPA realizes that the PCB caulk may need to be separated during removal from adjacent contaminated building materials due to the presence of other hazardous materials or may accidentally be separated during the removal process.)

- If PCB caulk has been removed from the surrounding building material and disposed of separately, any contaminated surrounding building materials and adjacent soil are considered PCB remediation waste. This could apply in situations where the PCB caulk is removed, but the contaminated substrate is to be remediated.
- The decision on how to manage PCB contaminated substrate may be subject to a variety of site-specific facts. The appropriate EPA regional office and regional PCB coordinator can be consulted as necessary for assistance with making these decisions. For instance, property owners have identified instances where PCB caulk contained high levels of other hazardous constituents such as asbestos. Similarly, there are cases where PCB paint has been found to contain high levels of leachable metals. In these scenarios, care must be taken to fully characterize the waste to determine the appropriate disposal option.

Disposal Options

PCB bulk product waste: The disposal of *PCB bulk product waste* is regulated under 40 CFR § 761.62 of TSCA. Under this provision, PCB bulk product waste must be disposed of in one of two ways: disposal in a permitted solid waste landfill or via risk-based disposal approval process.

Disposal in solid waste landfills: Certain PCB bulk product waste, such as PCB-containing caulk, even if the concentration of PCBs in the caulk is equal to or greater than 50 ppm, may be disposed of in non-hazardous waste landfills permitted by states. Disposal under this option does not require you to obtain approval from EPA. However, EPA recommends that you determine prior to shipment that the landfill is willing and able to accept the PCB waste. Anyone sending PCB bulk product waste to a non-hazardous waste landfill permitted by a state must send written notice to the landfill prior to shipment of the waste stating that the waste contains PCBs at greater than 50 ppm (see 40 CFR 761.72(b)(4)(ii)). This guidance document does not replace or supersede any (sampling) requirements that the receiving facility may deem necessary to determine acceptance of the waste into its facility. Additionally, this guidance does not supersede state requirements which may be more stringent than those mandated by the federal government for management of this debris.

Risk-based option: The risk-based option allows for a site-specific, risk-based evaluation of whether *PCB bulk product waste* may be disposed of in a manner other than under the performance-based disposal option or the solid waste landfill disposal option. Disposal of *PCB bulk product waste* under this option requires you to obtain approval from EPA based on a finding that the disposal will not present an unreasonable risk of injury to health or the environment.

PCB remediation waste: The disposal of PCB remediation waste is regulated under 40 CFR § 761.61 of TSCA. There are three options for management of *PCB remediation waste*:

- ***Self-implementing cleanup and disposal:*** The self-implementing option links cleanup levels with the expected occupancy rates of the area or building where the contaminated materials are present. The disposal requirements for the self-implementing regulatory option vary based on the type of contaminated material and concentration of PCBs in the materials, among other things. Cleanup and disposal under this option requires you to notify your EPA Regional PCB Coordinator.

- ***Performance-based disposal:*** The performance-based option allows for disposal of the contaminated materials in either a TSCA chemical waste landfill or TSCA incinerator, through a TSCA-approved alternate disposal method, under the TSCA-regulated decontamination procedures, or in a facility with a coordinated approval issued under TSCA. Disposal under this option generally does not require you to obtain approval from EPA.

- ***Risk-based cleanup and disposal:*** The risk-based option allows for a site-specific evaluation of whether *PCB remediation waste* may be cleaned up or disposed of in a manner other than the alternatives provided under the self-implementing or the performance-based disposal options. Disposal of PCB remediation waste under this option requires you to obtain an approval from EPA based on a finding that the disposal will not present an unreasonable risk of injury to health or the environment.

Additional Information on EPA's Website

EPA has developed an informational brochure and fact sheets to provide building owners and managers with key information on the current best practices for addressing PCBs in caulk. View these documents here.

Preventing Exposure to PCBs in Caulking Material || PDF version (2 pp, 2.7MB)

Fact Sheet: Testing for PCBs in Caulk in Buildings

Fact Sheet: Interim Measures for Reducing Risk and Taking Action to Reduce Exposures

Fact Sheet: Removal and Clean-Up of PCBs in Caulk and PCB-Contaminated Soil and Building Materials

Fact Sheet: Disposal Options for PCBs in Caulk and PCB-Contaminated Soil and Building Materials

EPA is Helping to Address the Issue of PCBs in Caulk

Where Can I Get More Information

EPA has conducted research on how the public is exposed to PCBs in caulk and on the best approaches for reducing exposure and potential risks associated with PCBs in caulk. Where PCBs have been found in the air, soil, or in the caulk and other building materials, EPA is committed to helping schools and communities enact plans to reduce exposure. Please contact your regional PCB coordinator for help with assessing contamination and exposure and developing cleanup plans. Please contact your regional EPA Regional PCB Coordinator help with assessing contamination and exposure and developing cleanup plans.

EXHIBIT 9

CNPS Botanical Survey Guidelines

CALIFORNIA NATIVE PLANT SOCIETY
December 9, 1983
Revised June 2, 2001

The following recommendations are intended to help those who prepare and review environmental documents determine when a botanical survey is needed, who should be considered qualified to conduct such surveys, how surveys should be conducted, and what information should be contained in the survey report. The California Native Plant Society recommends that lead agencies not accept the results of surveys unless they are conducted and reported according to these guidelines.

1. Botanical surveys are conducted in order to determine the environmental effects of proposed projects on all botanical resources, including special status plants (rare, threatened, and endangered plants) and plant (vegetation) communities. Special status plants are not limited to those that have been listed by state and federal agencies but include any plants that, based on all available data, can be shown to be rare, threatened, or endangered under the following definitions:

    > A species, subspecies, or variety of plant is “endangered” when the prospects of its survival and reproduction are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, or disease. A plant is "threatened" when it is likely to become endangered in the foreseeable future in the absence of protection measures. A plant is "rare" when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens.[1]

    Rare plant (vegetation) communities are those communities that are of highly limited distribution. These communities may or may not contain special status plants. The most current version of the California Natural Diversity Database's *List of California Terrestrial Natural Communities*[2] should be used as a guide to the names and status of communities.

    Consistent with the California Native Plant Society’s goal of preserving plant biodiversity on a regional and local scale, and with California Environmental Quality Act environmental impact assessment criteria[3], surveys should also assess impacts to locally significant plants. Both plants and plant communities can be considered significant if their local occurrence is on the outer limits of known distribution, a range extension, a rediscovery, or rare or uncommon in a local context (such as within a county or region). Lead agencies should address impacts to these locally unique botanical resources regardless of their status elsewhere in the state.

2. Botanical surveys must be conducted to determine if, or to the extent that, special status or locally significant plants and plant communities will be affected by a proposed project when any natural vegetation occurs on the site and the project has the potential for direct or indirect effects on vegetation.

3. Those conducting botanical surveys must possess the following qualifications:
    a. Experience conducting floristic field surveys;
    b. Knowledge of plant taxonomy and plant community ecology and classification;
    c. Familiarity with the plants of the area, including special status and locally significant plants;

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[1] California Environmental Quality Act Guidelines, §15065 and §15380.
[2] List of California Terrestrial Natural Communities. California Department of Fish and Game Natural Diversity Database. Sacramento, CA.
[3] California Environmental Quality Act Guidelines, Appendix G (Initial Study Environmental Checklist).

   d. Familiarity with the appropriate state and federal statutes related to plants and plant collecting; and,
   e. Experience with analyzing impacts of a project on native plants and communities.

4. Botanical surveys should be conducted in a manner that will locate any special status or locally significant plants or plant communities that may be present. Specifically, botanical surveys should be:

   a. Conducted in the field at the proper times of year when special status and locally significant plants are both evident and identifiable. When special status plants are known to occur in the type(s) of habitat present in the project area, nearby accessible occurrences of the plants (reference sites) should be observed to determine that the plants are identifiable at the time of survey.

   b. Floristic in nature. A floristic survey requires that every plant observed be identified to species, subspecies, or variety as applicable. In order to properly characterize the site, a complete list of plants observed on the site shall be included in every botanical survey report. In addition, a sufficient number of visits spaced throughout the growing season is necessary to prepare an accurate inventory of all plants that exist on the site. The number of visits and the timing between visits must be determined by geographic location, the plant communities present, and the weather patterns of the year(s) in which the surveys are conducted.

   c. Conducted in a manner that is consistent with conservation ethics and accepted plant collection and documentation techniques[4,5]. Collections (voucher specimens) of special status and locally significant plants should be made, unless such actions would jeopardize the continued existence of the population. A single sheet should be collected and deposited at a recognized public herbarium for future reference. All collections shall be made in accordance with applicable state and federal permit requirements. Photography may be used to document plant identification only when the population cannot withstand collection of voucher specimens.

   d. Conducted using systematic field techniques in all habitats of the site to ensure a thorough coverage of potential impact areas. All habitats within the project site must be surveyed thoroughly in order to properly inventory and document the plants present. The level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity.

   e. Well documented. When a special status plant (or rare plant community) is located, a California Native Species (or Community) Field Survey Form or equivalent written form, accompanied by a copy of the appropriate portion of a 7.5-minute topographic map with the occurrence mapped, shall be completed, included within the survey report, and separately submitted to the California Natural Diversity Database. Population boundaries should be mapped as accurately as possible. The number of individuals in each population should be counted or estimated, as appropriate.

5. Complete reports of botanical surveys shall be included with all environmental assessment documents, including Negative Declarations and Mitigated Negative Declarations, Timber Harvesting Plans, Environmental Impact Reports, and Environmental Impact Statements. Survey reports shall contain the following information:

   a. <u>Project location and description</u>**,** including:

[4] Collecting Guidelines and Documentation Techniques. California Native Plant Society Policy (adopted March 4, 1995).
[5] Ferren, W.R., Jr., D.L. Magney, and T.A. Sholars. 1995. The Future of California Floristics and Systematics: Collecting Guidelines and Documentation Techniques. *Madroño* 42(2):197-210.

1) A detailed map of the location and footprint of the proposed project.
2) A detailed description of the proposed project, including one-time activities and ongoing activities that may affect botanical resources.
3) A description of the general biological setting of the project area.

b. Methods, including:
1) Survey methods for each of the habitats present, and rationale for the methods used.
2) Description of reference site(s) visited and phenological development of the target special status plants, with an assessment of any conditions differing from the project site that may affect their identification.
3) Dates of surveys and rationale for timing and intervals; names of personnel conducting the surveys; and total hours spent in the field for each surveyor on each date.
4) Location of deposited voucher specimens and herbaria visited.

c. Results, including:
1) A description and map of the vegetation communities on the project site. The current standard for vegetation classification, *A Manual of California Vegetation*[6], should be used as a basis for the habitat descriptions and the vegetation map. If another vegetation classification system is used, the report must reference the system and provide the reason for its use.
2) A description of the phenology of each of the plant communities at the time of each survey date.
3) A list of all plants observed on the project site using accepted scientific nomenclature, along with any special status designation. The reference(s) used for scientific nomenclature shall be cited.
4) Written description and detailed map(s) showing the location of each special status or locally significant plant found, the size of each population, and method used to estimate or census the population.
5) Copies of all California Native Species Field Survey Forms or Natural Community Field Survey Forms and accompanying maps.

d. Discussion**,** including:
1) Any factors that may have affected the results of the surveys (*e.g*., drought, human disturbance, recent fire).
2) Discussion of any special local or range-wide significance of any plant population or community on the site.
3) An assessment of potential impacts. This shall include a map showing the distribution of special status and locally significant plants and communities on the site in relation to the proposed activities. Direct, indirect, and cumulative impacts to the plants and communities shall be discussed.
4) Recommended measures to avoid and/or minimize direct, indirect, and cumulative impacts.

e. References cited and persons contacted.

f. Qualifications of field personnel including any special experience with the habitats and special status plants present on the site.

[6] Sawyer, J.O. and T. Keeler-Wolf. 1995. *A Manual of California Vegetation*. California Native Plant Society. Sacramento, CA. 471 pp.

EXHIBIT 10

GENERAL RARE PLANT SURVEY GUIDELINES

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All surveys for rare plants should be conducted in accordance with the standardized guidelines issued by the regulatory agencies (U.S. Fish and Wildlife Service 1996, California Department of Fish and Game 2000) and the California Native Plant Society (2001). Some of the requirements specified in the standardized guidelines are that surveys must be conducted during the appropriate season and be floristic in nature. Thus, surveys should not target a single species but should aim to identify any and all rare species and rare plant communities in the area. The guidelines also provide information on selecting a qualified botanist and providing appropriate documentation of surveys. Additional considerations for conducting rare plant surveys are described by Nelson (1987). Permission of the landowner or land-management agency is required for both site access and plant collection. In addition, federal and/or state permits are necessary to collect specimens of plants listed as endangered, threatened, or rare.

The species-specific methods presented below are intended as a supplement to the basic guidelines. They describe the conditions under which the potential for discovering each listed plant species in the survey area will be maximized. Multiple visits to a site may be necessary to ensure that survey conditions have been appropriate for all potentially-occurring rare plant species.

Certain methods are common to all of the following species-specific survey guidelines; similar methods may be employed for species not covered herein. In the southern San Joaquin Valley, many of the listed plants are small and easily obscured by dense vegetation. Thus intensive, systematic surveys are recommended to detect rare plant species in this region. Biologists should walk parallel transects spaced 5 to 10 meters (16 to 33 feet) apart throughout the entire site, regardless of subjective habitat evaluations. Transects may be stratified by topography or plant community for convenience. Field survey crews should include at least one member who has seen the target species growing in its natural habitat. Other team members may be trained using photographs and/or herbarium specimens but should be accompanied in the field by the experienced crew member during all surveys. Project-area surveys are valid only for those species that are evident during the survey period. Prior to conducting surveys in a given year, at least one member of the survey crew should visit known populations of the target species that occur in areas similar in elevation, latitude, vegetation, and topography to the survey area. Such visits will determine whether precipitation has been adequate for germination and growth, as well as confirm current phenology of the target species. Survey reports should document the known locations that were visited, the date of the visit, and the observability and phenology of the target species at that time, plus the date of the survey, the abundance and distribution of all rare species in the survey area, and any other elements required by the agency guidelines. Information on the locations of known populations may be obtained from agency biologists, the California Natural Diversity Data Base, or local chapters of the California Native Plant Society (see below). The current status and abundance of any known populations visited as well as any new populations discovered also should be reported to the California Natural Diversity Data Base.

Surveys can confirm the presence of rare plants on a site, but negative results do not guarantee that rare plant species are absent. However, for practical purposes, surveys that adhere to the attached species-specific guidelines provide reasonable evidence that the specified plant taxa do not occur in the survey area. Surveys that employ methods or timing other than those recommended herein may be used as evidence of the presence (but not absence) of rare plant species.

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SUPPLEMENTAL SURVEY METHODS FOR SAN JOAQUIN WOOLLY-THREADS

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Literature review

San Joaquin woolly-threads [*Monolopia congdonii* (Gray) B.G. Baldwin] is an annual herb of the aster family (Asteraceae). When first described (Gray 1883), this species was included in the genus *Eatonella*; Greene (1897) later transferred it to *Lembertia*. The name *Lembertia congdonii* (Gray) Greene was in use for many years, but a recent revision based on phylogeny (Baldwin 1999) changed the scientific name to *Monolopia congdonii* (Gray) B.G. Baldwin. San Joaquin woolly-threads is federally listed as an endangered species (U.S. Fish and Wildlife Service 1990).

The plant size and habit of San Joaquin woolly-threads are influenced by associated vegetation. On sparsely-vegetated sites, individuals generally are 2 to 7 centimeters (0.8 to 2.8 inches) tall, erect, and single-stemmed, whereas individuals in tall, dense vegetation may have many decumbent stems up to 45 centimeters (17.7 inches) long (Cypher 1994). In years of below-average precipitation, few seeds of San Joaquin woolly-threads germinate (Twisselmann 1967, Taylor 1989), and those that do typically produce tiny plants (E. Cypher personal observation). Phenology also varies with location and weather conditions. Seed germination may begin as early as November (Taylor 1989) but usually occurs in December and January (Lewis 1993, E. Cypher unpublished data). San Joaquin woolly-threads typically flowers between late February and early April (Taylor 1989), but flowering may continue into early May if conditions are optimal (B. Delgado personal communication). Populations in the northern part of the range flower earlier than those on the Carrizo Plain (Mazer and Hendrickson 1993, Cypher 1994). Small, vegetative individuals closely resemble *Eriogonum* species, but flowering individuals are readily distinguishable (E. Cypher personal observation).

The historical range of this species included Fresno, Kern, Kings, San Benito, San Luis Obispo, Santa Barbara, and Tulare Counties (Taylor 1989, Tibor 2001). San Joaquin woolly-threads occurs in a number of the plant communities described by Holland (1986), including Non-native Grassland, Valley Saltbush Scrub, Interior Coast Range Saltbush Scrub, and Upper Sonoran Subshrub Scrub (Cypher 1994). However, this species typically occupies portions of the habitat with less than 10% shrub cover and may occur in association with cryptogamic crust (Taylor 1989, Cypher 1994). Occurrences have been reported at elevations ranging from as low as 60 m (190 feet) on the San Joaquin Valley floor up to 838 meters (2,750 feet) in the Inner Coast Ranges of San Luis Obispo and Santa Barbara counties (Lewis 1993, California Natural Diversity Data Base 2002).

San Joaquin woolly-threads occurs on soils of alluvial origin that are neutral to subalkaline (Taylor 1989, Lewis 1993). On the San Joaquin Valley floor, this species typically is found on sandy or sandy loam soils, particularly those of the Kimberlina series (Taylor 1989, Taylor and Buck 1993), whereas on the Carrizo Plain it occurs on silty soils (Lewis 1993). San Joaquin woolly-threads frequently occurs on sand dunes and sand ridges (Taylor 1989, California Natural Diversity Data Base 2002) as well as along the high-water line of washes and on adjacent terraces (Lewis 1993, E. Cypher personal observation). Populations of this species have been documented in previously cultivated lands, heavily grazed pastures, and remnant habitat in oil fields (Taylor 1989, Lewis 1993, Taylor and Buck 1993).

Survey guidelines

All surveys for rare plants should be conducted in accordance with the standardized guidelines issued by the regulatory agencies (U.S. Fish and Wildlife Service 1996, California Department of Fish and Game 2000) and the California Native Plant Society (2001). The species-specific methods presented below are intended as a supplement to those standardized guidelines.

Systematic surveys are recommended to detect presence and determine distribution of San Joaquin woolly-threads within the survey area. For systematic searches, biologists should walk parallel transects spaced 5 to 10 meters (16 to 33 feet) apart throughout the entire site, regardless of subjective habitat evaluations. However, transects may be stratified by topography or plant community for convenience. Field survey crews should include at least one member who has seen San Joaquin woolly-threads growing in its natural habitat. Other team members may be trained using photographs and/or herbarium specimens but should be accompanied in the field by the experienced crew member during all surveys.

Prior to beginning surveys in a given year, at least one member of the survey crew should visit one or more known locations of San Joaquin woolly-threads to verify that precipitation has been adequate for germination and to determine current phenology. The known locations should be as similar as possible to the survey area in elevation, habitat, and topography. Species-specific surveys should not be attempted if San Joaquin woolly-threads is not seen at known locations, the densities are very low relative to normal years, or the plants are inconspicuous. Survey reports should document the known locations that were visited, the date of the visit, and the observability and phenology of San Joaquin woolly-threads at that time, plus the date of the survey, the abundance and distribution of all rare species in the survey area, and any other elements required by the agency guidelines. The typical survey period for San Joaquin woolly-threads is March and April.

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SUPPLEMENTAL SURVEY METHODS FOR KERN MALLOW

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Literature review

The taxonomy of Kern mallow (*Eremalche kernensis* C.B. Wolf) is somewhat controversial. At issue are the taxonomic rank and the circumscription of Kern mallow in relation to Parry's mallow [*Eremalche parryi* (Greene) Greene]. Kern mallow was first described as *Eremalche kernensis* (Wolf 1938) but also has been included in the genus *Malvastrum* (Munz and Keck 1959). The most recently-published treatments of this complex (Bates 1992, Bates 1993) assign Kern mallow the name *Eremalche parryi* (Greene) Greene ssp. *kernensis* (Wolf) Bates, and Parry's mallow the name *E. parryi* ssp. *parryi*. Other combinations have been suggested (Leonelli 1986) but have not been validly published. After consultation with species experts, the U.S. Fish and Wildlife Service made the decision to continue using the original name and circumscription for Kern mallow (Medlin in litt. 1995). Kern mallow is federally listed as endangered (U.S. Fish and Wildlife Service 1990). In terms of status, its rank is irrelevant because subspecies also are protected under the federal Endangered Species Act (U.S. Fish and Wildlife Service 1992). Throughout this document, "Kern mallow" refers to *Eremalche kernensis* in the strict sense.

The circumscription debate centers around the gender, size, and color of flowers to be included in each taxon. Certain populations in the Kern/Parry's mallow complex exhibit a condition known as gynodioecy, meaning that some of the plants have only bisexual flowers and other plants in the same population have only pistillate flowers. Bisexual flowers have both male and female parts; these flowers also are known as perfect or hermaphroditic. Pistillate flowers have only female parts; these flowers also are known as male-sterile. Pistillate flowers have shorter petals than bisexual flowers in the same population (Bates 1992, Bates 1993, E. Cypher unpublished data) (Table 1). Experts agree that Kern mallow is gynodioecious. However, any gynodioecious population in the complex keys to *Eremalche parryi* ssp. *kernensis* in Bates (1993), including those that species experts consider to be Parry's mallow (Taylor and Davilla 1986, E. Cypher unpublished data). Other populations in the Kern/Parry's mallow complex consist only of plants with bisexual flowers; these populations key to *Eremalche parryi* ssp. *parryi* (Bates 1993) and are indisputably Parry's mallow. Parry's mallow is generally accepted to have larger flower parts than Kern mallow (Table 1) (Munz and Keck 1959, Bates 1992, Bates 1993, E. Cypher unpublished data).

Gynodioecious populations in the Kern/Parry's mallow complex may have a mixture of flower colors. Kern mallow flowers may be either white or pale lavender, regardless of gender (Wolf

Table 1. Comparison of morphological characters (ranges) of three *Eremalche* species. Compiled from Abrams (1951), Munz and Keck (1959), Bates (1992, 1993), Stebbins et al. (1992), and E. Cypher (unpublished data).

Character	*exilis*	*kernensis*		*parryi* [1]	
	(bisexual only)	pistillate flower	bisexual flower	pistillate flower	bisexual flower
Petal color	white, pinkish, or pale lavender	white or pale lavender	white or pale lavender	mauve, purple, or rose-pink, rarely white or lavender	mauve, purple, or rose-pink, rarely white or lavender
Petal length	3-6 mm	2.5-8.5 mm	3.5-10.5 mm	4.5-11 mm	5-19 mm
Calyx length	3-7 mm	2.5-7 mm	3-8 mm	3.5-9 mm	5-10 mm
Calyx lobe width	1.5-2.5 mm	1-3.5 mm	1-3.5 mm	1-4 mm	1.5-4 mm
Shape of sepal tip	acute	gradually tapering [2]	gradually tapering [2]	abruptly acuminate [2]	abruptly acuminate [2]
Bractlet length	3-7 mm	2-6 mm	2-6 mm	3-7 mm	3-9 mm
Filament length	equal to styles	-	shorter than styles	-	shorter than styles
Anther position	even with stigmas	-	below stigmas	-	below stigmas
Number of carpels	9-13	9-19	7-14	11-23	8-24
Number of rays per stellate hair	?	5-7 [2]	5-7 [2]	10-20 [2]	10-20 [2]

[1] Measurements obtained from plants in Kern, Tulare, and San Luis Obispo counties only.
[2] Not differentiated by flower gender.

1938, Munz and Keck 1959, E. Cypher unpublished data). Parry's mallow typically has mauve to purple flowers (Bates 1992), but white or pale lavender flowers are observed occasionally (Taylor and Davilla 1986, E. Cypher unpublished data).

Another source of confusion is that the closely-related desert mallow (*Eremalche exilis*) co-occurs with Kern and Parry's mallows in western Kern County. Desert mallow plants have only bisexual flowers that are similar in size to the pistillate flowers of Kern mallow (Table 1). Despite the gender difference, the bisexual flowers of desert mallow are easily mistaken for the pistillate flowers of Kern mallow due to their size and the fact that the anthers of the former are not easily distinguished from the stigmas (Andreasen et al. in press). Desert mallow is known to grow sympatrically with Kern mallow in the Lokern area but occupies a much broader range overall (Twisselmann 1956, Twisselmann 1967, Hoover 1970, Bates 1993, Andreasen et al. in press). Although Mojave desert populations of desert mallow typically have trailing stems, those in western Kern County and San Luis Obispo County may have either trailing stems or robust, upright stems. Numerous populations attributed to Kern mallow in the past actually consist of desert mallow (Andreasen et al. in press). Due to their morphological similarity, close inspection is required to differentiate the two species.

Widely varying geographical ranges have been reported for Kern mallow due to the unresolved taxonomic problems and misidentifications of desert mallow. Kern mallow in the strict sense occurs only in the Lokern area of Kern County (Wolf 1938, Munz and Keck 1959, Taylor and Davilla 1986, Tibor 2001, Andreasen et al. in press). Plants reported from elsewhere in Kern County or from San Luis Obispo, Santa Barbara, and Tulare counties (Hoover 1970, Leonelli 1986, Taylor and Davilla 1986, Olson and Magney 1992, Stebbins et al. 1992, California Natural Diversity Data Base 2002, E. Cypher personal observations) are referable either to Parry's mallow or desert mallow (Andreasen et al. in press). These erroneous locations include Buena Vista Valley, Carrizo Plain, Cuyama Valley, Elk Hills, Elkhorn Plain, Fellows, Lost Hills, Maricopa, McKittrick Hills, Panorama Hills, Pixley, Telephone Hills, and the Temblor Range. The distribution map in the recovery plan for Kern mallow (U.S. Fish and Wildlife Service 1998) has been invalidated by the recent research of Andreasen et al. (in press).

As with many desert annuals, the height, habit, density, and phenology of Kern mallow vary greatly depending on precipitation. Kern mallow may not germinate in dry years (Twisselmann 1956, Bates 1992). True Kern mallow typically flowers in March and early April, although flowers may be present in late February or into May if weather conditions are favorable (Taylor and Davilla 1986, E. Cypher unpublished data). The majority of Kern mallow flowers open in late morning (approximately 10:00 am standard time) and wither by late afternoon (approximately 3:00 pm standard time) of the same day. Desert mallow in Lokern begins flowering somewhat earlier in the season and flowers are open only for a few hours at mid-day (E. Cypher personal observation).

Kern mallow occurs primarily in the Valley Saltbush Scrub plant community (cf. Holland 1986) and its ecotones with Valley Sink Scrub and Non-native Grassland (Taylor and Davilla 1986, California Natural Diversity Data Base 2002, E. Cypher unpublished data). This species typically grows in areas where shrub cover is less than 25%. However, much of the Kern mallow habitat in Lokern is shrubless due to repeated fires, which type-converted the areas from shrubland to grassland. Herbaceous cover in occupied habitat is variable depending on rainfall; it has ranged from 48% to 97% between 1993 and 2001, but a lower cover probably would be optimal (Taylor and Davilla 1986, Cypher 1994, Anonymous 1997, Anonymous 1998, Anonymous 1999, Anonymous 2000, Anonymous 2001). Elevations at true Kern mallow locations range from 84 to 275 meters (275 to 900 feet) (California Natural Diversity Data Base 2002). The primary soil type supporting Kern mallow is Kimberlina sandy loam, followed by Kimberlina fine sandy loam and Panoche clay loam (E. Cypher unpublished data). Kern mallow occasionally has reinvaded disturbed sites when existing populations remained in adjacent areas to provide sources of seed (Mitchell 1989, E. Cypher unpublished observation).

Survey guidelines

All surveys for rare plants should be conducted in accordance with the standardized guidelines issued by the regulatory agencies (U.S. Fish and Wildlife Service 1996, California Department of Fish and Game 2000) and the California Native Plant Society (2001). The species-specific methods presented below are intended as a supplement to those standardized guidelines.

Systematic surveys are recommended to detect presence and determine distribution of Kern mallow within the survey area. For systematic searches, biologists should walk parallel transects spaced 5 to 10 meters (16 to 33 feet) apart throughout the entire site, regardless of subjective habitat evaluations. However, transects may be stratified by topography or plant community for convenience. Field survey crews should include at least one member who has seen Kern mallow growing in its natural habitat. Other team members may be trained using photographs and/or herbarium specimens but should be accompanied in the field by the experienced crew member during all surveys. The identity of each population discovered must be confirmed by a botanist familiar with both Kern mallow and desert mallow. Any non-flowering *Eremalche* populations that are observed during surveys must be revisited when the flowers are open to confirm their identity.

Prior to beginning surveys in a given year, at least one member of the survey crew should visit one or more known locations of Kern mallow in the Lokern area to verify that precipitation has been adequate for germination and to determine current phenology. The known locations should be as similar as possible to the survey area in elevation, habitat, and topography. Species-specific surveys should not be attempted if Kern mallow is not seen at known locations, the densities are very low relative to normal years, or the plants are inconspicuous. Survey reports should document the known locations that were visited, the date of the visit, and the observability and phenology of Kern mallow at that time, plus the date of the survey, the diagnostic characteristics of any *Eremalche* populations discovered, the abundance and distribution of all rare species in the survey area, and any other elements required by the agency guidelines. The typical survey period for Kern mallow is March and April.

Until biosystematic studies have been conducted to resolve the taxonomic issues, any gynodioecious or small-flowered *Eremalche* population west of the Sierra crest should be reported to the appropriate agency, regardless of flower color or apparent gender. The identity of populations to be acquired as mitigation for disturbance to known Kern mallow should be confirmed by a species expert.

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SUPPLEMENTAL SURVEY METHODS FOR CALIFORNIA JEWELFLOWER

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Literature review

California jewelflower [*Caulanthus californicus* (S. Watson) Payson] is a showy annual belonging to the mustard family (Brassicaceae). It was included previously in the genera *Stanfordia* (Watson 1880) and *Streptanthus* (Greene 1891). California jewelflower is both federally and state listed as an endangered species (U.S. Fish and Wildlife Service 1990, Tibor 2001).

As is typical of annuals, both the size of California jewelflower plants and population size may vary dramatically, depending on site and weather conditions. California jewelflower is most conspicuous during the flowering period, which can range from February into May (Taylor and Davilla 1986, E. Cypher unpublished data). Heights at flowering can range from less than 10 centimeters (4 inches) to 50 centimeters (20 inches) or more (Munz and Keck 1959, Mazer and Hendrickson 1993, Cypher 1994). Even in optimal years, California jewelflower colonies are very limited in extent due to the clumped distribution of plants (Taylor and Davilla 1986, Mazer and Hendrickson 1993).

Other species of *Caulanthus* resemble California jewelflower superficially. However, California jewelflower has smaller flowers and shorter, flatter fruits than Coulter's jewelflower (*C. coulteri* Watson) and desert candle *(C. inflatus* Watson) (Table 1). Depauperate individuals of desert candle may lack the characteristic inflated stems but can be identified by their lavender stigmas (Buck 1993, E. Cypher personal observation). The rosettes of California jewelflower can be confused with those of several other species in the mustard family and aster family (Asteraceae).

Historically, California jewelflower occurred in the San Joaquin Valley and the inner Coast Ranges from Fresno County south to Santa Barbara and Ventura Counties (Taylor and Davilla 1986). Populations have been reported from elevations ranging from approximately 75 to 945 meters (240 to 3,100 feet) and occur on level to gentle sloping (usually <25% slope) terrain. Soils at known locations are primarily subalkaline, sandy loams (Taylor and Davilla 1986, California Natural Diversity Data Base 2002, R. Lewis personal communication).

Plant communities (cf. Holland 1986) supporting extant California jewelflower populations include Non-native Grassland, Upper Sonoran Subshrub Scrub, and Cismontane Juniper Woodland and Scrub (E. Cypher unpublished data). Historical records suggest that California jewelflower also occurred in the Valley Saltbush Scrub plant community (California Natural

Table 1. Diagnostic characters of three *Caulanthus* species. Data from Buck (1993), Munz and Keck (1959), and E. Cypher (unpublished data).

Character	*C. californicus*	*C. coulteri*	*C. inflatus*
Filaments	distinct or 1 pair fused	1-2 pair fused	1-2 pair fused
Stem	not inflated	not inflated	usually inflated
Cauline leaf shape	ovate to rounded	oblong to ovate	oblong to ovate
Sepal length	4-10 mm	5-18 mm	8-10 mm
Petal length	6-11 mm	8-31 mm	8-14 mm
Stigma color	greenish	?	lavender
Mature fruit length	1-6 cm	4-13 cm	5-11 cm
Fruit cross-section	flattened perpendicular to septum	rounded or flattened parallel to septum	rounded to squarish
Seed shape	spheric	oblong	oblique-oblong

Diversity Data Base 2002). Herbaceous cover is dense at most locations except those in Santa Barbara County, where up to 50% of the surface is barren. Native plant species comprise a high proportion of the vegetation at many of the known locations (Taylor and Davilla 1986, Cypher 1994, R. Lewis personal communication).

Survey guidelines

All surveys for rare plants should be conducted in accordance with the standardized guidelines issued by the regulatory agencies (U.S. Fish and Wildlife Service 1996, California Department of Fish and Game 2000) and the California Native Plant Society (2001). The species-specific methods presented below are intended as a supplement to those standardized guidelines.

Systematic surveys are recommended to detect presence and determine distribution of California jewelflower within the survey area. For systematic searches, biologists should walk parallel transects spaced 5 to 10 meters (16 to 33 feet) apart throughout the entire site, regardless of subjective habitat evaluations. However, transects may be stratified by topography or plant community for convenience. Field survey crews should include at least one member who has seen California jewelflower growing in its natural habitat. Other team members may be trained using photographs and/or herbarium specimens but should be accompanied in the field by the experienced crew member during all surveys.

Prior to beginning surveys in a given year, at least one member of the survey crew should visit one or more known locations of California jewelflower to verify that precipitation has been adequate for germination and to determine current phenology. The known locations should be as similar as possible to the survey area in elevation, habitat, and topography. Species-specific surveys should not be attempted if California jewelflower is not seen at known locations, the densities are very low relative to normal years, or the plants are inconspicuous. Survey reports should document the known locations that were visited, the date of the visit, and the observability and phenology of Califomia jewelflower at that time, plus the date of the survey, the abundance and distribution of all rare species in the survey area, and any other elements required by the agency guidelines. The typical survey period for this species is March and April.

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SUPPLEMENTAL SURVEY METHODS FOR BAKERSFIELD CACTUS

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Literature review

The taxonomy of Bakersfield cactus has not been accepted universally, even though it was named over a century ago. Originally, Bakersfield cactus was treated as a full species, *Opuntia treleasii* Coulter (1896). Shortly thereafter, Toumey (1901) renamed Bakersfield cactus as a variety of the more widespread beavertail cactus (*Opuntia basilaris* Englemann and Bigelow), resulting in the combination *O. basilaris* var. *treleasii* (Coulter) Toumey for Bakersfield cactus. Griffiths and Hare (1906) considered Bakersfield cactus to be a distinct species and further subdivided it into two varieties, *O. treleasii* Coulter var. *treleasii* and *O. treleasii* Coulter var. *kernii* Griffiths and Hare. Britton and Rose (1920) corrected the spelling of the epithet to *treleasei* to be consistent with the name of the original collector, William Trelease. In the most recent treatment (Parfitt and Baker 1993), the scientific name of Bakersfield cactus was given as *Opuntia basilaris* var. *treleasei* (Coulter), which includes both varieties of the former *O. treleasei*. Some experts still consider Bakersfield cactus to be a unique species.

Bakersfield cactus differs from the common beavertail cactus (*O. basilaris* var. *basilaris*) in several key characters (Table 1). Bakersfield cactus is unique among the varieties of *O. basilaris* in that the eye-spots contain spines in addition to the bristles. Bakersfield cactus individuals from the type locality near Caliente in Kern County have spines less than 7 millimeters (0.3 inches) long, which may be shorter than the bristles (ESA 1986, R. van de Hoek personal communication). Most other populations of Bakersfield cactus have longer, more conspicuous spines. If the taxonomy of Griffiths and Hare (1906) is used, *O. treleasii* var. *treleasii* refers to the plants with short spines and *O. treleasii* var. *kernii* refers to the form with longer spines. Bakersfield cactus typically flowers in May (Munz and Keck 1959), and plants are less than 35 centimeters (1 foot) tall (Abrams 1951). It is federally and state listed as an endangered species (U.S. Fish and Wildlife Service 1990, Tibor 2001).

Bakersfield cactus is endemic to a limited area of central Kern County, ranging from Granite Station southeast to the Caliente Hills and south to Wheeler Ridge (Twisselmann 1967, U.S. Fish and Wildlife Service 1998, Tibor 2001). Only isolated remnants of the formerly extensive colonies remain (Twisselmann 1967, U.S. Fish and Wildlife Service 1990). Bakersfield cactus occurs on well-drained sandy, gravelly, or loamy soils on stream banks, ridges, bluffs, and rolling hills (ESA 1986, California Natural Diversity Data Base 2002). Historical records indicate that the majority of Bakersfield cactus occurred at elevations ranging from 88 to 396 meters (290 to 1,300 feet) with a few colonies, including the type locality, up to 550 meters

Table 1. Characters differentiating *Opuntia basilaris* var. *basilaris* from var. *treleasei*. Data from Coulter (1896), Griffiths and Hare (1906), Abrams (1951), and Benson (1969).

Character	var. *basilaris*	var. *treleasei*
Joint (pad) shape	obovate to orbicular	obovate to narrowly elliptic
Joint base	flattened	terete
Areoles (eye-spots)	depressed	not depressed
Spine length	absent	4-38 mm

(1,800 feet) in elevation (California Natural Diversity Data Base 2002). Plant communities in which it grows include Sierra-Tehachapi Saltbush Scrub, Relictual Interior Dune Grassland, and Blue Oak Woodland (ESA 1986, Holland 1986, Griggs et al. 1992, California Natural Diversity Data Base 2002, R. van de Hoek personal communication). Beavertail cactus also is found in Kern County, occurring in the Mojave Desert and the western foothills of the Sierra Nevada and Tehachapi mountains (Twisselmann 1967). The ranges of Bakersfield cactus and beavertail cactus may overlap in the Caliente and Kern Canyon areas (Twisselmann 1967, E. Cypher personal observation). Cultivated prickly-pear cacti (*Opuntia* spp.) also have escaped in the vicinity of Bakersfield (E. Cypher personal observation).

Survey guidelines

All surveys for rare plants should be conducted in accordance with the standardized guidelines issued by the regulatory agencies (U.S. Fish and Wildlife Service 1996, California Department of Fish and Game 2000) and the California Native Plant Society (2001). The species-specific methods presented below are intended as a supplement to those standardized guidelines.

Surveys for Bakersfield cactus are possible year-round because it is a perennial. However, vegetative individuals may be obscured by dense annual grasses, and thus plants are most conspicuous while they are in flower. Systematic surveys are recommended to detect presence and determine distribution of Bakersfield cactus within the survey area. For systematic searches, biologists should walk parallel transects spaced 5 to 15 meters (approximately 15 to 50 feet) apart throughout the entire site, regardless of subjective habitat evaluations. However, transects may be stratified by topography or plant community for convenience. Field survey crews should include at least one member who has seen Bakersfield cactus growing in its natural habitat. Other team members may be trained using photographs and/or herbarium specimens but should be accompanied in the field by the experienced crew member during all surveys.

Visits to one or more known locations of Bakersfield cactus are recommended to determine current phenology and observability. The known locations should be as similar as possible to the survey area in elevation, habitat, and topography. Survey reports should document the known locations that were visited, the date of the visit, and the observability and phenology of Bakersfield cactus at that time, plus the date of the survey, the diagnostic characteristics of any *Opuntia* populations discovered, the abundance and distribution of all rare species in the survey area, and any other elements required by the agency guidelines.

Due to the difficulty of identifying short-spined populations of Bakersfield cactus, any wild *Opuntia* population in Kern County west of the Sierra crest should be reported to the appropriate agency. The identity of any such cactus populations outside of the range reported in the recovery plan (U.S. Fish and Wildlife Service 1998) should be confirmed by a species expert before being disturbed or acquired as mitigation for disturbance to known Bakersfield cactus.

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SUPPLEMENTAL SURVEY METHODS FOR HOOVER'S WOOLLY-STAR

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Literature review

Hoover's woolly-star [*Eriastrum hooveri* (Jepson) Mason] is an inconspicuous annual member of the phlox family (Polemoniaceae). It was named originally by Jepson (1943) as *Huegelia hooveri* Jepson but has been known as *Eriastrum hooveri* since Mason (1945) revised the genus. Hoover's woolly-star has small, white to pale blue flowers that are less than 5 millimeters (0.2 inches) long; the stamens are shorter than the corolla (Abrams 1951, Munz and Keck 1959, Patterson 1993). Many-flowered eriastrum [*Eriastrum pluriflorum* (Heller) Mason] frequently occurs in mixed populations with Hoover's woolly-star (Lewis 1992, Cypher 1994). Many-flowered eriastrum can be distinguished by its dark blue flowers that are 16 millimeters (0.6 inches) or more in length and stamens that protrude from the corolla (Abrams 1951, Munz and Keck 1959, Taylor and Davilla 1986, Patterson 1993). Hoover's woolly-star is federally listed as a threatened species (U.S. Fish and Wildlife Service 1990). It has been proposed for delisting (U.S. Fish and Wildlife Service 2001) but must be treated as a listed species until a final rule is published that officially delists this species.

The flowering period for Hoover's woolly-star occurs between March and June (Munz and Keck 1959, Lewis 1992, Cypher 1994), but phenology varies among sites and years. Unlike many other annual forbs, stems of *Eriastrum* species may persist for many months after the plants die. However, surveys outside of the flowering season are unreliable because dead stems do not always persist and even if they do, the plants are not identifiable to species unless the corollas remain attached (Taylor and Davilla 1986, Lewis 1992).

Differing rainfall and site conditions can affect the size of both individual plants and populations (Cypher 1994). The wiry stems of Hoover's woolly-star may be simple or branching and vary in height from 1 to 17 centimeters (0.4 to 6.7 inches) at flowering; similarly, single plants have been observed with as few as 1 and as many as 82 flowers (E. Cypher unpublished data). Densities may vary greatly within a single population (Cypher 1994).

Hoover's woolly-star is known to be extant from Fresno and San Benito Counties south to Kern and Santa Barbara Counties (U.S. Fish and Wildlife Service 1998, Tibor 2001); recently, two populations were discovered in the Antelope Valley of Los Angeles County (Boyd and Porter 1999). The species occurs in a wide variety of sites, from alkali sinks to ridgetops (Lewis 1992). Populations of Hoover's woolly-star have been reported from approximately 50 to 915 meters

(165 to 3,000 feet) in elevation (Danielson et al. 1994, California Natural Diversity Data Base 1995), but the majority of valley-floor populations have been extirpated due to agricultural conversion (Taylor and Davilla 1986).

A wide variety of plant communities support Hoover's woolly-star. Most are dominated by shrubs such as saltbush (*Atriplex* spp.), Mormon tea (*Ephedra* spp.), and iodinebush (*Allenrolfea occidentalis*), but other shrubs, herbs, or trees may dominate the landscape in some areas (Taylor and Davilla 1986, Danielson et al. 1994, California Natural Diversity Data Base 1995). Shrub cover in occupied habitats typically is less than 20% (Taylor and Davilla 1986, Cypher 1994). Features common to many Hoover's woolly-star sites are stabilized silty to sandy soils, a low cover of competing herbaceous vegetation, and presence of cryptogamic crust (Taylor and Davilla 1986, Lewis 1992). However, dense vegetation, other soil types, and lack of cryptogamic crust do not preclude the occurrence of Hoover's woolly-star (Cypher 1994, California Natural Diversity Data Base 1995). Hoover's woolly-star may reinvade disturbed soil surfaces (*e.g.,* well pads, dirt roads) if seeds remain in the vicinity (Lewis 1992, Danielson et al. 1994, Hinshaw et al. 1998, Holmstead and Anderson 1998).

Survey guidelines

All surveys for rare plants should be conducted in accordance with the standardized guidelines issued by the regulatory agencies (U.S. Fish and Wildlife Service 1996, California Department of Fish and Game 2000) and the California Native Plant Society (2001). The species-specific methods presented below are intended as a supplement to those standardized guidelines.

Systematic surveys are recommended to detect presence and determine distribution of Hoover's woolly-star within the survey area. For systematic searches, biologists should walk parallel transects spaced 5 to 10 meters (16 to 33 feet) apart throughout the entire site, regardless of subjective habitat evaluations. However, transects may be stratified by topography or plant community for convenience. Field survey crews should include at least one member who has seen Hoover's woolly-star growing in its natural habitat. Other team members may be trained using photographs and/or herbarium specimens but should be accompanied in the field by the experienced crew member during all surveys.

Prior to beginning surveys in a given year, at least one member of the survey crew should visit one or more known locations of Hoover's woolly-star to verify that precipitation has been adequate for germination and to determine current phenology. The known locations should be as similar as possible to the survey area in elevation, habitat, and topography. Species-specific surveys should not be attempted if Hoover's woolly-star is not seen at known locations, the densities are very low relative to normal years, or the plants are inconspicuous. Survey reports should document the known locations that were visited, the date of the visit, and the observability and phenology of Hoover’s woolly-star at that time, plus the date of the survey, the abundance and distribution of all rare species in the survey area, and any other elements required by the agency guidelines. If *Eriastrum* stems are observed outside of the flowering season, the site should be treated as if a threatened species was present, and the population should be revisited at the appropriate time to determine the identity of the plants. The typical survey period for Hoover's woolly-star is April and May.

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EXHIBIT 11

Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities

State of California
CALIFORNIA NATURAL RESOURCES AGENCY
Department of Fish and Game
November 24, 2009[1]

INTRODUCTION AND PURPOSE

The conservation of special status native plants and their habitats, as well as natural communities, is integral to maintaining biological diversity. The purpose of these protocols is to facilitate a consistent and systematic approach to the survey and assessment of special status native plants and natural communities so that reliable information is produced and the potential of locating a special status plant species or natural community is maximized. They may also help those who prepare and review environmental documents determine when a botanical survey is needed, how field surveys may be conducted, what information to include in a survey report, and what qualifications to consider for surveyors. The protocols may help avoid delays caused when inadequate biological information is provided during the environmental review process; assist lead, trustee and responsible reviewing agencies to make an informed decision regarding the direct, indirect, and cumulative effects of a proposed development, activity, or action on special status native plants and natural communities; meet California Environmental Quality Act (CEQA)[2] requirements for adequate disclosure of potential impacts; and conserve public trust resources.

DEPARTMENT OF FISH AND GAME TRUSTEE AND RESPONSIBLE AGENCY MISSION

The mission of the Department of Fish and Game (DFG) is to manage California's diverse wildlife and native plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. DFG has jurisdiction over the conservation, protection, and management of wildlife, native plants, and habitat necessary to maintain biologically sustainable populations (Fish and Game Code §1802). DFG, as trustee agency under CEQA §15386, provides expertise in reviewing and commenting on environmental documents and makes protocols regarding potential negative impacts to those resources held in trust for the people of California.

Certain species are in danger of extinction because their habitats have been severely reduced in acreage, are threatened with destruction or adverse modification, or because of a combination of these and other factors. The California Endangered Species Act (CESA) provides additional protections for such species, including take prohibitions (Fish and Game Code §2050 *et seq.*). As a responsible agency, DFG has the authority to issue permits for the take of species listed under CESA if the take is incidental to an otherwise lawful activity; DFG has determined that the impacts of the take have been minimized and fully mitigated; and, the take would not jeopardize the continued existence of the species (Fish and Game Code §2081). Surveys are one of the preliminary steps to detect a listed or special status plant species or natural community that may be impacted significantly by a project.

DEFINITIONS

Botanical surveys provide information used to determine the potential environmental effects of proposed projects on all special status plants and natural communities as required by law (i.e., CEQA, CESA, and Federal Endangered Species Act (ESA)). Some key terms in this document appear in **bold font** for assistance in use of the document.

For the purposes of this document, **special status plants** include all plant species that meet one or more of the following criteria[3]:

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1 This document replaces the DFG document entitled "Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened and Endangered Plants and Natural Communities."

2 http://ceres.ca.gov/ceqa/

3 Adapted from the East Alameda County Conservation Strategy available at http://www.fws.gov/sacramento/EACCS/Documents/080228_Species_Evaluation_EACCS.pdf

- Listed or proposed for listing as threatened or endangered under ESA or candidates for possible future listing as threatened or endangered under the ESA (50 CFR §17.12).

- Listed[4] or candidates for listing by the State of California as threatened or endangered under CESA (Fish and Game Code §2050 *et seq.*). A species, subspecies, or variety of plant is **endangered** when the prospects of its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, disease, or other factors (Fish and Game Code §2062). A plant is **threatened** when it is likely to become endangered in the foreseeable future in the absence of special protection and management measures (Fish and Game Code §2067).

- Listed as rare under the California Native Plant Protection Act (Fish and Game Code §1900 *et seq*.). A plant is **rare** when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens (Fish and Game Code §1901).

- Meet the definition of rare or endangered under CEQA §15380(b) and (d). Species that may meet the definition of rare or endangered include the following:

  - Species considered by the California Native Plant Society (CNPS) to be "rare, threatened or endangered in California" (Lists 1A, 1B and 2);

  - Species that may warrant consideration on the basis of local significance or recent biological information[5];

  - Some species included on the California Natural Diversity Database's (CNDDB) *Special Plants, Bryophytes, and Lichens List* (California Department of Fish and Game 2008)[6].

- Considered a **locally significant species,** that is, a species that is not rare from a statewide perspective but is rare or uncommon in a local context such as within a county or region (CEQA §15125 (c)) or is so designated in local or regional plans, policies, or ordinances (CEQA Guidelines, Appendix G). Examples include a species at the outer limits of its known range or a species occurring on an uncommon soil type.

Special status natural communities are communities that are of limited distribution statewide or within a county or region and are often vulnerable to environmental effects of projects. These communities may or may not contain special status species or their habitat. The most current version of the Department's *List of California Terrestrial Natural Communities*[7] indicates which natural communities are of special status given the current state of the California classification.

Most types of wetlands and riparian communities are considered special status natural communities due to their limited distribution in California. These natural communities often contain special status plants such as those described above. These protocols may be used in conjunction with protocols formulated by other agencies, for example, those developed by the U.S. Army Corps of Engineers to delineate jurisdictional wetlands[8] or by the U.S. Fish and Wildlife Service to survey for the presence of special status plants[9].

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4 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata.

5 In general, CNPS List 3 plants (plants about which more information is needed) and List 4 plants (plants of limited distribution) may not warrant consideration under CEQA §15380. These plants may be included on special status plant lists such as those developed by counties where they would be addressed under CEQA §15380. List 3 plants may be analyzed under CEQA §15380 if sufficient information is available to assess potential impacts to such plants. Factors such as regional rarity vs. statewide rarity should be considered in determining whether cumulative impacts to a List 4 plant are significant even if individual project impacts are not. List 3 and 4 plants are also included in the California Natural Diversity Database's (CNDDB) *Special Plants, Bryophytes, and Lichens List.* [Refer to the current online published list available at: http://www.dfg.ca.gov/biogeodata.] Data on Lists 3 and 4 plants should be submitted to CNDDB. Such data aids in determining or revising priority ranking.

6 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata.

7 http://www.dfg.ca.gov/biogeodata/vegcamp/pdfs/natcomlist.pdf. The rare natural communities are asterisked on this list.

8 http://www.wetlands.com/regs/tlpge02e.htm

9 U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/sacramento/es/protocol.htm

BOTANICAL SURVEYS

Conduct botanical surveys prior to the commencement of any activities that may modify vegetation, such as clearing, mowing, or ground-breaking activities. It is appropriate to conduct a botanical field survey when:

- Natural (or naturalized) vegetation occurs on the site, and it is unknown if special status plant species or natural communities occur on the site, and the project has the potential for direct or indirect effects on vegetation; or
- Special status plants or natural communities have historically been identified on the project site; or
- Special status plants or natural communities occur on sites with similar physical and biological properties as the project site.

SURVEY OBJECTIVES

Conduct field surveys in a manner which maximizes the likelihood of locating special status plant species or special status natural communities that may be present. Surveys should be **floristic in nature**, meaning that every plant taxon that occurs on site is identified to the taxonomic level necessary to determine rarity and listing status. "Focused surveys" that are limited to habitats known to support special status species or are restricted to lists of likely potential species are not considered floristic in nature and are not adequate to identify all plant taxa on site to the level necessary to determine rarity and listing status. Include a list of plants and natural communities detected on the site for each botanical survey conducted. More than one field visit may be necessary to adequately capture the floristic diversity of a site. An indication of the prevalence (estimated total numbers, percent cover, density, etc.) of the species and communities on the site is also useful to assess the significance of a particular population.

SURVEY PREPARATION

Before field surveys are conducted, compile relevant botanical information in the general project area to provide a regional context for the investigators. Consult the CNDDB[10] and BIOS[11] for known occurrences of special status plants and natural communities in the project area prior to field surveys. Generally, identify vegetation and habitat types potentially occurring in the project area based on biological and physical properties of the site and surrounding ecoregion[12], unless a larger assessment area is appropriate. Then, develop a list of special status plants with the potential to occur within these vegetation types. This list can serve as a tool for the investigators and facilitate the use of reference sites; however, special status plants on site might not be limited to those on the list. Field surveys and subsequent reporting should be comprehensive and floristic in nature and not restricted to or focused only on this list. Include in the survey report the list of potential special status species and natural communities, and the list of references used to compile the background botanical information for the site.

SURVEY EXTENT

Surveys should be comprehensive over the entire site, including areas that will be directly or indirectly impacted by the project. Adjoining properties should also be surveyed where direct or indirect project effects, such as those from fuel modification or herbicide application, could potentially extend offsite. Pre-project surveys restricted to known CNDDB rare plant locations may not identify all special status plants and communities present and do not provide a sufficient level of information to determine potential impacts.

FIELD SURVEY METHOD

Conduct surveys using **systematic field techniques** in all habitats of the site to ensure thorough coverage of potential impact areas. The level of effort required per given area and habitat is dependent upon the vegetation and its overall diversity and structural complexity, which determines the distance at which plants can be identified. Conduct surveys by walking over the entire site to ensure thorough coverage, noting all plant taxa

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[10] Available at http://www.dfg.ca.gov/biogeodata/cnddb

[11] http://www.bios.dfg.ca.gov/

[12] Ecological Subregions of California, available at http://www.fs.fed.us/r5/projects/ecoregions/toc.htm

observed. The level of effort should be sufficient to provide comprehensive reporting. For example, one person-hour per eight acres per survey date is needed for a comprehensive field survey in grassland with medium diversity and moderate terrain[13], with additional time allocated for species identification.

TIMING AND NUMBER OF VISITS

Conduct surveys in the field at the time of year when species are both evident and identifiable. Usually this is during flowering or fruiting. Space visits throughout the growing season to accurately determine what plants exist on site. Many times this may involve multiple visits to the same site (e.g. in early, mid, and late-season for flowering plants) to capture the floristic diversity at a level necessary to determine if special status plants are present[14]. The timing and number of visits are determined by geographic location, the natural communities present, and the weather patterns of the year(s) in which the surveys are conducted.

REFERENCE SITES

When special status plants are known to occur in the type(s) of habitat present in the project area, observe reference sites (nearby accessible occurrences of the plants) to determine whether those species are identifiable at the time of the survey and to obtain a visual image of the target species, associated habitat, and associated natural community.

USE OF EXISTING SURVEYS

For some sites, floristic inventories or special status plant surveys may already exist. Additional surveys may be necessary for the following reasons:

- Surveys are not current[15]; or
- Surveys were conducted in natural systems that commonly experience year to year fluctuations such as periods of drought or flooding (e.g. vernal pool habitats or riverine systems); or
- Surveys are not comprehensive in nature; or fire history, land use, physical conditions of the site, or climatic conditions have changed since the last survey was conducted[16]; or
- Surveys were conducted in natural systems where special status plants may not be observed if an annual above ground phase is not visible (e.g. flowers from a bulb); or
- Changes in vegetation or species distribution may have occurred since the last survey was conducted, due to habitat alteration, fluctuations in species abundance and/or seed bank dynamics.

NEGATIVE SURVEYS

Adverse conditions may prevent investigators from determining the presence of, or accurately identifying, some species in potential habitat of target species. Disease, drought, predation, or herbivory may preclude the presence or identification of target species in any given year. Discuss such conditions in the report.

The failure to locate a known special status plant occurrence during one field season does not constitute evidence that this plant occurrence no longer exists at this location, particularly if adverse conditions are present. For example, surveys over a number of years may be necessary if the species is an annual plant having a persistent, long-lived seed bank and is known not to germinate every year. Visits to the site in more

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13 Adapted from U.S. Fish and Wildlife Service kit fox survey guidelines available at www.fws.gov/sacramento/es/documents/kitfox_no_protocol.pdf

14 U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/sacramento/es/protocol.htm

15 Habitats, such as grasslands or desert plant communities that have annual and short-lived perennial plants as major floristic components may require yearly surveys to accurately document baseline conditions for purposes of impact assessment. In forested areas, however, surveys at intervals of five years may adequately represent current conditions. For forested areas, refer to "Guidelines for Conservation of Sensitive Plant Resources Within the Timber Harvest Review Process and During Timber Harvesting Operations", available at https://r1.dfg.ca.gov/portal/Portals/12/THPBotanicalGuidelinesJuly2005.pdf

16 U.S. Fish and Wildlife Service Survey Guidelines available at http://www.fws.gov/ventura/speciesinfo/protocols_guidelines/docs/botanicalinventories.pdf

than one year increase the likelihood of detection of a special status plant especially if conditions change. To further substantiate negative findings for a known occurrence, a visit to a nearby reference site may ensure that the timing of the survey was appropriate.

REPORTING AND DATA COLLECTION

Adequate information about special status plants and natural communities present in a project area will enable reviewing agencies and the public to effectively assess potential impacts to special status plants or natural communities[17] and will guide the development of minimization and mitigation measures. The next section describes necessary information to assess impacts. For comprehensive, systematic surveys where no special status species or natural communities were found, reporting and data collection responsibilities for investigators remain as described below, excluding specific occurrence information.

SPECIAL STATUS PLANT OR NATURAL COMMUNITY OBSERVATIONS

Record the following information for locations of each special status plant or natural community detected during a field survey of a project site.

- A detailed map (1:24,000 or larger) showing locations and boundaries of each special status species occurrence or natural community found as related to the proposed project. Mark occurrences and boundaries as accurately as possible. Locations documented by use of global positioning system (GPS) coordinates must include the datum[18] in which they were collected;
- The site-specific characteristics of occurrences, such as associated species, habitat and microhabitat, structure of vegetation, topographic features, soil type, texture, and soil parent material. If the species is associated with a wetland, provide a description of the direction of flow and integrity of surface or subsurface hydrology and adjacent off-site hydrological influences as appropriate;
- The number of individuals in each special status plant population as counted (if population is small) or estimated (if population is large);
- If applicable, information about the percentage of individuals in each life stage such as seedlings vs. reproductive individuals;
- The number of individuals of the species per unit area, identifying areas of relatively high, medium and low density of the species over the project site; and
- Digital images of the target species and representative habitats to support information and descriptions.

FIELD SURVEY FORMS

When a special status plant or natural community is located, complete and submit to the CNDDB a California Native Species (or Community) Field Survey Form[19] or equivalent written report, accompanied by a copy of the relevant portion of a 7.5 minute topographic map with the occurrence mapped. Present locations documented by use of GPS coordinates in map and digital form. Data submitted in digital form must include the datum[20] in which it was collected. If a potentially undescribed special status natural community is found on the site, document it with a Rapid Assessment or Relevé form[21] and submit it with the CNDDB form.

VOUCHER COLLECTION

Voucher specimens provide verifiable documentation of species presence and identification as well as a public record of conditions. This information is vital to all conservation efforts. Collection of voucher specimens should

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17 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata. For Timber Harvest Plans (THPs) please refer to the "Guidelines for Conservation of Sensitive Plant Resources Within the Timber Harvest Review Process and During Timber Harvesting Operations", available at https://r1.dfg.ca.gov/portal/Portals/12/THPBotanicalGuidelinesJuly2005.pdf

18 NAD83, NAD27 or WGS84

19 http://www.dfg.ca.gov/biogeodata

20 NAD83, NAD27 or WGS84

21 http://www.dfg.ca.gov/biogeodata/vegcamp/veg_publications_protocols.asp

be conducted in a manner that is consistent with conservation ethics, and is in accordance with applicable state and federal permit requirements (e.g. incidental take permit, scientific collection permit). Voucher collections of special status species (or suspected special status species) should be made only when such actions would not jeopardize the continued existence of the population or species.

Deposit voucher specimens with an indexed regional herbarium[22] no later than 60 days after the collections have been made. Digital imagery can be used to supplement plant identification and document habitat. Record all relevant permittee names and permit numbers on specimen labels. A collecting permit is required prior to the collection of State-listed plant species[23].

BOTANICAL SURVEY REPORTS

Include reports of botanical field surveys containing the following information with project environmental documents:

- **Project and site description**
  - A description of the proposed project;
  - A detailed map of the project location and study area that identifies topographic and landscape features and includes a north arrow and bar scale; and,
  - A written description of the biological setting, including vegetation[24] and structure of the vegetation; geological and hydrological characteristics; and land use or management history.

- **Detailed description of survey methodology and results**
  - Dates of field surveys (indicating which areas were surveyed on which dates), name of field investigator(s), and total person-hours spent on field surveys;
  - A discussion of how the timing of the surveys affects the comprehensiveness of the survey;
  - A list of potential special status species or natural communities;
  - A description of the area surveyed relative to the project area;
  - References cited, persons contacted, and herbaria visited;
  - Description of reference site(s), if visited, and phenological development of special status plant(s);
  - A list of all taxa occurring on the project site. Identify plants to the taxonomic level necessary to determine whether or not they are a special status species;
  - Any use of existing surveys and a discussion of applicability to this project;
  - A discussion of the potential for a false negative survey;
  - Provide detailed data and maps for all special plants detected. Information specified above under the headings “Special Status Plant or Natural Community Observations,” and “Field Survey Forms,” should be provided for locations of each special status plant detected;
  - Copies of all California Native Species Field Survey Forms or Natural Community Field Survey Forms should be sent to the CNDDB and included in the environmental document as an Appendix. It is not necessary to submit entire environmental documents to the CNDDB; and,
  - The location of voucher specimens, if collected.

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22 For a complete list of indexed herbaria, see: Holmgren, P., N. Holmgren and L. Barnett. 1990. Index Herbariorum, Part 1: Herbaria of the World. New York Botanic Garden, Bronx, New York. 693 pp. Or: http://www.nybg.org/bsci/ih/ih.html

23 Refer to current online published lists available at: http://www.dfg.ca.gov/biogeodata.

24 A vegetation map that uses the National Vegetation Classification System (http://biology.usgs.gov/npsveg/nvcs.html), for example *A Manual of California Vegetation*, and highlights any special status natural communities. If another vegetation classification system is used, the report should reference the system, provide the reason for its use, and provide a crosswalk to the National Vegetation Classification System.

- **Assessment of potential impacts**
  - A discussion of the significance of special status plant populations in the project area considering nearby populations and total species distribution;
  - A discussion of the significance of special status natural communities in the project area considering nearby occurrences and natural community distribution;
  - A discussion of direct, indirect, and cumulative impacts to the plants and natural communities;
  - A discussion of threats, including those from invasive species, to the plants and natural communities;
  - A discussion of the degree of impact, if any, of the proposed project on unoccupied, potential habitat of the species;
  - A discussion of the immediacy of potential impacts; and,
  - Recommended measures to avoid, minimize, or mitigate impacts.

QUALIFICATIONS

Botanical consultants should possess the following qualifications:

- Knowledge of plant taxonomy and natural community ecology;
- Familiarity with the plants of the area, including special status species;
- Familiarity with natural communities of the area, including special status natural communities;
- Experience conducting floristic field surveys or experience with floristic surveys conducted under the direction of an experienced surveyor;
- Familiarity with the appropriate state and federal statutes related to plants and plant collecting; and,
- Experience with analyzing impacts of development on native plant species and natural communities.

SUGGESTED REFERENCES

Barbour, M., T. Keeler-Wolf, and A. A. Schoenherr (eds.). 2007. Terrestrial vegetation of California (3rd Edition). University of California Press.

Bonham, C.D. 1988. Measurements for terrestrial vegetation. John Wiley and Sons, Inc., New York, NY.

California Native Plant Society. Most recent version. Inventory of rare and endangered plants (online edition). California Native Plant Society, Sacramento, CA. Online URL http://www.cnps.org/inventory.

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Elzinga, C.L., D.W. Salzer, and J. Willoughby. 1998. Measuring and monitoring plant populations. BLM Technical Reference 1730-1. U.S. Dept. of the Interior, Bureau of Land Management, Denver, Colorado.

Leppig, G. and J.W. White. 2006. Conservation of peripheral plant populations in California. Madroño 53:264-274.

Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, Inc., New York, NY.

U.S. Fish and Wildlife Service. 1996. Guidelines for conducting and reporting botanical inventories for federally listed plants on the Santa Rosa Plain. Sacramento, CA.

U.S. Fish and Wildlife Service. 1996. Guidelines for conducting and reporting botanical inventories for federally listed, proposed and candidate plants. Sacramento, CA.

Van der Maarel, E. 2005. Vegetation Ecology. Blackwell Science Ltd., Malden, MA.

EXHIBIT 12

Forest and Woodlands Alliances and Stands		Global & State Rank
*88.800.00	***Abies amabilis* (Pacific silver fir forest) Alliance**	G5 S1
*88.800.01	*Abies amabilis*	
*88.300.00	***Abies bracteata* (Santa Lucia fir groves) Alliance**	G3 S3
*88.300.01	*Abies bracteata / Galium clementis*	
*88.300.02	*Abies bracteata / Polystichum munitum*	
88.500.00	***Abies concolor* (White fir forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
88.500.40	*Abies concolor - Calocedrus decurrens - Pinus jeffreyi*	
88.510.10	*Abies concolor - Calocedrus decurrens - Pseudotsuga macrocarpa - Pinus coulteri*	
88.500.29	*Abies concolor - Calocedrus decurrens - Quercus kelloggii*	
88.500.31	*Abies concolor - Calocedrus decurrens / Pyrola picta*	
88.500.30	*Abies concolor - Calocedrus decurrens / Symphoricarpos mollis*	
*88.500.37	*Abies concolor - Chrysolepis chrysophylla*	
88.500.35	*Abies concolor / (Rosa gymnocarpa) - Symphoricarpos mollis*	
88.500.60	*Abies concolor / Acer glabrum*	
88.500.12	*Abies concolor / Achlys triphylla*	
88.500.33	*Abies concolor / Amelanchier alnifolia*	
88.500.10	*Abies concolor / Arctostaphylos nevadensis*	
88.500.17	*Abies concolor / Arnica cordifolia*	
88.500.32	*Abies concolor / Chimaphila menziesii - Pyrola picta*	
88.500.11	*Abies concolor / Chimaphila umbellata*	
88.500.59	*Abies concolor / Goodyera oblongifolia*	
88.500.54	*Abies concolor / Mahonia nervosa*	
88.500.58	*Abies concolor / Prunus emarginata*	
88.500.61	*Abies concolor / Pseudostellaria jamesiana*	
88.500.57	*Abies concolor / Trillium ovatum*	
88.500.53	*Abies concolor / Vicia americana*	
88.510.00	***Abies concolor - Pinus lambertiana* (White fir - sugar pine forest) Alliance**	G4 S4
88.510.01	*Abies concolor - Pinus lambertiana*	
88.510.09	*Abies concolor - Pinus lambertiana - Calocedrus decurrens - Quercus chrysolepis*	
88.510.06	*Abies concolor - Pinus lambertiana - Calocedrus decurrens / Adenocaulon bicolor*	
88.510.07	*Abies concolor - Pinus lambertiana - Calocedrus decurrens / Chrysolepis sempervirens*	
88.510.05	*Abies concolor - Pinus lambertiana - Calocedrus decurrens / Cornus nuttallii / Corylus cornuta*	
88.510.08	*Abies concolor - Pinus lambertiana - Calocedrus decurrens / Symphoricarpos mollis / Kelloggia galioides*	
88.510.04	*Abies concolor - Pinus lambertiana - Pinus jeffreyi*	
88.510.17	*Abies concolor - Pinus lambertiana - Pinus ponderosa / Lithocarpus densiflorus var. echinoides*	
88.510.14	*Abies concolor - Pinus lambertiana - Pseudotsuga menziesii / Carex rossii*	
88.510.13	*Abies concolor - Pinus lambertiana / Ceanothus cordulatus*	
88.510.03	*Abies concolor - Pinus lambertiana / Maianthemum racemosa - Prosartes hookeri*	
88.510.16	*Abies concolor - Pinus ponderosa / Lithocarpus densiflorus var. echinoides*	
88.510.15	*Pinus ponderosa - Pinus lambertiana / Lithocarpus densiflorus var. echinoides*	
88.530.00	***Abies concolor - Pseudotsuga menziesii* (White fir - Douglas fir forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
88.530.34	*Abies concolor - Pseudotsuga menziesii - (mixed conifer) / Acer circinatum - Chrysolepis sempervirens*	
*88.530.06	*Abies concolor - Pseudotsuga menziesii - (Quercus chrysolepis)*	
88.530.30	*Abies concolor - Pseudotsuga menziesii - Calocedrus decurrens*	
88.530.35	*Abies concolor - Pseudotsuga menziesii / Amelanchier utahensis*	
88.530.14	*Abies concolor - Pseudotsuga menziesii / Arnica cordifolia*	
88.530.36	*Abies concolor - Pseudotsuga menziesii / Cornus nuttallii*	
88.530.37	*Abies concolor - Pseudotsuga menziesii / Cornus nuttallii / Corylus cornuta*	

*88.530.15	*Abies concolor - Pseudotsuga menziesii / Corylus cornuta*	
88.530.32	*Abies concolor - Pseudotsuga menziesii / Corylus cornuta / Adenocaulon bicolor*	
88.530.16	*Abies concolor - Pseudotsuga menziesii / Melica subulata*	
88.530.29	*Abies concolor - Pseudotsuga menziesii / Pteridium aquilinum*	
88.530.17	*Abies concolor - Pseudotsuga menziesii / Quercus sadleriana*	
88.530.18	*Abies concolor - Pseudotsuga menziesii / Quercus sadleriana - Arctostaphylos nevadensis*	
88.530.19	*Abies concolor - Pseudotsuga menziesii / Quercus sadleriana - Quercus vacciniifolia*	
88.530.38	*Abies concolor - Pseudotsuga menziesii / Quercus sadleriana - Rhododendron macrophyllum*	
88.530.20	*Abies concolor - Pseudotsuga menziesii / Quercus vacciniifolia*	
*88.530.21	*Abies concolor - Pseudotsuga menziesii / Rhododendron macrophyllum - Quercus*	
88.530.23	*Abies concolor - Pseudotsuga menziesii / Rosa gymnocarpa - Linnaea borealis - Symphoricarpos mollis*	
88.530.24	*Abies concolor - Pseudotsuga menziesii / Rosa gymnocarpa - Symphoricarpos mollis*	
*88.530.25	*Abies concolor - Pseudotsuga menziesii / Rosa gymnocarpa / Linnaea borealis*	
88.530.31	*Abies concolor - Pseudotsuga menziesii / Rubus ameniacus*	
*88.530.26	*Abies concolor - Pseudotsuga menziesii / Rubus parviflorus*	
88.530.33	*Abies concolor - Pseudotsuga menziesii / Trientalis latifolia*	
88.530.28	*Abies concolor - Pseudotsuga menziesii / Xerophyllum tenax*	
*88.100.00	***Abies grandis* (Grand fir forest) Alliance**	G4 S2
*88.400.00	***Abies lasiocarpa* (Subalpine fir forest) Alliance**	G5 S2
*88.400.01	*Abies lasiocarpa*	
88.200.00	***Abies magnifica* (Red fir forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
88.200.23	*Abies magnifica*	
88.200.30	*Abies magnifica - Pinus monticola*	
88.200.15	*Abies magnifica - Tsuga mertensiana / Orthilia secunda*	
88.200.14	*Abies magnifica - Picea breweriana / Quercus sadleriana - Vaccinium membranaceum*	
88.200.16	*Abies magnifica - Pinus contorta / Sphenosciadium capitellatum*	
88.200.24	*Abies magnifica - Pinus contorta ssp. murrayana / Hieracium albiflorum*	
88.200.29	*Abies magnifica - Pinus monticola - Pinus contorta ssp. murrayana*	
88.200.43	*Abies magnifica - Pinus monticola / Quercus vacciniifolia*	
*88.200.10	*Abies magnifica - (Calocedrus decurrens)*	
88.200.03	*Abies magnifica / Achlys triphylla*	
88.200.27	*Abies magnifica / Arctostaphylos nevadensis*	
88.200.05	*Abies magnifica / Chimaphila umbellata*	
88.200.35	*Abies magnifica / Leucothoe davisiae*	
88.200.37	*Abies magnifica / Linnaea borealis*	
88.200.41	*Abies magnifica / Lupinus albifrons*	
88.200.11	*Abies magnifica / Orthilia secunda*	
88.200.06	*Abies magnifica / Penstemon gracilentus*	
88.200.25	*Abies magnifica / Pinus contorta ssp. murrayana*	
88.200.28	*Abies magnifica / Pinus monticola / Arctostaphylos nevadensis*	
88.200.31	*Abies magnifica / Pinus monticola / Chrysolepis sempervirens*	
88.200.13	*Abies magnifica / Pyrola picta*	
88.200.01	*Abies magnifica / Quercus sadleriana*	
88.200.09	*Abies magnifica / Quercus sadleriana - Arctostaphylos nevadensis*	
88.200.36	*Abies magnifica / Quercus vacciniifolia*	
*88.200.12	*Abies magnifica / Rhododendron macrophyllum*	
*88.200.02	*Abies magnifica / Vaccinium membranaceum*	
88.200.26	*Abies magnifica / Wyethia mollis*	
88.520.00	***Abies magnifica - Abies concolor* (Red fir - white fir forest) Alliance**	G5 S4
88.520.01	*Abies magnifica - Abies concolor*	
88.520.09	*Abies magnifica - Abies concolor - Pinus jeffreyi*	
88.520.11	*Abies magnifica - Abies concolor / Acer glabrum*	
88.520.08	*Abies magnifica - Abies concolor / Achlys triphylla*	
88.520.16	*Abies magnifica - Abies concolor / Anemone deltoidea*	

88.520.07	*Abies magnifica - Abies concolor / Arctostaphylos nevadensis*	
88.520.12	*Abies magnifica - Abies concolor / Arctostaphylos nevadensis*	
88.520.03	*Abies magnifica - Abies concolor / Arnica cordifolia*	
88.520.13	*Abies magnifica - Abies concolor / Penstemon anguineus - Monardella odoratissima*	
88.520.10	*Abies magnifica - Abies concolor / Pinus lambertiana*	
88.520.02	*Abies magnifica - Abies concolor / Pteridium aquilinum*	
88.520.15	*Abies magnifica - Abies concolor / Pyrola picta*	
88.520.06	*Abies magnifica - Abies concolor / Quercus sadleriana*	
88.520.14	*Abies magnifica - Abies concolor / Quercus sadleriana*	
88.520.05	*Abies magnifica - Abies concolor / Symphoricarpos mollis - Rosa gymnocarpa*	
88.520.04	*Abies magnifica - Abies concolor / Symphoricarpos mollis / Pyrola picta*	
*61.450.00	***Acer macrophyllum* (Bigleaf maple forest) Alliance**	G4 S3
*61.450.01	*Acer macrophyllum*	
*61.450.02	*Acer macrophyllum - Pseudotsuga menziesii / Adenocaulon bicolor*	
*61.450.04	*Acer macrophyllum - Pseudotsuga menziesii / Corylus cornuta*	
*61.450.03	*Acer macrophyllum - Pseudotsuga menziesii / Dryopteris arguta*	
*61.450.05	*Acer macrophyllum - Pseudotsuga menziesii / Philadelphus lewisii*	
*61.450.06	*Acer macrophyllum - Pseudotsuga menziesii / Polystichum munitum*	
*61.440.00	***Acer negundo* (Box-elder forest) Alliance**	G5 S2
*61.440.01	*Acer negundo - Salix gooddingii*	
*75.100.00	***Aesculus californica* (California buckeye groves) Alliance**	G3 S3
*75.100.03	*Aesculus californica*	
*75.100.02	*Aesculus californica - Umbellularia californica / Diplacus aurantiacus*	
*75.100.06	*Aesculus californica - Umbellularia californica / Holodiscus discolor*	
*75.100.04	*Aesculus californica / Datisca glomerata*	
*75.100.05	*Aesculus californica / Lupinus albifrons*	
*75.100.01	*Aesculus californica / Toxicodendron diversilobum / moss*	
61.420.00	***Alnus rhombifolia* (White alder groves) Alliance**	G4 S4 (some associations are of high priority for inventory)
61.420.10	*Alnus rhombifolia*	
61.420.03	*Alnus rhombifolia - Acer macrophyllum*	
*61.420.11	*Alnus rhombifolia - Platanus racemosa*	
61.420.12	*Alnus rhombifolia - Platanus racemosa - Quercus chrysolepis*	
*61.420.15	*Alnus rhombifolia - Platanus racemosa - Salix laevigata*	
61.420.29	*Alnus rhombifolia - Pseudotsuga menziesii*	
61.420.31	*Alnus rhombifolia - Pseudotsuga menziesii - Calocedrus decurrens*	
61.420.30	*Alnus rhombifolia - Pseudotsuga menziesii / Darmera peltata*	
61.420.04	*Alnus rhombifolia - Pseudotsuga menziesii / Rubus armeniacus*	
61.420.22	*Alnus rhombifolia - Quercus chrysolepis*	
*61.420.13	*Alnus rhombifolia - Salix laevigata*	
61.420.02	*Alnus rhombifolia / Aruncus dioicus*	
61.420.09	*Alnus rhombifolia / Baccharis salicifolia*	
61.420.24	*Alnus rhombifolia / Carex nudata*	
61.420.23	*Alnus rhombifolia / Carex spp*	
*61.420.07	*Alnus rhombifolia / Cornus sericea*	
61.420.06	*Alnus rhombifolia / Cornus sessilis*	
*61.420.05	*Alnus rhombifolia / Darmera peltata*	
61.420.08	*Alnus rhombifolia / Galium trifolium*	
61.420.26	*Alnus rhombifolia / Galium trifolium - Stachys ajugoides*	
61.420.21	*Alnus rhombifolia / Leucothoe davisiae*	
*61.420.01	*Alnus rhombifolia / Polypodium californicum*	
61.420.27	*Alnus rhombifolia / Pteridium aquilinum*	
*61.420.17	*Alnus rhombifolia / Rhododendron occidentale*	
*61.420.18	*Alnus rhombifolia / Salix exigua - (Rosa californica)*	

61.410.00	***Alnus rubra* (Red alder forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
*61.410.01	*Alnus rubra - Pseudotsuga menziesii / Acer circinatum / Claytonia sibirica*	
*61.410.02	*Alnus rubra / Gaultheria shallon*	
61.410.07	*Alnus rubra / Rubus spectabilis*	
*61.410.06	*Alnus rubra / Rubus spectabilis - Sambucus racemosa*	
*61.410.05	*Alnus rubra / Salix lasiolepis*	
*73.200.00	***Arbutus menziesii* (Madrone forest) Alliance**	G4 S3
*73.200.03	*Arbutus menziesii - Quercus agrifolia*	
*73.200.01	*Arbutus menziesii - Umbellularia californica - (Lithocarpus densiflorus)*	
*73.200.02	*Arbutus menziesii - Umbellularia californica - Quercus kelloggii*	
*33.120.00	***Bursera microphylla* (Elephant tree stands) Special Stands**	G4 S1
*81.606.00	***Callitropsis abramsiana* (Santa Cruz cypress groves) Special Stands**	G1 S1
*81.601.00	***Callitropsis bakeri* (Baker cypress stands) Alliance**	G2 S2
*81.601.01	*Callitropsis bakeri / Arctostaphylos patula*	
*81.607.00	***Callitropsis forbesii* (Tecate cypress stands) Alliance**	G2 S2
*81.603.00	***Callitropsis goveniana* (Monterey pygmy cypress stands) Special Stands**	G1 S1
*81.300.00	***Callitropsis macnabiana* (McNab cypress woodland) Alliance**	G3 S3
*81.300.02	*Callitropsis macnabiana / Arctostaphylos viscida*	
*81.604.00	***Callitropsis macrocarpa* (Monterey cypress stands) Special Stands**	G1 S1
*81.605.00	***Callitropsis nevadensis* (Piute cypress woodland) Alliance**	G2 S2
*81.605.01	*Callitropsis nevadensis*	
*81.200.00	***Callitropsis nootkatensis* (Alaska yellow-cedar stands) Alliance**	G4 S1
*81.400.00	***Callitropsis pigmaea* (Mendocino pygmy cypress woodland) Alliance**	G2 S2
*81.400.01	*Callitropsis pigmaea / Cladonia bellidiflora*	
*81.400.03	*Callitropsis pigmaea / Ramalina tharusta*	
*81.400.04	*Callitropsis pigmaea / Usnea subfloridana*	
*81.400.02	*Callitropsis pimaea / Cladina impexa*	
*81.500.00	***Callitropsis sargentii* (Sargent cypress woodland) Alliance**	G3 S3
*81.500.01	*Callitropsis sargentii*	
*81.500.03	*Callitropsis sargentii / Arctostaphylos montana*	
*81.500.02	*Callitropsis sargentii / riparian*	
*81.610.00	***Callitropsis stephensonii* (Cuyamaca cypress stands) Special Stands**	G1 S1
*85.100.00	***Calocedrus decurrens* (Incense cedar forest) Alliance**	G4 S3
*85.100.05	*Calocedrus decurrens - Abies concolor / Senecio triangularis*	
*85.100.03	*Calocedrus decurrens - Alnus rhombifolia*	
*85.100.04	*Calocedrus decurrens - Quercus chrysolepis - Quercus kelloggii*	
*85.100.01	*Calocedrus decurrens / Listera convallarioides*	
*81.100.00	***Chamaecyparis lawsoniana* (Port Orford cedar forest) Alliance**	G3 S3
*81.100.31	*Chamaecyparis lawsoniana - Abies concolor / Acer circinatum*	
*81.100.30	*Chamaecyparis lawsoniana - Abies concolor / Alnus viridis*	
*81.100.14	*Chamaecyparis lawsoniana - Abies concolor / Chrysolepis sempervirens (-Rhododendron occidentale - Leucothoe davisiae)*	
*81.100.08	*Chamaecyparis lawsoniana - Abies concolor / herb*	
*81.100.07	*Chamaecyparis lawsoniana - Abies concolor / Quercus sadleriana*	
*81.100.09	*Chamaecyparis lawsoniana - Abies concolor / Quercus vacciniifolia*	

*81.100.06 *Chamaecyparis lawsoniana - Abies concolor / Rhododendron occidentale*
*81.100.32 *Chamaecyparis lawsoniana - Abies x shastensis - Picea breweri / Quercus sadleriana - Quercus vacciniifolia*
*81.100.33 *Chamaecyparis lawsoniana - Abies x shastensis / Alnus viridis - Quercus sadleriana*
*81.100.34 *Chamaecyparis lawsoniana - Abies x shastensis / Alnus viridis / Darlingtonia californica*
*81.100.03 *Chamaecyparis lawsoniana - Abies x shastensis / Quercus sadleriana - Vaccinium membranaceum*
*81.100.39 *Chamaecyparis lawsoniana - Calocedrus decurrens - Alnus rhombifolia*
*81.100.40 *Chamaecyparis lawsoniana - Calocedrus decurrens / Quercus vacciniifolia*
*81.100.16 *Chamaecyparis lawsoniana - Pinus monticola / Alnus viridis*
*81.100.19 *Chamaecyparis lawsoniana - Pinus monticola / dry herb complex*
*81.100.10 *Chamaecyparis lawsoniana - Pinus monticola / Quercus vacciniifolia*
*81.100.15 *Chamaecyparis lawsoniana - Pinus monticola / Rhododendron neoglandulosum / Darlingtonia californica*
*81.100.38 *Chamaecyparis lawsoniana - Pinus monticola / Rhododendron neoglandulosum / Darlingtonia californica*
*81.100.37 *Chamaecyparis lawsoniana - Pinus monticola / Rhododendron occidentale - Lithocarpus densiflorus var. echinoides - Rhododendron neoglandulosum*
*81.100.17 *Chamaecyparis lawsoniana - Pinus monticola / Vaccinium membranaceum*
*81.100.18 *Chamaecyparis lawsoniana - Pinus monticola / wet herb complex*
*81.100.25 *Chamaecyparis lawsoniana - Pseudotsuga menziesii - Lithocarpus densiflorus / Quercus vacciniifolia*
*81.100.26 *Chamaecyparis lawsoniana - Pseudotsuga menziesii - Lithocarpus densiflorus / Rhododendron macrophyllum*
*81.100.22 *Chamaecyparis lawsoniana - Pseudotsuga menziesii / Calycanthus occidentalis*
*81.100.35 *Chamaecyparis lawsoniana - Pseudotsuga menziesii / Corylus cornuta*
*81.100.02 *Chamaecyparis lawsoniana - Pseudotsuga menziesii / Quercus vacciniifolia*
*81.100.20 *Chamaecyparis lawsoniana - Tsuga heterophylla / Chrysolepis sempervirens*
*81.100.24 *Chamaecyparis lawsoniana - Tsuga heterophylla / Leucothoe davisiae*
*81.100.21 *Chamaecyparis lawsoniana - Tsuga heterophylla / Rhododendron neoglandulosum*
*81.100.05 *Chamaecyparis lawsoniana / Gaultheria shallon*
*81.100.12 *Chamaecyparis lawsoniana / Quercus vacciniifolia - Rhododendron occidentale*
*81.100.04 *Chamaecyparis lawsoniana / Rhododendron macrophyllum - Gaultheria shallon*
*81.100.01 *Chamaecyparis lawsoniana / Rhododendron occidentale*
*81.100.11 *Chamaecyparis lawsoniana / Rhododendron occidentale - Lithocarpus densiflorus var. echinoides*

*61.550.00 ***Chilopsis linearis* (Desert willow woodland) Alliance** G4 S3
*61.550.01 *Chilopsis linearis*
*61.550.02 *Chilopsis linearis / Ambrosia salsola*
*61.550.08 *Chilopsis linearis / Atriplex polycarpa*
*61.550.07 *Chilopsis linearis / Ericameria paniculata*
*61.550.04 *Chilopsis linearis / Prunus fasciculata*
*61.550.03 *Chilopsis linearis / Prunus fasciculata - Ambrosia salsola*
*61.550.05 *Chilopsis linearis / Salvia dorrii*
*61.550.06 *Chilopsis linearis / Viguiera parishii*

79.100.00 ***Eucalyptus (globulus, camaldulensis)* (Eucalyptus groves) Semi-natural Stands**

*61.960.00 ***Fraxinus latifolia* (Oregon ash groves) Alliance** G4 S3
*61.960.04 *Fraxinus latifolia*
*61.960.02 *Fraxinus latifolia - Alnus rhombifolia*
*61.960.03 *Fraxinus latifolia / Cornus sericea*
*61.960.01 *Fraxinus latifolia / Toxicodendron diversilobum*

*72.100.00 ***Juglans californica* (California walnut groves) Alliance** G3 S3
*72.100.08 *Juglans californica - Quercus agrifolia*
*72.100.03 *Juglans californica / annual herbaceous*
*72.100.04 *Juglans californica / Artemisia californica / Leymus condensatus*
*72.100.05 *Juglans californica / Ceanothus spinosus*
*72.100.06 *Juglans californica / Heteromeles arbutifolia*
*72.100.07 *Juglans californica / Malosma laurina*

*61.810.00	***Juglans hindsii and Hybrids* (Hinds's walnut and related stands) Special Stands**	G1 S1
89.100.00	***Juniperus californica* (California juniper woodland) Alliance**	G4 S4 (some associations are of high priority for inventory)
89.100.08	*Juniperus californica - (Yucca schidigera) / Pleuraphis rigida*	
*89.100.01	*Juniperus californica - Adenostoma fasciculatum - Eriogonum fasciculatum*	
*89.100.04	*Juniperus californica - Coleogyne ramosissima*	
89.100.06	*Juniperus californica - Coleogyne ramosissima - Yucca schidigera*	
*89.100.02	*Juniperus californica - Ericameria linearifolia / annual - perennial - herb*	
89.100.12	*Juniperus californica - Eriogonum fasciculatum - Artemisia californica*	
*89.100.14	*Juniperus californica - Fraxinus dipetala - Ericameria linearifolia*	
89.100.05	*Juniperus californica - Quercus cornelius - mulleri / Coleogyne ramosissima*	
89.100.18	*Juniperus californica - Yucca schidigera*	
89.100.03	*Juniperus californica / Agave deserti*	
*89.100.15	*Juniperus californica / annual herbaceous*	
89.100.17	*Juniperus californica / Hesperostipa comata*	
89.100.11	*Juniperus californica / Nolina parryi*	
89.100.16	*Juniperus californica / Prunus ilicifolia / moss*	
89.200.00	***Juniperus grandis* (Mountain juniper woodland) Alliance**	G4 S4 (some associations are of high priority for inventory)
89.200.01	*Juniperus grandis*	
*89.200.03	*Juniperus grandis - Cercocarpus ledifolius / Artemisia tridentata*	
89.200.05	*Juniperus grandis / Arctostaphylos nevadensis*	
*89.200.02	*Juniperus grandis / Artemisia tridentata*	
89.200.04	*Juniperus grandis / Holodiscus discolor*	
89.400.00	***Juniperus occidentalis* (Western juniper woodland) Alliance**	G5 S4
89.400.02	*Juniperus occidentalis*	
89.400.03	*Juniperus occidentalis - Pinus jeffreyi / (Purshia tridentata) - (Prunus virginiana*	
89.400.04	*Juniperus occidentalis / Artemisia arbuscula*	
*89.300.00	***Juniperus osteosperma* (Utah juniper woodland) Alliance**	G5 S3
*89.300.01	*Juniperus osteosperma*	
*89.300.07	*Juniperus osteosperma / Ambrosia dumosa*	
*89.300.02	*Juniperus osteosperma / Artemisia tridentata - Ephedra viridis*	
*89.300.03	*Juniperus osteosperma / Artemisia tridentata - Purshia glandulosa - Ephedra nevadensis*	
*89.300.06	*Juniperus osteosperma / Atriplex confertifolia - (Tetradymia axillaris)*	
*89.300.08	*Juniperus osteosperma / Coleogyne ramosissima / (Achnatherum speciosum)*	
*89.300.09	*Juniperus osteosperma / Coleogyne ramosissima / Pleuraphis jamesii*	
*89.300.11	*Juniperus osteosperma / Ephedra nevadensis / Achnatherium speciosum*	
*89.300.04	*Juniperus osteosperma / Eriogonum fasciculatum*	
*89.300.05	*Juniperus osteosperma / Gutierrezia microcephala*	
*89.300.10	*Juniperus osteosperma / Yucca baccata*	
*73.100.00	***Lithocarpus densiflorus* (Tanoak forest) Alliance**	G4 S3
*73.100.10	*Lithocarpus densiflorus - Acer circinatum*	
*73.100.11	*Lithocarpus densiflorus - Acer macrophyllum*	
*73.100.03	*Lithocarpus densiflorus - Arbutus menziesii*	
*73.100.12	*Lithocarpus densiflorus - Calocedrus decurrens / Festuca californica*	
*73.100.13	*Lithocarpus densiflorus - Chamaecyparis lawsoniana*	
*73.100.14	*Lithocarpus densiflorus - Chrysolepis chrysophylla*	
*73.100.15	*Lithocarpus densiflorus - Cornus nuttallii*	
*73.100.16	*Lithocarpus densiflorus - Cornus nuttallii / Toxicodendron diversilobum*	
*73.100.01	*Lithocarpus densiflorus - Pinus lambertiana / Toxicodendron diversilobum*	
*73.100.17	*Lithocarpus densiflorus - Quercus chrysolepis*	
*73.100.18	*Lithocarpus densiflorus - Quercus kelloggii*	
*73.100.19	*Lithocarpus densiflorus - Umbellularia californica*	
*73.100.04	*Lithocarpus densiflorus / Corylus cornuta*	
*73.100.02	*Lithocarpus densiflorus / Frangula californica*	

*73.100.05	*Lithocarpus densiflorus / Gaultheria shallon*	
*73.100.06	*Lithocarpus densiflorus / Mahonia nervosa*	
*73.100.07	*Lithocarpus densiflorus / Quercus vacciniifolia - Rhododendron macrophyllum*	
*73.100.08	*Lithocarpus densiflorus / Toxicodendron diversilobum - Lonicera hispidula var. vacillens*	
*73.100.09	*Lithocarpus densiflorus / Vaccinium ovatum*	
*77.000.00	***Lyonothamnus floribundus*** **(Catalina ironwood groves) Special Stands**	G2 S2
*61.545.00	***Parkinsonia florida - Olneya tesota*** **(Blue palo verde - Ironwood woodland) Alliance**	G4 S3
*61.545.05	*Parkinsonia florida*	
*61.545.06	*Parkinsonia florida - Acacia greggii - Encelia frutescens Parkinsonia florida*	
*61.545.10	*Parkinsonia florida - Olneya tesota*	
*61.545.12	*Parkinsonia florida - Olneya tesota / Cylindropuntia munzii*	
*61.545.11	*Parkinsonia florida - Olneya tesota / Hyptis emoryi*	
*61.545.07	*Parkinsonia florida / Chilopsis linearis*	
*61.545.08	*Parkinsonia florida / Hyptis emoryi*	
*61.545.09	*Parkinsonia florida / Larrea tridentata - Peucephyllum schottii*	
*61.545.01	*Olneya tesota*	
*61.545.02	*Olneya tesota - Psorothamnus schottii*	
*61.545.04	*Olneya tesota / Hyptis emoryi*	
*61.545.03	*Olneya tesota / Larrea tridentata - Encelia farinosa*	
*83.300.00	***Picea breweriana*** **(Brewer spruce forest) Alliance**	G3 S2
*83.300.03	*Picea breweriana - Abies concolor / Chimaphila umbellata - Pyrola picta*	
*83.100.00	***Picea engelmannii*** **(Engelmann spruce forest) Alliance**	G5 S2
*83.200.00	***Picea sitchensis*** **(Sitka spruce forest) Alliance**	G5 S2
*83.200.04	*Picea sitchensis - Tsuga heterophylla*	
*83.200.01	*Picea sitchensis / Maianthemum dilatatum*	
*83.200.03	*Picea sitchensis / Polystichum munitum*	
*83.200.02	*Picea sitchensis / Rubus spectabilis*	
87.180.00	***Pinus albicaulis*** **(Whitebark pine forest) Alliance**	G5 S4
87.180.07	*Pinus albicaulis - Tsuga mertensiana*	
87.180.01	*Pinus albicaulis / Achnatherum californica*	
87.180.03	*Pinus albicaulis / Arenaria aculeata*	
87.180.08	*Pinus albicaulis / Carex filifolia*	
87.180.09	*Pinus albicaulis / Carex rossii*	
87.180.04	*Pinus albicaulis / Holodiscus discolor*	
87.180.06	*Pinus albicaulis / Penstemon davidsonii*	
87.180.02	*Pinus albicaulis / Penstemon gracilentus*	
87.180.05	*Pinus albicaulis / Poa wheeleri*	
87.100.00	***Pinus attenuata*** **(Knobcone pine forest) Alliance**	G4 S4
87.100.08	*Pinus attenuata - mixed oak / Arctostaphylos viscida*	
87.100.04	*Pinus attenuata / Adenostoma fasciculatum*	
87.100.01	*Pinus attenuata / Arctostaphylos columbiana*	
87.100.06	*Pinus attenuata / Arctostaphylos glandulosa*	
87.100.02	*Pinus attenuata / Arctostaphylos patula*	
87.100.05	*Pinus attenuata / Arctostaphylos viscida*	
87.100.07	*Pinus attenuata / Ceanothus lemmonii*	
87.100.03	*Pinus attenuata / Quercus vacciniifolia*	
*87.150.00	***Pinus balfouriana*** **(Foxtail pine woodland) Alliance**	G3 S3
*87.150.01	*Pinus balfouriana*	
*87.150.04	*Pinus balfouriana - Abies magnifica*	
*87.150.05	*Pinus balfouriana - Pinus albicaulis*	
*87.150.07	*Pinus balfouriana - Pinus flexilis*	
*87.150.06	*Pinus balfouriana - Pinus monticola*	
*87.150.02	*Pinus balfouriana / Anemone drummondii*	

*87.150.03	*Pinus balfouriana / Chrysolepis sempervirens*	
87.080.00	***Pinus contorta ssp. murrayana* (Lodgepole pine forest) Alliance**	G4 S4
87.080.01	*Pinus contorta ssp. murrayana*	
87.080.17	*Pinus contorta ssp. murrayana - Pinus albicaulis / Carex filifolia*	
87.080.11	*Pinus contorta ssp. murrayana - Pinus albicaulis / Carex rossii*	
87.080.02	*Pinus contorta ssp. murrayana / Artemisia tridentata*	
87.080.10	*Pinus contorta ssp. murrayana / Carex filifolia*	
87.080.06	*Pinus contorta ssp. murrayana / Carex rossii*	
87.080.13	*Pinus contorta ssp. murrayana / Carex spp.*	
87.080.05	*Pinus contorta ssp. murrayana / Cistanthe umbellata*	
87.080.03	*Pinus contorta ssp. murrayana / Ligusticum grayi*	
87.080.12	*Pinus contorta ssp. murrayana / Penstemon newberryi*	
87.080.08	*Pinus contorta ssp. murrayana / Rhododendron neoglandulosum*	
87.080.14	*Pinus contorta ssp. murrayana / Rhododendron neoglandulosum - Phyllodoce breweri*	
87.080.07	*Pinus contorta ssp. murrayana / Thalictrum fendleri*	
87.080.15	*Pinus contorta ssp. murrayana / Vaccinium caespitosum*	
87.080.09	*Pinus contorta ssp. murrayana / Vaccinium uliginosum*	
87.080.16	*Pinus contorta ssp. murrayana / Vaccinium uliginosum - Rhododendron neoglandulosum*	
*87.060.00	***Pinus contorta var. contorta* (Beach pine forest) Alliance**	G5 S3
*87.060.01	*Pinus contorta var. contorta*	
*87.060.02	*Pinus contorta ssp. contorta - Picea sitchensis*	
87.090.00	***Pinus coulteri* (Coulter pine woodland) Alliance**	G4 S4 (some associations are of high priority for inventory)
*87.090.01	*Pinus coulteri - Calocedrus decurrens - Pinus jeffreyi / Quercus durata*	
*87.092.03	*Pinus coulteri - Calocedrus decurrens / Frangula californica spp. tomentella / Aquilegia eximia*	
*87.090.02	*Pinus coulteri - Calocedrus decurrens / Quercus durata - Arctostaphylos glauca*	
*87.090.03	*Pinus coulteri - Pinus sabiniana / Quercus durata - Arctostaphylos pungens*	
87.090.04	*Pinus coulteri - Quercus chrysolepis*	
*87.090.06	*Pinus coulteri - Quercus chrysolepis / Arctostaphylos pringlei*	
87.092.08	*Pinus coulteri - Quercus kelloggii*	
87.092.05	*Pinus coulteri - Quercus wislizeni*	
87.092.07	*Pinus coulteri / Arctostaphylos glandulosa*	
87.092.01	*Pinus coulteri / Arctostaphylos glandulosa - Quercus wislizeni*	
87.092.02	*Pinus coulteri / Arctostaphylos glauca*	
*87.092.04	*Pinus coulteri / Quercus durata*	
*87.050.00	***Pinus edulis* (Two-needle pinyon stands) Special Stands**	G4 S2?
*87.160.00	***Pinus flexilis* (Limber pine woodland) Alliance**	G5 S3
*87.160.02	*Pinus flexilis - Pinus contorta / Chrysolepis sempervirens*	
*87.160.03	*Pinus flexilis - Pinus contorta ssp. murryana*	
*87.160.01	*Pinus flexilis / Cercocarpus ledifolius*	
87.020.00	***Pinus jeffreyi* (Jeffrey pine forest) Alliance**	G4 S4 (some associations are of high priority for inventory)
87.205.03	*Pinus jeffreyi - Abies concolor - Abies magnifica*	
87.020.30	*Pinus jeffreyi - Abies concolor / Chrysolepis sempervirens*	
87.205.06	*Pinus jeffreyi - Abies concolor / Iris innominata*	
87.205.05	*Pinus jeffreyi - Abies concolor / Quercus sadleriana*	
87.205.07	*Pinus jeffreyi - Abies concolor / Symphoricarpos rotundifolius / Elymus elymoides*	
87.020.39	*Pinus jeffreyi - Abies magnifica*	
87.020.04	*Pinus jeffreyi - Calocedrus decurrens / Ceanothus cuneatus*	
87.020.28	*Pinus jeffreyi - Calocedrus decurrens / Ceanothus pumila*	
87.020.37	*Pinus jeffreyi - Calocedrus decurrens / Quercus vacciniifolia*	
87.020.05	*Pinus jeffreyi - Calocedrus decurrens / Quercus vacciniifolia / Xerophyllum tenax*	
87.020.26	*Pinus jeffreyi - Pinus monophylla*	
87.200.08	*Pinus jeffreyi - Pinus ponderosa - Quercus kelloggii / Poa wheeleri / granite*	

87.200.09 *Pinus jeffreyi - Pinus ponderosa / Amelanchier alnifolia - Mahonia repens*
*87.200.03 *Pinus jeffreyi - Pinus ponderosa / Purshia tridentata var. tridentata / Festuca idahoensis / Granite*
*87.200.07 *Pinus jeffreyi - Pinus ponderosa / Symphoricarpos mollis / Wyethia mollis*
*87.020.02 *Pinus jeffreyi - Pseudotsuga menziesii / Quercus vacciniifolia / Festuca californica*
87.020.38 *Pinus jeffreyi - Quercus chrysolepis / Arctostaphylos viscida*
87.020.25 *Pinus jeffreyi - Quercus kelloggii*
*87.020.15 *Pinus jeffreyi - Quercus kelloggii / Poa secunda*
*87.020.16 *Pinus jeffreyi - Quercus kelloggii / Rhus trilobata*
87.020.24 *Pinus jeffreyi / Arctostaphylos nevadensis*
87.020.09 *Pinus jeffreyi / Arctostaphylos patula*
87.020.35 *Pinus jeffreyi / Arctostaphylos patula - Ceanothus velutinus*
87.020.32 *Pinus jeffreyi / Artemisia tridentata / Penstemon centranthifolius*
*87.020.19 *Pinus jeffreyi / Artemisia tridentata var. vaseyana / Festuca idahoensis*
*87.020.23 *Pinus jeffreyi / Calamagrostis koelerioides*
87.020.10 *Pinus jeffreyi / Ceanothus cordulatus*
87.020.36 *Pinus jeffreyi / Ceanothus cordulatus - Artemisia tridentata*
*87.020.17 *Pinus jeffreyi / Cercocarpus ledifolius*
*87.020.20 *Pinus jeffreyi / Chrysolepis sempervirens*
*87.020.22 *Pinus jeffreyi / Ericameria ophitidis*
*87.020.03 *Pinus jeffreyi / Festuca idahoensis*
87.020.11 *Pinus jeffreyi / Lupinus caudatus*
*87.020.21 *Pinus jeffreyi / Purshia tridentata var. tridentata*
*87.020.14 *Pinus jeffreyi / Purshia tridentata var. tridentata - Symphoricarpos longiflorus / Poa wheeleri*
*87.020.13 *Pinus jeffreyi / Purshia tridentata var. tridentata / Cercocarpus ledifolius / Achnatherum occidentalis*
*87.020.12 *Pinus jeffreyi / Purshia tridentata var. tridentata / Wyethia mollis*
87.020.33 *Pinus jeffreyi / Quercus palmeri*
87.020.01 *Pinus jeffreyi / Quercus sadleriana / Xerophyllum tenax*
87.020.08 *Pinus jeffreyi / Quercus vacciniifolia*
87.020.27 *Pinus jeffreyi / Quercus vacciniifolia - Arctostaphylos nevadensis / Festuca idahoensis*
87.020.34 *Pinus jeffreyi / Quercus wislizeni*
*87.020.18 *Pinus jeffreyi / Symphoricarpos longiflorus / Poa wheeleri*

*87.206.00 ***Pinus lambertiana* (Sugar pine forest) Alliance** G4 S3
*87.206.01 *Pinus lambertiana - Chrysolepis chrysophylla / Quercus vacciniifolia - Quercus sadleriana*
*87.206.02 *Pinus lambertiana - Pinus contorta ssp contorta / Quercus vacciniifolia - Lithocarpus densiflorus var. echinoides*
*87.206.03 *Pinus lambertiana - Pinus contorta ssp. contorta / Lithocarpus densiflorus var. echinoides - Rhododendron macrophyllum*
*87.206.04 *Pinus lambertiana - Pinus monticola / Quercus vacciniifolia - Garrya buxifolia*

*87.140.00 ***Pinus longaeva* (Bristlecone pine woodland) Alliance** G4 S2
*87.140.01 *Pinus longaeva*
*87.140.02 *Pinus longaeva / Cercocarpus intricatus*

87.040.00 ***Pinus monophylla* (Singleleaf pinyon woodlands) Alliance** G5 S4
87.040.14 *Pinus monophylla - Juniperus californica / Achnatherum speciosum*
87.040.18 *Pinus monophylla - Juniperus californica / Quercus cornelius-mulleri*
87.040.16 *Pinus monophylla - Juniperus osteosperma / Artemisia tridentata*
87.040.17 *Pinus monophylla - Juniperus osteosperma / Cercocarpus intricatus*
87.040.02 *Pinus monophylla / Artemisia tridentata*
87.040.15 *Pinus monophylla / Artemisia tridentata / Elymus elymoides*
87.040.12 *Pinus monophylla / Cercocarpus ledifolius / Artemisia tridentata - Purshia tridentata*
87.040.03 *Pinus monophylla / Ephedra viridis*
87.040.05 *Pinus monophylla / Garrya flavescens*
87.040.06 *Pinus monophylla / Juniperus californica / Artemisia tridentata - Coleogyne ramosissima*
87.040.07 *Pinus monophylla / Juniperus osteosperma / Artemisia nova*
87.040.13 *Pinus monophylla / Juniperus osteosperma / Purshia mexicana*
87.040.10 *Pinus monophylla / Prunus fasciculata - Rhus trilobata*
87.040.09 *Pinus monophylla / Quercus cornelius - mulleri / Nama californica*
87.040.11 *Pinus monophylla / Ribes velutinum*

	87.040.04	*Pinus monophylla / Symphoricarpos rotundifolia - Ribes velutinum*	
87.170.00		***Pinus monticola* (Western white pine forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
	*87.170.01	*Pinus monticola - Pinus contorta ssp. contorta / Lithocarpus densiflorus var. echinoides*	
	87.170.07	*Pinus monticola - Pinus contorta var. ssp. Murrayana*	
	87.170.08	*Pinus monticola - Pseudotsuga menziesii / Quercus vacciniifolia - Lithocarpus densiflorus var. echinoides*	
	87.170.06	*Pinus monticola / Achnatherum occidentalis*	
	*87.170.04	*Pinus monticola / Angelica arguta*	
	*87.170.02	*Pinus monticola / Holodiscus discolor*	
	*87.170.03	*Pinus monticola / Xerophyllum tenax*	
*87.070.00		***Pinus muricata* (Bishop pine forest) Alliance**	G3 S3
	*87.070.01	*Pinus muricata - (Arbutus menziesii) / Vaccinium ovatum*	
	*87.070.10	*Pinus muricata - Callitropsis pigmaea*	
	*87.070.02	*Pinus muricata - Pinus contorta ssp. bolanderi*	
	*87.070.03	*Pinus muricata - Pinus contorta ssp. bolanderi / Arnica discoidea*	
	*87.070.04	*Pinus muricata - Pseudotsuga menziesii*	
	*87.070.07	*Pinus muricata / Arctostaphylos glandulosa*	
	*87.070.09	*Pinus muricata / Xerophyllum tenax*	
87.010.00		***Pinus ponderosa* (Ponderosa pine forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
	87.010.45	*Pinus ponderosa - Abies concolor / Lithocarpus densiflorus var. echinoides*	
	87.010.37	*Pinus ponderosa - Alnus rhombifolia*	
	87.010.44	*Pinus ponderosa - Alnus rhombifolia*	
	87.010.46	*Pinus ponderosa - Lithocarpus densiflorus*	
	*87.010.23	*Pinus ponderosa - Pinus contorta ssp. murrayana / Amelanchier alnifolia*	
	87.010.54	*Pinus ponderosa - Pinus jeffreyi / Achnatherum occidentalis*	
	*87.010.25	*Pinus ponderosa - Pinus jeffreyi / Artemisia tridentata var. vaseyana - Purshia tridentata var. tridentata*	
	87.010.55	*Pinus ponderosa - Pinus jeffreyi / Balsamorhiza sagittata*	
	87.010.49	*Pinus ponderosa - Pinus jeffreyi / Cercocarpus ledifolius / Pseudoroegneria spicata*	
	87.010.51	*Pinus ponderosa - Pinus jeffreyi / Frangula rubra / Poa secunda*	
	87.010.50	*Pinus ponderosa - Pinus jeffreyi / Purshia tridentata var. tridentata / Senecio integerrimus / granite*	
	87.010.53	*Pinus ponderosa - Pinus jeffreyi / Quercus vacciniifolia*	
	87.010.52	*Pinus ponderosa - Pinus jeffreyi / Quercus vacciniifolia / Wyethia mollis*	
	87.010.48	*Pinus ponderosa - Pinus lambertiana - Quercus chrysolepis / Lithocarpus densiflorus var. echinoides*	
	87.010.47	*Pinus ponderosa - Pinus lambertiana / Arctostaphylos patula - Lithocarpus densiflorus var. echinoides*	
	*87.010.18	*Pinus ponderosa / Achnatherum nelsonii*	
	*87.010.27	*Pinus ponderosa / Amelanchier alnifolia - Mahonia repens / Arnica cordifolia*	
	87.010.42	*Pinus ponderosa / Amelanchier alnifolia - Mahonia repens / Arnica cordifolia*	
	*87.010.26	*Pinus ponderosa / Amelanchier alnifolia - Prunus virginiana*	
	*87.010.03	*Pinus ponderosa / Arctostaphylos patula - Chamaebatia foliolosa*	
	87.010.39	*Pinus ponderosa / Arctostaphylos viscida*	
	*87.010.04	*Pinus ponderosa / Artemisia tridentata*	
	*87.010.24	*Pinus ponderosa / Artemisia tridentata var. vaseyana / Festuca idahoensis*	
	*87.010.06	*Pinus ponderosa / Bromus carinatus*	
	*87.010.09	*Pinus ponderosa / Ceanothus cuneatus*	
	*87.010.08	*Pinus ponderosa / Ceanothus prostratus*	
	*87.010.28	*Pinus ponderosa / Ceanothus velutinus / Achnatherum nelsonii*	
	*87.010.19	*Pinus ponderosa / Cercocarpus ledifolius - Purshia tridentata var. tridentata / Festuca idahoensis*	
	*87.010.20	*Pinus ponderosa / Cercocarpus ledifolius / Pseudoroegneria spicata*	
	*87.010.02	*Pinus ponderosa / Chamaebatia foliolosa*	
	*87.010.07	*Pinus ponderosa / Galium angustifolium*	
	87.010.43	*Pinus ponderosa / Lithocarpus densiflorus var. echinoides*	
	*87.010.05	*Pinus ponderosa / Purshia tridentata var. tridentata*	

	*87.010.13	*Pinus ponderosa / Purshia tridentata var. tridentata - Arctostaphylos patula / Achnatherum nelsonii*	
	*87.010.14	*Pinus ponderosa / Purshia tridentata var. tridentata - Ceanothus velutinus*	
	87.010.41	*Pinus ponderosa / Purshia tridentata var. tridentata - Prunus virginiana / Bromus orcuttianus*	
	*87.010.16	*Pinus ponderosa / Purshia tridentata var. tridentata - Ribes cereum / Bromus orcuttianus*	
	*87.010.12	*Pinus ponderosa / Purshia tridentata var. tridentata / Achnatherum nelsonii / pumice*	
	*87.010.10	*Pinus ponderosa / Purshia tridentata var. tridentata / Balsamorhiza sagittata*	
	87.010.40	*Pinus ponderosa / Purshia tridentata var. tridentata / Galium bolanderi*	
	*87.010.15	*Pinus ponderosa / Purshia tridentata var. tridentata / Senecio integerrimus / granite*	
	*87.010.29	*Pinus ponderosa / Symphoricarpos longiflorus*	
	87.010.38	*Pinus ponderosa stream terrace*	
87.015.00		***Pinus ponderosa - Calocedrus decurrens* (Mixed conifer forest) Alliance**	G4 S4
	87.015.02	*Pinus ponderosa - Calocedrus decurrens - Quercus kelloggii*	
	87.015.04	*Pinus ponderosa - Calocedrus decurrens (mixed conifer) - Quercus chrysolepis / Chamaebatia foliosa*	
	87.015.08	*Pinus ponderosa - Calocedrus decurrens (mixed conifer) / Arctostaphylos sp. - Chamaebatia foliolosa*	
	87.015.01	*Pinus ponderosa - Calocedrus decurrens (mixed conifer) / Galium bolanderi - Polygala cornuta*	
	87.015.10	*Pinus ponderosa - Calocedrus decurrens / Ceanothus prostratus*	
	87.015.11	*Pinus ponderosa - Calocedrus decurrens / Chamaebatia foliolosa / Galium bolanderi*	
	87.015.03	*Pinus ponderosa - Calocedrus decurrens / Chamaebatia foliosa*	
	87.015.09	*Pinus ponderosa - Calocedrus decurrens / Mahonia nervosa*	
	87.015.14	*Pinus ponderosa - Calocedrus decurrens / Purshia tridentata / Achnatherum occidentalis*	
	87.015.13	*Pinus ponderosa - Calocedrus decurrens / Purshia tridentata var. tridentata / (Balsamorhiza sagittata - Achnatherum occidentalis)*	
	87.015.12	*Pinus ponderosa - Calocedrus decurrens / Quercus chrysolepis var. nana - Quercus vacciniifolia*	
	87.015.05	*Pinus ponderosa - Calocedrus decurrens / Quercus vaccinifolia (serpentine)*	
82.400.00		***Pinus ponderosa - Pseudotsuga menziesii* (Ponderosa pine - Douglas fir forest) Alliance**	G4 S4 (some associations are of high priority for inventory)
	82.400.08	*Pinus ponderosa - Pseudotsuga menziesii - Lithocarpus densiflorus / Chamaebatia foliolosa*	
	82.400.09	*Pinus ponderosa - Pseudotsuga menziesii - Quercus chrysolepis / Galium bolanderi*	
	82.400.07	*Pinus ponderosa - Pseudotsuga menziesii / Antennaria rosea - Eriogonum nudum*	
	82.400.06	*Pinus ponderosa - Pseudotsuga menziesii / Purshia tridentata var. tridentata / Wyethia*	
	*82.400.04	*Pseudotsuga menziesii - Pinus ponderosa*	
	*82.400.02	*Pseudotsuga menziesii - Pinus ponderosa - Calocedrus decurrens*	
	*82.400.03	*Pseudotsuga menziesii - Pinus ponderosa - Pinus jeffreyi / Poa secunda*	
*87.030.00		***Pinus quadrifolia* (Parry pinyon woodland) Alliance**	G3 S2
	*87.030.01	*Pinus quadrifolia / Quercus cornelius - mulleri*	
*87.110.00		***Pinus radiata* (Monterey pine forest) Alliance**	G1 S1
	*87.110.03	*Pinus radiata - Pinus muricata / Arctostaphylos tomentosa - Arctostaphylos hookeri*	
	*87.110.04	*Pinus radiata - Quercus agrifolia / Toxicodendron diversilobum*	
	*87.110.01	*Pinus radiata / Arctostaphylos tomentosa - Vaccinium ovatum*	
	*87.110.02	*Pinus radiata / Toxicodendron diversilobum*	
87.130.00		***Pinus sabiniana* (Ghost pine woodland) Alliance**	G4 S4 (some associations are of high priority for inventory)
	87.130.02	*Pinus sabiniana - Juniperus californica / grass*	
	87.130.12	*Pinus sabiniana - Quercus chrysolepis / Arctostaphylos viscida*	
	87.130.11	*Pinus sabiniana - Quercus wislizeni / Adenostoma fasciculatum*	
	87.130.04	*Pinus sabiniana - Quercus wislizeni / Ceanothus cuneatus*	
	87.130.07	*Pinus sabiniana / Adenostoma fasciculatum*	
	87.130.08	*Pinus sabiniana / Arctostaphylos viscida*	
	87.130.06	*Pinus sabiniana / Artemisia californica - Ceanothus ferrisiae - Heteromeles arbutifolia*	
	87.130.09	*Pinus sabiniana / Ceanothus cuneatus - Heteromeles arbutifolia*	
	87.130.10	*Pinus sabiniana / Ceanothus cuneatus - Rhamnus illicifolia*	
	*87.130.03	*Pinus sabiniana / Ceanothus cuneatus / Plantago erecta*	

87.130.13	*Pinus sabiniana / Frangula californica ssp. tomentella*	
*87.190.00	***Pinus torreyana* (Torrey pine stands) Special Stands**	G1 S1
*87.190.01	*Pinus torreyana / Artemisia californica - Rhus integrifolia*	
*87.120.00	***Pinus washoensis* (Washoe pine woodland) Alliance**	G2 S2
*87.120.03	*Pinus washoensis / Arctostaphylos nevadensis*	
*87.120.01	*Pinus washoensis / Lupinus caudatus*	
*87.120.02	*Pinus washoensis / Symphoricarpos longiflorus / Pseudostellaria jamesiana*	
*61.310.00	***Platanus racemosa* (California sycamore woodlands) Alliance**	G3 S3
*61.314.01	*Platanus racemosa - Populus fremontii*	
*61.314.03	*Platanus racemosa - Populus fremontii / Salix lasiolepis*	
*61.314.02	*Platanus racemosa - Populus fremontii / Salix lasiolepis - Salix exigua / Scirpus americanus*	
*61.312.01	*Platanus racemosa - Quercus agrifolia*	
*61.312.06	*Platanus racemosa - Quercus agrifolia - Populus fremontii - Salix laevigata*	
*61.312.03	*Platanus racemosa - Quercus agrifolia - Salix lasiolepis*	
*61.312.04	*Platanus racemosa - Quercus agrifolia / Baccharis salicifolia / Artemisia douglasiana*	
*61.312.07	*Platanus racemosa - Salix laevigata*	
*61.312.05	*Platanus racemosa - Salix laevigata / Salix lasiolepis - Baccharis salicifolia*	
*61.313.03	*Platanus racemosa / Adenostoma fasciculatum*	
*61.311.03	*Platanus racemosa / annual grass*	
*61.311.01	*Platanus racemosa / Avena barbata*	
*61.313.01	*Platanus racemosa / Baccharis salicifolia*	
*61.311.02	*Platanus racemosa / Bromus hordeaceus*	
*61.313.02	*Platanus racemosa / Toxicodendron diversilobum*	
*61.130.00	***Populus fremontii* (Fremont cottonwood forest) Alliance**	G4 S3
*61.130.06	*Populus fremontii*	
*61.130.18	*Populus fremontii - Juglans californica*	
*61.130.19	*Populus fremontii - Prosopis pubescens*	
*61.130.20	*Populus fremontii - Quercus agrifolia*	
*61.130.24	*Populus fremontii - Salix (laevigata, lasiolepis, lucida ssp. lasiandra)*	
*61.130.14	*Populus fremontii - Salix gooddingii / Baccharis salicifolia*	
*61.130.15	*Populus fremontii - Salix laevigata*	
*61.130.22	*Populus fremontii - Salix laevigata / Salix lasiolepis - Baccharis salicifolia*	
*61.130.21	*Populus fremontii - Salix laevigata / Salix lasiolepis / Vitis girdiana*	
*61.130.23	*Populus fremontii - Salix lasiolepis*	
*61.130.25	*Populus fremontii - Salix lucida ssp. lasiandra*	
*61.130.26	*Populus fremontii - Sambucus nigra*	
*61.130.07	*Populus fremontii / Acer negundo*	
*61.130.08	*Populus fremontii / Acer negundo / Rubus armeniacus*	
*61.130.09	*Populus fremontii / Artemisia douglasiana*	
*61.130.16	*Populus fremontii / Baccharis salicifolia*	
*61.130.10	*Populus fremontii / Galium aparine*	
*61.130.11	*Populus fremontii / Rubus ursinus*	
*61.130.17	*Populus fremontii / Salix exigua*	
*61.130.13	*Populus fremontii / Vitis californica*	
*61.111.00	***Populus tremuloides* (Aspen groves) Alliance**	G5 S3
*61.111.02	*Populus tremuloides*	
*61.111.11	*Populus tremuloides - Pinus contorta / Artemisia tridentata / Poa pratensis*	
*61.111.06	*Populus tremuloides / Artemisia tridentata*	
*61.111.07	*Populus tremuloides / Artemisia tridentata / Monardella odoratissima - Kelloggia galioides*	
*61.111.19	*Populus tremuloides / Bromus carinatus*	
*61.111.18	*Populus tremuloides / dry graminoid*	
*61.111.17	*Populus tremuloides / mesic forb*	
*61.111.08	*Populus tremuloides / Monardella odoratissima*	
*61.111.09	*Populus tremuloides / Pinus jeffreyi*	
*61.111.20	*Populus tremuloides / Poa pratensis*	
*61.111.14	*Populus tremuloides / Prunus*	

*61.111.10	*Populus tremuloides / Rosa woodsii*	
*61.111.15	*Populus tremuloides / Symphoricarpos albus*	
*61.111.16	*Populus tremuloides / Symphoricarpos rotundifolius*	
*61.111.05	*Populus tremuloides / Symphyotricum foliaceum*	
*61.111.04	*Populus tremuloides / upland*	
*61.111.03	*Populus tremuloides / Veratrum californicum*	
*61.120.00	***Populus trichocarpa* (Black cottonwood forest) Alliance**	G5 S3
*61.120.01	*Populus trichocarpa*	
*61.120.03	*Populus trichocarpa - Pinus jeffreyi*	
*61.120.08	*Populus trichocarpa - Quercus agrifolia*	
*61.120.09	*Populus trichocarpa - Salix laevigata*	
*61.120.10	*Populus trichocarpa - Salix lasiolepis*	
*61.120.11	*Populus trichocarpa - Salix lucida*	
*61.120.04	*Populus trichocarpa / Artemisia tridentata ssp. vaseyana*	
*61.120.07	*Populus trichocarpa / Rhododendron occidentalis*	
*61.120.05	*Populus trichocarpa / Symphoricarpos rotundifolius*	
*61.120.06	*Populus / Salix*	
*61.512.00	***Prosopis glandulosa* (Mesquite bosque, mesquite thicket) Alliance**	G5 S3
*61.512.01	*Prosopis glandulosa*	
*61.512.09	*Prosopis glandulosa - Salix exigua - Salix lasiolepis*	
*61.512.02	*Prosopis glandulosa - Sambucus nigra*	
*61.512.04	*Prosopis glandulosa / Atriplex canescens*	
*61.512.03	*Prosopis glandulosa / Atriplex spp. (alkaline)*	
*61.512.05	*Prosopis glandulosa / Bebbia juncea - Petalonyx thurberi (wash)*	
*61.512.06	*Prosopis glandulosa / Pluchea sericea - Atriplex canescens (alkaline spring)*	
*61.512.07	*Prosopis glandulosa / Rhus ovata (upper desert spring)*	
*61.512.08	*Prosopis glandulosa / Suaeda moquinii*	
*61.513.00	***Prosopis pubescens* (Screwbean mesquite bosques) Alliance**	G3 S2
*61.513.01	*Prosopis / Atriplex spp. (alkaline)*	
*61.513.03	*Prosopis / Bebbia juncea - Petalonyx thurberi (wash)*	
*61.513.02	*Prosopis / Pluchea sericea - Atriplex canescens (alkaline spring)*	
*82.100.00	***Pseudotsuga macrocarpa* (Bigcone Douglas fir forest) Alliance**	G3 S3
*82.100.01	*Pseudotsuga macrocarpa - Quercus agrifolia*	
*82.100.02	*Pseudotsuga macrocarpa - Quercus chrysolepis*	
82.200.00	***Pseudotsuga menziesii* (Douglas fir forest) Alliance**	G5 S4 (some associations are of high priority for inventory)
82.200.77	*Pseudotsuga menziesii*	
*82.200.12	*Pseudotsuga menziesii - Chrysolepis chrysophylla - Lithocarpus densiflorus*	
*82.200.13	*Pseudotsuga menziesii - Chrysolepis chrysophylla - Lithocarpus densiflorus / Mahonia nervosa*	
82.200.79	*Pseudotsuga menziesii - Chrysolepis chrysophylla / Rhododendron macrophyllum - Gaultheria shallon*	
*82.200.10	*Pseudotsuga menziesii - Chrysolepis chrysophylla / Rhododendron macrophyllum - Mahonia nervosa*	
*82.200.11	*Pseudotsuga menziesii - Chrysolepis chrysophylla / Rhododendron macrophyllum - Quercus sadleriana - Xerophyllum tenax*	
*82.200.09	*Pseudotsuga menziesii - Chrysolepis chrysophylla / Xerophyllum tenax*	
82.200.71	*Pseudotsuga menziesii - Quercus agrifolia*	
*82.300.03	*Pseudotsuga menziesii - Quercus chrysolepis*	
82.300.07	*Pseudotsuga menziesii - Quercus chrysolepis - Acer macrophyllum / Toxicodendron diversilobum*	
*82.300.02	*Pseudotsuga menziesii - Quercus chrysolepis - Arbutus menziesii / Toxicodendron diversilobum*	
*82.300.05	*Pseudotsuga menziesii - Quercus chrysolepis - Lithocarpus densiflorus*	
*82.300.01	*Pseudotsuga menziesii - Quercus chrysolepis - mixed conifer / Polystichum munitum*	
82.300.06	*Pseudotsuga menziesii - Quercus chrysolepis / Arctostaphylos manzanita*	
*82.200.19	*Pseudotsuga menziesii - Quercus garryana var. garryana / grass*	

*82.200.60	*Pseudotsuga menziesii - Quercus kelloggii*	
82.200.80	*Pseudotsuga menziesii - Quercus kelloggii*	
*82.200.66	*Pseudotsuga menziesii - Umbellularia californica*	
82.200.70	*Pseudotsuga menziesii - Umbellularia californica / Frangula californica*	
82.200.81	*Pseudotsuga menziesii - Umbellularia californica / Holodiscus discolor*	
82.200.69	*Pseudotsuga menziesii - Umbellularia californica / Polystichum munitum*	
*82.200.05	*Pseudotsuga menziesii - Umbellularia californica / Toxicodendron diversilobum*	
*82.200.20	*Pseudotsuga menziesii / Acer circinatum - Mahonia nervosa*	
*82.200.49	*Pseudotsuga menziesii / Achlys triphylla*	
*82.200.50	*Pseudotsuga menziesii / Arbutus menziesii*	
82.200.53	*Pseudotsuga menziesii / Arctostaphylos patula*	
82.200.72	*Pseudotsuga menziesii / Baccharis pilularis*	
*82.200.54	*Pseudotsuga menziesii / Chimaphila umbellata*	
*82.200.56	*Pseudotsuga menziesii / Corylus cornuta*	
*82.200.04	*Pseudotsuga menziesii / Corylus cornuta / Adenocaulon bicolor*	
*82.200.59	*Pseudotsuga menziesii / Gaultheria shallon*	
*82.200.55	*Pseudotsuga menziesii / Linnaea borealis*	
82.200.78	*Pseudotsuga menziesii / Lithocarpus densiflorus var. echinoides / Iris douglasii*	
*82.200.64	*Pseudotsuga menziesii / Mahonia nervosa*	
*82.200.15	*Pseudotsuga menziesii / Quercus vacciniifolia*	
*82.200.16	*Pseudotsuga menziesii / Quercus vacciniifolia - Lithocarpus densiflorus var. echinoides*	
*82.200.74	*Pseudotsuga menziesii / Quercus vacciniifolia - Rhododendron macrophyllum*	
*82.200.58	*Pseudotsuga menziesii / Rhododendron spp.*	
*82.200.57	*Pseudotsuga menziesii / Vancouveria planipetala*	
*82.600.00	***Pseudotsuga menziesii - Calocedrus decurrens* (Douglas fir - Incense cedar forest) Alliance**	G3 S3
*82.600.15	*Pseudotsuga menziesii - Calocedrus decurrens - (Pinus jeffreyi) / Nassella pulchra*	
*82.600.14	*Pseudotsuga menziesii - Calocedrus decurrens - (Quercus kellogii) / Nassella pulchra*	
*82.600.12	*Pseudotsuga menziesii - Calocedrus decurrens - Pinus jeffreyi*	
*82.600.13	*Pseudotsuga menziesii - Calocedrus decurrens - Pinus jeffreyi / Festuca californica*	
*82.600.01	*Pseudotsuga menziesii - Calocedrus decurrens - Umbellularia californica / Toxicodendron diversilobum*	
*82.600.02	*Pseudotsuga menziesii - Calocedrus decurrens / Festuca californica*	
*82.600.04	*Pseudotsuga menziesii - Calocedrus decurrens / Quercus vacciniifolia*	
82.500.00	***Pseudotsuga menziesii - Lithocarpus densiflorus* (Douglas fir - tanoak forest) Alliance**	G4 S4
82.500.48	*Pseudotsuga menziesii - Lithocarpus densiflorus*	
82.500.02	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Acer macrophyllum) / Polystichum munitum*	
82.500.50	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Acer macrophyllum) / Polystichum munitum*	
82.500.22	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Calocedrus decurrens) / Festuca californica*	
82.500.31	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana - Alnus rubra) / riparian*	
82.500.24	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana - Umbellularia californica) / Vaccinium ovatum*	
82.500.25	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana) / Mahonia nervosa / Linnaea borealis*	
82.500.30	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana) / Acer circinatum*	
82.500.29	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana) / Gaultheria shallon*	
82.500.26	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana) / Vaccinium ovatum*	
82.500.27	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana) / Vaccinium ovatum - Rhododendron occidentalis*	
82.500.28	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chamaecyparis lawsoniana) / Vaccinium parvifolium*	
82.500.16	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chrysolepis chrysophylla) / Gaultheria shallon*	

82.500.12	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chrysolepis chrysophylla) / Pteridium aquilinum*	
82.500.15	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Chrysolepis chrysophylla) / Rhododendron macrophyllum - Gaultheria shallon*	
82.500.39	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Pinus lambertiana)*	
82.500.13	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus chrysolepis) / Mahonia nervosa*	
82.500.06	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus chrysolepis) / Mahonia nervosa - Gaultheria shallon*	
82.500.11	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus chrysolepis) / rockpile*	
82.500.10	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus chrysolepis) / Toxicodendron diversilobum*	
82.500.08	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus chrysolepis) / Vaccinium ovatum*	
82.500.05	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus chrysolepis, Quercus kelloggii) / Toxicodendron diversilobum*	
82.500.03	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Quercus kelloggii) / Rosa gymnocarpa*	
82.500.04	*Pseudotsuga menziesii - Lithocarpus densiflorus - (Umbellularia californica) / Toxicodendron diversilobum*	
82.500.44	*Pseudotsuga menziesii - Lithocarpus densiflorus / Iris*	
82.500.51	*Pseudotsuga menziesii - Lithocarpus densiflorus - Thuja plicata / Vaccinium ovatum - Gaultheria shallon*	
82.500.36	*Pseudotsuga menziesii - Lithocarpus densiflorus / Acer circinatum*	
82.500.40	*Pseudotsuga menziesii - Lithocarpus densiflorus / Achlys triphylla*	
82.500.01	*Pseudotsuga menziesii - Lithocarpus densiflorus / Chimaphila umbellata*	
82.500.43	*Pseudotsuga menziesii - Lithocarpus densiflorus / Cornus nuttallii*	
82.500.21	*Pseudotsuga menziesii - Lithocarpus densiflorus / Corylus cornuta*	
82.500.35	*Pseudotsuga menziesii - Lithocarpus densiflorus / Gaultheria shallon*	
82.500.07	*Pseudotsuga menziesii - Lithocarpus densiflorus / Mahonia nervosa*	
82.500.46	*Pseudotsuga menziesii - Lithocarpus densiflorus / Quercus vacciniifolia - Holodiscus*	
82.500.49	*Pseudotsuga menziesii - Lithocarpus densiflorus / Rhododendron macrophyllum*	
82.500.38	*Pseudotsuga menziesii - Lithocarpus densiflorus / Taxus brevifolia*	
82.500.23	*Pseudotsuga menziesii - Lithocarpus densiflorus / Toxicodendron diversilobum - (Lonicera hispidula)*	
82.500.19	*Pseudotsuga menziesii - Lithocarpus densiflorus / Vaccinium ovatum*	
82.500.20	*Pseudotsuga menziesii - Lithocarpus densiflorus / Vaccinium ovatum - (Gaultheria shallon)*	
82.500.47	*Pseudotsuga menziesii - Lithocarpus densiflorus / Whipplea modesta*	
*61.570.00	***Psorothamnus spinosus* (Smoke tree woodland) Alliance**	G4 S3
*61.570.01	*Psorothamnus spinosus*	
*61.570.06	*Psorothamnus spinosus - Acacia greggii - Chrysothamnus sp*	
*61.570.02	*Psorothamnus spinosus / Ambrosia salsola - Bebbia juncea*	
*61.570.03	*Psorothamnus spinosus / Ephedra californica - Ambrosia salsola*	
*61.570.04	*Psorothamnus spinosus / Hyptis emoryi - Acacia greggii*	
71.100.00	***Quercus (agrifolia, douglasii, garryana, kelloggii, lobata, wislizeni)* (Mixed oak forest) Alliance**	G4 S4
71.100.05	*Mixed oak - Aesculus californica / grass*	
71.100.07	*Mixed oak - Pinus sabiniana / grass*	
71.100.06	*Mixed oak - Quercus agrifolia / Toxicodendron diversilobum*	
71.100.04	*Mixed oak - Quercus kelloggii / grass*	
71.100.10	*Mixed oak / Baccharis pilularis - Toxicodendron diversilobum*	
71.100.08	*Mixed oak / grass*	
71.100.14	*Quercus douglasii - Quercus lobata - Quercus agrifolia / Toxicodendron diversilobum*	
71.060.00	***Quercus agrifolia* (Coast live oak woodland) Alliance**	G5 S4 (some associations are of high priority for inventory)
71.060.02	*Quercus agrifolia*	
71.060.03	*Quercus agrifolia - Acer macrophyllum / Frangula californica - Holodiscus discolor*	
71.060.52	*Quercus agrifolia - Aesculus californica*	
71.060.40	*Quercus agrifolia - Arbutus menziesii*	
71.060.41	*Quercus agrifolia - Arbutus menziesii - Toxicodendron diversilobum*	
71.060.26	*Quercus agrifolia - Arbutus menziesii - Umbellularia californica*	

71.060.10	*Quercus agrifolia - Arbutus menziesii / Corylus cornuta - Rubus spp.*	
71.060.27	*Quercus agrifolia - Juglans californica*	
71.060.23	*Quercus agrifolia - Pinus coulteri*	
71.060.43	*Quercus agrifolia - Platanus racemosa - Salix laevigata*	
71.060.42	*Quercus agrifolia - Platanus racemosa / Toxicodendron diversilobum*	
71.060.01	*Quercus agrifolia - Quercus douglasii*	
71.060.45	*Quercus agrifolia - Quercus engelmannii / Eriogonum fasciculatum*	
*71.060.18	*Quercus agrifolia - Quercus kelloggii*	
71.060.47	*Quercus agrifolia - Salix lasiolepis*	
71.060.48	*Quercus agrifolia - Umbellularia californica*	
71.060.51	*Quercus agrifolia - Umbellularia californica / Arctostaphylos glauca - Toxicodendron diversilobum*	
71.060.49	*Quercus agrifolia - Umbellularia californica / Ceanothus oliganthus*	
71.060.05	*Quercus agrifolia - Umbellularia californica / Heteromeles arbutifolia - Quercus berberidifolia*	
71.060.50	*Quercus agrifolia - Umbellularia californica / Toxicodendron diversilobum*	
71.060.07	*Quercus agrifolia / Adenostoma fasciculatum (- Salvia mellifera)*	
71.060.08	*Quercus agrifolia / Artemisia californica*	
71.060.16	*Quercus agrifolia / Ceanothus oliganthus*	
71.060.34	*Quercus agrifolia / Ceanothus spinosus*	
71.060.29	*Quercus agrifolia / chaparral*	
71.060.28	*Quercus agrifolia / coastal sage scrub*	
71.060.35	*Quercus agrifolia / Equisetum hymale*	
71.060.22	*Quercus agrifolia / Eriogonum wrightii*	
71.060.06	*Quercus agrifolia / Frangula californica - Heteromeles arbutifolia*	
71.060.36	*Quercus agrifolia / Frangula californica ssp. tomentella / Stachys pycnantha*	
71.060.09	*Quercus agrifolia / grass*	
71.060.14	*Quercus agrifolia / Heteromeles arbutifolia*	
71.060.15	*Quercus agrifolia / Heteromeles arbutifolia - Toxicodendron diversilobum*	
71.060.11	*Quercus agrifolia / Holodiscus discolor - Symphoricarpos albus*	
71.060.37	*Quercus agrifolia / Quercus berberidifolia*	
71.060.04	*Quercus agrifolia / Rubus spp. / Pteridium aquilinum*	
71.060.38	*Quercus agrifolia / Salvia leucophylla - Artemisia californica*	
71.060.17	*Quercus agrifolia / Symphoricarpos albus*	
71.060.13	*Quercus agrifolia / Toxicodendron diversilobum*	
71.060.25	*Quercus agrifolia / Toxicodendron diversilobum - (Corylus cornuta)*	
71.060.12	*Quercus agrifolia / Toxicodendron diversilobum / grass*	
71.060.39	*Quercus agrifolia / Toxicodendron diversilobum riparian*	
71.050.00	***Quercus chrysolepis* (Canyon live oak forest) Alliance**	G5 S5 (some associations are of high priority for inventory)
71.050.31	*Pinus ponderosa - Quercus chrysolepis / Arctostaphylos viscida*	
71.050.04	*Quercus chrysolepis*	
71.050.01	*Quercus chrysolepis - Arbutus menziesii - Lithocarpus densiflorus var. densiflorus*	
71.050.19	*Quercus chrysolepis - Calocedrus decurrens*	
*71.050.03	*Quercus chrysolepis - Ceanothus integerrimus*	
71.050.32	*Quercus chrysolepis - Pinus jeffreyi*	
*71.050.02	*Quercus chrysolepis - Pinus lambertiana*	
*71.050.18	*Quercus chrysolepis - Pinus ponderosa*	
71.050.16	*Quercus chrysolepis - Pinus sabiniana*	
*71.050.07	*Quercus chrysolepis - Quercus garryana var. garryana / Pentagramma triangularis*	
*71.050.27	*Quercus chrysolepis - Quercus kelloggii - Acer macrophyllum*	
71.050.26	*Quercus chrysolepis - Quercus kelloggii / (Toxicodendron diversilobum)*	
*71.050.28	*Quercus chrysolepis - Quercus lobata / Vitis californica*	
71.050.29	*Quercus chrysolepis - Quercus wislizeni*	
71.050.13	*Quercus chrysolepis - Umbellularia californica*	
*71.050.30	*Quercus chrysolepis - Umbellularia californica / Vitis californica*	
71.050.09	*Quercus chrysolepis / Arctostaphylos mewukka*	
71.050.15	*Quercus chrysolepis / Arctostaphylos patula*	
71.050.14	*Quercus chrysolepis / Arctostaphylos viscida*	
71.050.17	*Quercus chrysolepis / Dryopteris arguta*	
71.050.25	*Quercus chrysolepis / Lithocarpus densiflorus var. echinoides*	

71.050.08	*Quercus chrysolepis / Polystichum imbricans*	
71.050.33	*Querecus chrysolepis / Rhamnus ilicifolia*	
71.050.21	*Quercus chrysolepis / Toxicodendron diversilobum*	
71.020.00	***Quercus douglasii* (Blue oak woodland) Alliance**	G4 S4 (some associations are of high priority for inventory)
71.020.44	*Quercus douglasii - Aesculus californica / Asclepias fascicularis*	
71.020.24	*Quercus douglasii - Aesculus californicus / grass*	
71.020.02	*Quercus douglasii - Pinus sabiniana*	
71.020.04	*Quercus douglasii - Pinus sabiniana / Arctostaphylos viscida*	
71.020.03	*Quercus douglasii - Pinus sabiniana / Ceanothus cuneatus - Cercocapus montanus*	
71.020.25	*Quercus douglasii - Pinus sabiniana / Cercocarpus montanus*	
71.020.01	*Quercus douglasii - Quercus agrifolia*	
*71.020.11	*Quercus douglasii - Quercus lobata*	
71.020.06	*Quercus douglasii - Quercus wislizeni*	
71.020.18	*Quercus douglasii - Quercus wislizeni - Pinus sabiniana*	
71.020.17	*Quercus douglasii - Quercus wislizeni / Bromus spp. - Daucus pusillus*	
71.020.07	*Quercus douglasii - Quercus wislizeni / Ceanothus cuneatus*	
71.020.46	*Quercus douglasii - Quercus wislizeni / Lithophragma cymbalaria*	
71.020.42	*Quercus douglasii / Juniperus californica - Cercocarpus montanus*	
71.020.43	*Quercus douglasii / Achnatherum lemmonii*	
71.020.27	*Quercus douglasii / Amsinckia intermedia - Plagiobothrys nothofulvus*	
71.020.22	*Quercus douglasii / Arctostaphylos manzanita / herbaceous*	
71.020.28	*Quercus douglasii / Brachypodium distachyon*	
71.020.30	*Quercus douglasii / Bromus hordeaceus - Lolium multiflorum*	
71.020.29	*Quercus douglasii / Bromus hordeaceus - Madia gracilis*	
71.020.31	*Quercus douglasii / Bromus hordeaceus - Triteleia laxa*	
71.020.16	*Quercus douglasii / Bromus spp. - Daucus pusillus*	
71.020.12	*Quercus douglasii / Ceanothus cuneatus*	
*71.020.14	*Quercus douglasii / Cercocarpus montanus / Bowlesia incana - Lithophragma affine*	
71.020.32	*Quercus douglasii / Collinsia sparsiflora - Rigiopappus leptocladus*	
71.020.33	*Quercus douglasii / Delphinium parryi - Phacelia imbricata*	
71.020.08	*Quercus douglasii / Ericameria linearifolia*	
71.020.19	*Quercus douglasii / Ericameria linearifolia - Juniperus californica*	
71.020.34	*Quercus douglasii / Eriogonum elongatum / Lotus subpinnatus - Plantago erecta*	
71.020.20	*Quercus douglasii / Eriogonum fasciculatum / herbaceous*	
71.020.35	*Quercus douglasii / Erodium moschatum - Hordeum leporinum*	
71.020.36	*Quercus douglasii / Euphorbia spathulata - Pentagramma triangularis*	
71.020.37	*Quercus douglasii / Galium andrewsii - Lupinus concinnus*	
71.020.05	*Quercus douglasii / grass*	
71.020.38	*Quercus douglasii / Hordeum leporinum - Viola pedunculata*	
71.020.26	*Quercus douglasii / Juniperus californica*	
*71.020.23	*Quercus douglasii / Juniperus californica - Ceanothus cuneatus*	
71.020.41	*Quercus douglasii / Juniperus californica - Quercus john-tuckeri*	
71.020.40	*Quercus douglasii / Lotus subpinnatus - Nassella pulchra*	
71.020.39	*Quercus douglasii / Lupinus concinnus - Trifolium ciliolatum*	
71.020.15	*Quercus douglasii / Ribes californica / Bromus diandrus*	
*71.020.21	*Quercus douglasii / Selaginella hansenii - Navarretia pubescens*	
71.020.45	*Quercus douglasii / Toxicodendron diversilobum / grass*	
71.020.09	*Quercus douglasii / understory oak*	
***71.070.00**	***Quercus engelmannii* (Engelmann oak woodland) Alliance**	G3 S3
*71.070.02	*Quercus engelmannii - Quercus agrifolia / Artemisia californica*	
*71.070.03	*Quercus engelmannii - Quercus agrifolia / chaparral (Adenostoma fasciculatum - Quercus berberidifolia - Rhamnus ilicifolia)*	
*71.070.04	*Quercus engelmannii - Quercus agrifolia / Toxicodendron diversilobum / annual grass*	
*71.070.05	*Quercus engelmannii / Adenostoma fasciculatum - Arctostaphylos glauca*	
*71.070.06	*Quercus engelmannii / annual grass - herb*	
*71.070.07	*Quercus engelmannii / Quercus berberidifolia*	
*71.070.08	*Quercus engelmannii / Salvia apiana / grass - herb*	
*71.070.09	*Quercus engelmannii / Toxicodendron diversilobum / grass*	

*71.030.00	***Quercus garryana* (Oregon white oak woodland) Alliance**	G4 S3
*71.030.03	*Quercus garryana - Pseudotsuga menziesii / Festuca californica*	
*71.030.01	*Quercus garryana - Quercus kelloggii / Arrhenatherum elatius*	
*71.030.15	*Quercus garryana - Quercus kelloggii / Dichelostemma ida-maia*	
*71.030.14	*Quercus garryana - Quercus kelloggii / Toxicodendron diversilobum*	
*71.030.02	*Quercus garryana var. garryana - Quercus garryana var. breweri / Festuca californica*	
*71.030.11	*Quercus garryana / Bromus carinatus*	
*71.030.06	*Quercus garryana / Cynosurus cristatus*	
*71.030.10	*Quercus garryana / Dactylis glomerata*	
*71.030.09	*Quercus garryana / Delphinium trolliifolium*	
*71.030.13	*Quercus garryana / Melica subulata*	
*71.030.08	*Quercus garryana / Philadelphus lewisii*	
*71.030.07	*Quercus garryana / Ribes roezlii*	
*71.030.05	*Quercus garryana / Symphoricarpos albus*	
*71.030.04	*Quercus garryana / Toxicodendron diversilobum*	
71.010.00	***Quercus kelloggii* (California black oak forest) Alliance**	G4 S4 (some associations are of high priority for inventory)
71.010.18	*Quercus kelloggii*	
71.010.22	*Quercus kelloggii - Arbutus menziesii - Quercus agrifolia*	
71.010.21	*Quercus kelloggii - Calocedrus decurrens*	
71.010.32	*Quercus kelloggii - Pinus coulteri*	
71.010.33	*Quercus kelloggii - Pinus coulteri / Arctostaphylos glandulosa*	
71.010.34	*Quercus kelloggii - Pinus coulteri / Arctostaphylos pringlei*	
71.010.26	*Quercus kelloggii - Pinus ponderosa*	
71.010.27	*Quercus kelloggii - Pinus ponderosa / Arctostaphylos viscida*	
71.010.28	*Quercus kelloggii - Pinus ponderosa / Ceanothus integerrimus*	
71.010.35	*Quercus kelloggii - Pinus sabiniana / Styrax officinalis - Toxicodendron diversilobum*	
*71.010.17	*Quercus kelloggii - Pseudotsuga menziesii*	
71.010.16	*Quercus kelloggii - Pseudotsuga menziesii - Acer macrophyllum*	
*71.010.29	*Quercus kelloggii - Pseudotsuga menziesii - Umbellularia californica*	
*71.010.02	*Quercus kelloggii - Quercus agrifolia - pine / Holodiscus discolor*	
71.010.12	*Quercus kelloggii - Quercus chrysolepis*	
71.010.01	*Quercus kelloggii - Quercus chrysolepis / Toxicodendron diversilobum*	
71.010.23	*Quercus kelloggii - Quercus chrysolepis / Toxicodendron diversilobum*	
*71.010.11	*Quercus kelloggii - Quercus lobata / grass*	
71.010.30	*Quercus kelloggii / annual grass - herb*	
71.010.20	*Quercus kelloggii / Arctostaphylos mewukka / Chamaebatia foliosa*	
71.010.06	*Quercus kelloggii / Arctostaphylos patula*	
71.010.24	*Quercus kelloggii / Arctostaphylos viscida*	
71.010.03	*Quercus kelloggii / Ceanothus integerrimus*	
71.010.04	*Quercus kelloggii / Ceanothus integerrimus - Toxicodendron diversilobum / Pteridium*	
71.010.31	*Quercus kelloggii / Heteromeles arbutifolia - Toxicodendron diversilobum*	
71.010.08	*Quercus kelloggii / Toxicodendron diversilobum*	
*71.010.10	*Quercus kelloggii / Toxicodendron diversilobum - Styrax officinalis / Triteleia laxa*	
71.010.25	*Quercus kelloggii / Toxicodendron diversilobum / grass*	
71.010.05	*Quercus kelloggii/ Triteleia spp.*	
*71.040.00	***Quercus lobata* (Valley oak woodland) Alliance**	G3 S3 (some associations are of high priority for inventory)
*71.040.15	*Quercus lobata - Acer negundo*	
*71.040.11	*Quercus lobata - Alnus rhombifolia*	
*71.040.16	*Quercus lobata - Fraxinus latifolia / Vitis californica*	
*71.040.06	*Quercus lobata - Quercus agrifolia / grass*	
*71.040.17	*Quercus lobata - Quercus agrifolia / Toxicodendron diversilobum*	
*71.040.18	*Quercus lobata - Quercus douglasii*	
*71.040.19	*Quercus lobata - Quercus kelloggii*	
*71.040.12	*Quercus lobata - Quercus wislizeni*	
*71.040.20	*Quercus lobata - Salix lasiolepis*	
*71.040.14	*Quercus lobata (Sacramento River)*	

*71.040.05	*Quercus lobata / grass*	
*71.040.13	*Quercus lobata / herbaceous semi-riparian*	
*71.040.09	*Quercus lobata / Rhus trilobata*	
*71.040.10	*Quercus lobata / Rubus armeniacus*	
*71.085.00	***Quercus parvula var. shrevei*** **(Shreve oak forests) Provisional Alliance**	G2 S2
*71.090.00	***Quercus tomentella*** **(Island oak groves) Special Stands**	G3 S3
71.080.00	***Quercus wislizeni*** **(Interior live oak woodland) Alliance**	G4 S4
71.080.14	*Quercus wislizeni - Aesculus californica*	
71.080.37	*Quercus wislizeni - Aesculus californica / Toxicodendron diversilobum*	
71.080.03	*Quercus wislizeni - Arbutus menziesii / Toxicodendron diversilobum*	
*71.080.15	*Quercus wislizeni - Pinus ponderosa*	
71.080.42	*Quercus wislizeni - Pinus sabiniana / annual grass - herb*	
*71.080.02	*Quercus wislizeni - Pinus sabiniana / Arctostaphylos manzanita*	
71.080.08	*Quercus wislizeni - Pinus sabiniana / Arctostaphylos viscida*	
71.080.39	*Quercus wislizeni - Quercus chrysolepis - Pinus coulteri*	
71.080.38	*Quercus wislizeni - Quercus chrysolepis tree*	
71.080.43	*Quercus wislizeni - Quercus douglasii - Aesculus californica*	
71.080.01	*Quercus wislizeni - Quercus douglasii - Pinus sabiniana / (grass)*	
71.080.41	*Quercus wislizeni - Quercus douglasii - Pinus sabiniana / Toxicodendron diversilobum*	
71.080.44	*Quercus wislizeni - Quercus douglasii / herbaceous*	
71.080.46	*Quercus wislizeni - Quercus douglasii / Toxicodendron diversilobum*	
71.080.45	*Quercus wislizeni - Quercus kelloggii*	
71.080.47	*Quercus wislizeni - Quercus kelloggii / Heteromeles arbutifolia - Toxicodendron*	
*71.080.13	*Quercus wislizeni - Salix laevigata / Frangula californica*	
71.080.04	*Quercus wislizeni / Arctostaphylos viscida*	
71.080.05	*Quercus wislizeni / Eriodictyon californicum*	
71.080.40	*Quercus wislizeni / Heteromeles arbutifolia*	
71.080.48	*Quercus wislizeni / Toxicodendron diversilobum*	
71.080.16	*Quercus wislizeni / Toxicodendron diversilobum / Centaurea solstitialis*	
*61.211.00	***Salix gooddingii*** **(Black willow thickets) Alliance**	G4 S3
*61.211.01	*Salix gooddingii*	
*61.211.04	*Salix gooddingi - Populus fremontii*	
*61.211.06	*Salix gooddingii - Quercus lobata / wetland herb*	
*61.211.05	*Salix gooddingii - Salix laevigata*	
*61.211.08	*Salix gooddingii - Salix lucida - Populus fremontii*	
*61.211.02	*Salix gooddingii / Baccharis salicifolia*	
*61.211.03	*Salix gooddingii / Lepidium latifolium*	
*61.211.07	*Salix gooddingii / Rubus armeniacus*	
*61.205.00	***Salix laevigata*** **(Red willow thickets) Alliance**	G3 S3
*61.205.01	*Salix laevigata*	
*61.205.05	*Salix laevigata - Cornus sericea / Scirpus microcarpus*	
*61.205.02	*Salix laevigata - Salix lasiolepis*	
*61.205.03	*Salix laevigata - Salix lasiolepis / Artemisia douglasiana - Rubus ursinus*	
*61.205.07	*Salix laevigata - Salix lasiolepis / Baccharis salicifolia*	
*61.205.04	*Salix laevigata / Rosa californica*	
*61.205.06	*Salix laevigata / Salix lasiolepis / Artemisia douglasiana*	
*61.204.00	***Salix lucida*** **(Shining willow groves) Alliance**	G4 S3
*61.204.02	*Salix lucida / Poa pratensis*	
*61.204.03	*Salix lucida ssp. lasiandra*	
*61.204.04	*Salix lucida ssp. lasiandra / Cornus sericea*	
*61.204.05	*Salix lucida ssp. lasiandra / Equisetum arvense*	
*61.204.06	*Salix lucida ssp. lasiandra / Trifolium longipes*	

79.200.00	***Schinus (molle, terebinthifolius) - Myoporum laetum* (Pepper tree or Myoporum groves) Semi-natural Stands**	
79.200.01	*Myoporum laetum / Arundo donax*	
79.200.02	*Schinus molle*	
79.200.03	*Schinus molle / Lepidospartum squamatum*	
*86.100.00	***Sequoia sempervirens* (Redwood forest) Alliance**	G3 S3
*86.100.04	*Sequoia sempervirens*	
*86.100.14	*Sequoia sempervirens - Acer macrophyllum - Umbellularia californica*	
*86.100.01	*Sequoia sempervirens - Acer macrophyllum / Polypodium californicum*	
*86.100.29	*Sequoia sempervirens - Alnus rubra / Rubus spectabilis*	
*86.100.15	*Sequoia sempervirens - Arbutus menziesii / Vaccinium ovatum*	
*86.100.18	*Sequoia sempervirens - Chrysolepis chrysophylla / Arctostaphylos glandulosa*	
*86.100.06	*Sequoia sempervirens - Lithocarpus densiflorus / Carex globosa - Iris douglasiana*	
*86.100.16	*Sequoia sempervirens - Lithocarpus densiflorus / Vaccinium ovatum*	
*86.100.23	*Sequoia sempervirens - Pseudotsuga menziesii - Lithocarpus densiflorus - Chamaecyparis lawsoniana / Vaccinium ovatum*	
*86.100.20	*Sequoia sempervirens - Pseudotsuga menziesii - Umbellularia californica*	
*86.100.10	*Sequoia sempervirens - Pseudotsuga menziesii / Arbutus menziesii*	
*86.100.11	*Sequoia sempervirens - Pseudotsuga menziesii / Gaultheria shallon*	
*86.100.26	*Sequoia sempervirens - Pseudotsuga menziesii / Rhododendron macrophyllum*	
*86.100.12	*Sequoia sempervirens - Pseudotsuga menziesii / Vaccinium ovatum*	
*86.100.28	*Sequoia sempervirens - Tsuga heterophylla / Polystichum munitum*	
*86.100.30	*Sequoia sempervirens - Tsuga heterophylla / Rubus spectabilis*	
*86.100.27	*Sequoia sempervirens - Tsuga heterophylla / Vaccinium ovatum*	
*86.100.21	*Sequoia sempervirens - Umbellularia californica*	
*86.100.02	*Sequoia sempervirens / (Pteridium aquilinum) - Woodwardia fimbriata*	
*86.100.09	*Sequoia sempervirens / Arbutus menziesii*	
*86.100.07	*Sequoia sempervirens / Blechnum spicant*	
*86.100.08	*Sequoia sempervirens / Mahonia nervosa*	
*86.100.05	*Sequoia sempervirens / Marah fabaceus - Vicia angustifolia*	
*86.100.13	*Sequoia sempervirens / Oxalis oregana*	
*86.100.25	*Sequoia sempervirens / Polystichum munitum*	
*86.100.24	*Sequoia sempervirens / Pteridium aquilinum*	
*86.100.03	*Sequoia sempervirens / Pteridium aquilinum - Trillium ovatum*	
*86.200.00	***Sequoiadendron giganteum* (Giant sequoia forest) Alliance**	G3 S3
*86.200.01	*Sequoiadendron giganteum - Pinus lambertiana / Cornus nuttallii*	
*84.200.00	***Tsuga heterophylla* (Western hemlock forest) Alliance**	G5 S2
*84.200.01	*Tsuga heterophylla - Pseudotsuga menziesii - Chamaecyparis lawsoniana*	
84.100.00	***Tsuga mertensiana* (Mountain hemlock forest) Alliance**	G5 S4
84.100.04	*Tsuga mertensiana*	
84.100.15	*Tsuga mertensiana - Pinus contorta ssp. murrayana*	
84.100.11	*Tsuga mertensiana - Pinus contorta var. murrayana - Pinus monticola*	
84.100.10	*Tsuga mertensiana - Pinus monticola*	
84.100.09	*Tsuga mertensiana / Arnica cordifolia*	
84.100.02	*Tsuga mertensiana / Juncus parryi*	
84.100.01	*Tsuga mertensiana / Phyllodoce empetriformis*	
84.100.08	*Tsuga mertensiana / Pyrola picta*	
84.100.03	*Tsuga mertensiana / Quercus sadleriana*	
84.100.07	*Tsuga mertensiana / Quercus vacciniifolia*	
84.100.14	*Tsuga mertensiana / steep*	
*74.100.00	***Umbellularia californica* (California bay forest) Alliance**	G4 S3
*74.100.01	*Umbellularia californica*	
*74.100.10	*Umbellularia californica - Acer macrophyllum*	
*74.100.06	*Umbellularia californica - Aesculus californica / Holodiscus discolor*	
*74.100.16	*Umbellularia californica - Alnus rhombifolia*	
*74.100.03	*Umbellularia californica - Arbutus menziesii*	

*74.100.11	*Umbellularia californica - Juglans californica / Ceanothus spinosus*	
*74.100.12	*Umbellularia californica - Lithocarpus densiflorus*	
*74.100.13	*Umbellularia californica - Platanus racemosa*	
*74.100.17	*Umbellularia californica - Pseudotsuga menziesii / Rhododendron occidentale*	
*74.100.15	*Umbellularia californica - Quercus agrifolia / (Genista monspessulana)*	
*74.100.19	*Umbellularia californica - Quercus agrifolia / Heteromeles arbutifolia - Toxicodendron diversilobum / Melica torreyana*	
*74.100.05	*Umbellularia californica - Quercus agrifolia / Toxicodendron diversilobum (Corylus cornuta)*	
*74.100.20	*Umbellularia californica - Quercus chrysolepis*	
*74.100.18	*Umbellularia californica - Quercus wislizeni*	
*74.100.07	*Umbellularia californica / Ceanothus oliganthus*	
*74.100.08	*Umbellularia californica / Polystichum munitum*	
*74.100.09	*Umbellularia californica / Toxicodendron diversilobum*	
*61.520.00	***Washingtonia filifera* (California fan palm oasis) Alliance**	G3 S3
*61.520.04	*Washingtonia filifera - Platanus racemosa / Salix spp*	
*61.520.03	*Washingtonia filifera / spring (Atriplex - Baccharis - Pluchea)*	
*33.170.00	***Yucca brevifolia* (Joshua tree woodland) Alliance**	G4 S3
*33.170.01	*Yucca brevifolia*	
*33.170.20	*Yucca brevifolia / Ephedra nevadensis*	
*33.170.18	*Yucca brevifolia / Yucca baccata / Pleuraphis jamesii*	
*33.170.04	*Yucca brevifolia / Artemisia tridentata - Atriplex confertifolia*	
*33.170.02	*Yucca brevifolia / Coleogyne ramosissima*	
*33.170.06	*Yucca brevifolia / Cylindropuntia acanthocarpa*	
*33.170.14	*Yucca brevifolia / Gutierrezia microcephala / Pleuraphis rigida*	
*33.170.03	*Yucca brevifolia / Juniperus californica / Coleogyne ramosissima*	
*33.170.19	*Yucca brevifolia / Juniperus californica / Ephedra nevadensis*	
*33.170.10	*Yucca brevifolia / Larrea tridentata - Yucca schidigera*	
*33.170.11	*Yucca brevifolia / Larrea tridentata - Ambrosia dumosa - Eriogonum fasciculatum*	
*33.170.15	*Yucca brevifolia / Larrea tridentata - Pleuraphis rigida*	
*33.170.08	*Yucca brevifolia / Lycium andersonii*	
*33.170.07	*Yucca brevifolia / Pleuraphis (rigida, jamesii)*	
*33.170.16	*Yucca brevifolia / Pleuraphis rigida*	
*33.170.17	*Yucca brevifolia / Pleuraphis rigida - Muhlenbergia porteri*	
*33.170.13	*Yucca brevifolia / Prunus fasciculata*	
*33.170.09	*Yucca brevifolia / Salazaria mexicana*	

Shrubland Alliances and Stands		**Global & State Rank**
33.040.00	***Acacia greggii* (Catclaw acacia thorn scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
*33.040.08	*Acacia greggii - Ambrosia eriocentra*	
33.040.05	*Acacia greggii - Ambrosia salsola*	
33.040.02	*Acacia greggii - annual herbs (Bromus rubens)*	
33.040.10	*Acacia greggii - Bebbia juncea*	
33.040.12	*Acacia greggii - Encelia virginensis*	
33.040.13	*Acacia greggii - Eriogonum fasciculatum*	
33.040.03	*Acacia greggii - Hyptis emoryi*	
33.040.07	*Acacia greggii - Prunus fasciculata*	
33.040.09	*Acacia greggii - Salvia dorrii*	
33.040.06	*Acacia greggii - Viguiera parishii*	
*33.040.11	*Acacia greggii / Eriogonum nudum var. pauciflorum*	
33.040.01	*Acacia greggii wash (Justicia californica)*	
*61.430.00	***Acer glabrum* (Rocky Mountain maple thickets) Provisional Alliance**	G5 S3?

37.101.00	***Adenostoma fasciculatum*** **(Chamise chaparral) Alliance**		G5 S5 (some associations are of high priority for inventory)
	37.101.16	*Adenostoma fasciculatum*	
	37.101.07	*Adenostoma fasciculatum - (Arctostaphylos glandulosa)*	
	*37.101.19	*Adenostoma fasciculatum - (Arctostaphylos manzanita)*	
	37.101.26	*Adenostoma fasciculatum - (Arctostaphylos pungens)*	
	37.101.27	*Adenostoma fasciculatum - (Arctostaphylos viscida)*	
	37.101.08	*Adenostoma fasciculatum - (Ceanothus crassifolius)*	
	37.101.10	*Adenostoma fasciculatum - (Ceanothus cuneatus)*	
	*37.101.06	*Adenostoma fasciculatum - (Ceanothus greggii / mafic)*	
	37.101.11	*Adenostoma fasciculatum - (Ceanothus tomentosus)*	
	37.101.32	*Adenostoma fasciculatum - Arctostaphylos glandulosa - Ceanothus jepsonii / Calamagrostis ophitidis*	
	37.101.22	*Adenostoma fasciculatum - Arctostaphylos pringlei*	
	*37.101.12	*Adenostoma fasciculatum - Diplacus aurantiacus*	
	37.101.31	*Adenostoma fasciculatum - Eriodictyon californicum (Lotus scoparius)*	
	37.101.14	*Adenostoma fasciculatum - Eriogonum fasciculatum*	
	37.103.03	*Adenostoma fasciculatum - Eriogonum fasciculatum - Salvia apiana*	
	37.101.04	*Adenostoma fasciculatum - Hesperoyucca whipplei*	
	37.101.28	*Adenostoma fasciculatum - Heteromeles arbutifolia / Melica torreyana*	
	37.101.21	*Adenostoma fasciculatum - Malosma laurina*	
	37.101.33	*Adenostoma fasciculatum - Malosma laurina - Eriodictyon crassifolium*	
	37.101.24	*Adenostoma fasciculatum / annual grass - forb*	
	37.101.29	*Adenostoma fasciculatum / Castilleja pruinosa*	
	37.101.25	*Adenostoma fasciculatum / mixed herb - moss*	
	37.101.30	*Adenostoma fasciculatum / Selaginella bigelovii*	
	37.101.17	*Adenostoma fasciculatum disturbance*	
	*37.101.15	*Adenostoma fasciculatum serpentine*	
*37.103.00	***Adenostoma fasciculatum - Salvia apiana*** **(Chamise - white sage chaparral) Alliance**		G3 S3
	*37.103.01	*Adenostoma fasciculatum - Salvia apiana*	
	*37.103.02	*Adenostoma fasciculatum - Salvia apiana - Artemisia californica*	
	*37.101.23	*Adenostoma fasciculatum - Salvia leucophylla*	
37.102.00	***Adenostoma fasciculatum - Salvia mellifera*** **(Chamise - black sage chaparral) Alliance**		G5 S5 (some associations are of high priority for inventory)
	37.102.04	*Adenostoma fasciculatum - Salvia mellifera - Artemisia californica*	
	37.102.05	*Adenostoma fasciculatum - Salvia mellifera - Ceanothus crassifolius*	
	37.102.06	*Adenostoma fasciculatum - Salvia mellifera - Malosma laurina*	
	37.102.07	*Adenostoma fasciculatum - Salvia mellifera - Rhus ovata*	
	37.102.02	*Adenostoma fasciculatum - Salvia mellifera / (herbaceous)*	
	*37.102.03	*Adenostoma fasciculatum - Salvia mellifera / mixed shrub*	
*37.109.00	***Adenostoma fasciculatum - Xylococcus bicolor*** **(Chamise-mission manzanita chaparral) Alliance**		G4 S3
	*37.109.01	*Adenostoma fasciculatum - Xylococcus bicolor*	
	*37.109.05	*Adenostoma fasciculatum - Xylococcus bicolor - Ceanothus crassifolius*	
	*37.109.14	*Adenostoma fasciculatum - Xylococcus bicolor - Ceanothus crassifolius - Malosma laurina*	
	*37.109.02	*Adenostoma fasciculatum - Xylococcus bicolor - Ceanothus tomentosus*	
	*37.109.08	*Adenostoma fasciculatum - Xylococcus bicolor - Ceanothus verrucosus*	
	*37.109.09	*Adenostoma fasciculatum - Xylococcus bicolor - Cneoridium dumosum*	
	*37.109.10	*Adenostoma fasciculatum - Xylococcus bicolor - Eriogonum fasciculatum*	
	*37.109.12	*Adenostoma fasciculatum - Xylococcus bicolor - Quercus berberidifolia*	
	*37.109.11	*Adenostoma fasciculatum - Xylococcus bicolor - Rhus integrifolia*	
	*37.109.13	*Adenostoma fasciculatum - Xylococcus bicolor - Salvia mellifera - Malosma laurina*	
37.501.00	***Adenostoma sparsifolium*** **(Redshank chaparral) Alliance**		G4 S4 (some associations are of high priority for inventory)
	*37.501.01	*Adenostoma sparsifolium*	
	37.503.05	*Adenostoma sparsifolium - Adenostoma fasciculatum - Arctostaphylos glauca*	
	*37.503.03	*Adenostoma sparsifolium - Adenostoma fasciculatum - Arctostaphylos pungens*	
	37.503.04	*Adenostoma sparsifolium - Adenostoma fasciculatum - Ceanothus crassifolius*	

*37.503.02	*Adenostoma sparsifolium - Adenostoma fasciculatum - Ceanothus greggii*	
*37.503.01	*Adenostoma sparsifolium - Adenostoma fasciculatum - Cercocarpus montanus*	
37.503.06	*Adenostoma sparsifolium - Adenostoma fasciculatum - Opuntia parryi*	
37.501.02	*Adenostoma sparsifolium - Artemisia tridentata*	
37.501.03	*Adenostoma sparsifolium - Ceanothus crassifolius*	
37.501.04	*Adenostoma sparsifolium - Ceanothus cuneatus*	
37.502.01	*Adenostoma sparsifolium - Cercocarpus montanus*	
37.501.06	*Adenostoma sparsifolium - Ericameria linearifolia - Eriogonum fasciculatum - Opuntia basilaris*	
37.501.07	*Adenostoma sparsifolium - Eriogonum fasciculatum - Lotus scoparius*	
*33.075.00	***Agave deserti* (Desert agave scrub) Alliance**	G3 S3
*33.075.01	*Agave deserti - Ambroia salsola (wash and terrace)*	
*33.075.02	*Agave deserti - Yucca schidigera*	
*36.120.00	***Allenrolfea occidentalis* (Iodine bush scrub) Alliance**	G4 S3
*36.120.04	*Allenrolfea occidentalis*	
*36.120.03	*Allenrolfea occidentalis - Sporobolus airoides*	
*36.120.02	*Allenrolfea occidentalis - Suaeda moquinii*	
*63.210.00	***Alnus incana* (Mountain alder thicket) Alliance**	G4 S3
*63.210.01	*Alnus incana*	
*63.210.02	*Alnus incana / Glyceria elata*	
*63.210.03	*Alnus incana / bench*	
*63.220.00	***Alnus viridis* (Sitka alder thickets) Provisional Alliance**	G5 S3?
33.060.00	***Ambrosia dumosa* (White bursage scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
*33.060.02	*Ambrosia dumosa*	
*33.060.01	*Ambrosia dumosa - Acamptopappus sphaerocephalus*	
33.060.03	*Ambrosia dumosa - Atriplex hymenolytra*	
33.060.06	*Ambrosia dumosa - Encelia farinosa*	
33.060.07	*Ambrosia dumosa - Ephedra californica / sandy*	
33.060.09	*Ambrosia dumosa - Olneya tesota - Calliandra eriophylla*	
*33.060.04	*Ambrosia dumosa / Pleuraphis rigida*	
33.200.00	***Ambrosia salsola* (Cheesebush scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
33.200.01	*Ambrosia salsola*	
*33.200.06	*Ambrosia salsola - Ambrosia eriocentra*	
33.200.04	*Ambrosia salsola - Atriplex confertifolia*	
33.200.05	*Ambrosia salsola - Bebbia juncea*	
33.200.07	*Ambrosia salsola - Brickellia incana*	
33.200.02	*Ambrosia salsola - Eriogonum fasciculatum*	
33.200.10	*Ambrosia salsola - Larrea tridentata*	
33.200.09	*Ambrosia salsola - Psorothamnus schottii*	
33.200.08	*Ambrosia salsola - Senna armata*	
33.200.11	*Ambrosia salsola -Petalonyx thurberi*	
*37.308.00	***Arctostaphylos (crustacea, tomentosa)* (Brittle leaf-Woolly leaf manzanita chaparral)**	G2 S2
*37.306.00	***Arctostaphylos (nummularia, sensitiva)* (Glossy leaf manzanita chaparral) Alliance**	G2 S2
*37.322.00	***Arctostaphylos (purissima, rudis)* (Burton Mesa chaparral) Provisional Alliance**	G1 S1
*37.317.00	***Arctostaphylos bakeri* (Stands of Baker manzanita) Special Stands**	G1 S1

*37.311.00	***Arctostaphylos canescens* (Hoary manzanita chaparral) Provisional Alliance**	G3? S3?
*37.311.01	*Arctostaphylos canescens - Arctostaphylos glandulosa - Adenostoma fasciculatum*	
*37.308.03	*Arctostaphylos crustacea*	
*37.308.04	*Arctostaphylos crustacea - Adenostoma fasciculatum - Ceanothus (cuneatus, papillosus)*	
*37.308.05	*Arctostaphylos crustacea - Arctostaphylos gabilanensis*	
37.302.00	***Arctostaphylos glandulosa* (Eastwood manzanita chaparral) Alliance**	G4 S4 (some associations are of high priority for inventory)
37.302.01	*Arctostaphylos glandulosa*	
37.106.13	*Arctostaphylos glandulosa - Adenostoma fasciculatum*	
37.106.12	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Arctostaphylos glauca*	
37.106.04	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Ceanothus crassifolius*	
37.106.07	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Ceanothus cuneatus*	
37.106.02	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Ceanothus leucodermis*	
37.106.01	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Cercocarpus montanus*	
37.106.11	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Quercus berberidifolia*	
37.106.10	*Arctostaphylos glandulosa - Adenostoma fasciculatum - Quercus wislizeni*	
*37.106.05	*Arctostaphylos glandulosa - Adenostoma fasciculatum / mafic soils*	
37.106.03	*Arctostaphylos glandulosa - Adenostoma fasciculatum -Ceanothus greggii*	
*37.302.07	*Arctostaphylos glandulosa - Arctostaphylos pringlei*	
37.302.03	*Arctostaphylos glandulosa - Cercocarpus montanus*	
37.302.04	*Arctostaphylos glandulosa - Quercus wislizeni*	
*37.302.02	*Arctostaphylos glandulosa ssp. adamsii*	
37.301.00	***Arctostaphylos glauca* (Bigberry manzanita chaparral) Alliance**	G4 S4 (some associations are of high priority for inventory)
37.301.01	*Arctostaphylos glauca*	
37.104.01	*Arctostaphylos glauca - Adenostoma fasciculatum*	
37.104.05	*Arctostaphylos glauca - Adenostoma fasciculatum - Ceanothus crassifolius*	
37.104.07	*Arctostaphylos glauca - Adenostoma fasciculatum - Ceanothus cuneatus*	
37.104.04	*Arctostaphylos glauca - Adenostoma fasciculatum - Ceanothus greggii*	
37.104.02	*Arctostaphylos glauca - Adenostoma fasciculatum - Ceanothus leucodermis*	
37.104.08	*Arctostaphylos glauca - Adenostoma fasciculatum - Diplacus aurantiacus*	
37.104.03	*Arctostaphylos glauca - Adenostoma fasciculatum - Hesperoyucca whipplei*	
37.104.06	*Arctostaphylos glauca - Adenostoma fasciculatum - Quercus berberidifolia*	
37.104.09	*Arctostaphylos glauca - Adenostoma fasciculatum - Rhus ovata*	
37.104.10	*Arctostaphylos glauca - Adenostoma fasciculatum - Salvia mellifera*	
37.104.11	*Arctostaphylos glauca - Adenostoma fasciculatum on serpentine*	
37.301.03	*Arctostaphylos glauca - Artemisia californica - Salvia mellifera*	
37.301.05	*Arctostaphylos glauca - Cercocarpus montanus*	
*37.301.04	*Arctostaphylos glauca - Quercus durata / Pinus sabiniana*	
*37.301.02	*Arctostaphylos glauca / Melica torreyana*	
*37.321.00	***Arctostaphylos hookeri* (Hooker's manzanita chaparral) Provisional Alliance**	G2 S2
*37.312.00	***Arctostaphylos hooveri* (Hoover's manzanita chaparral) Alliance**	G2 S2
*37.312.01	*Arctostaphylos hooveri*	
*37.313.00	***Arctostaphylos manzanita* (Spiny menodora scrub) Provisional Alliance**	G3? S3?
*37.307.00	***Arctostaphylos montana* (Mount Tamalpais manzanita chaparral) Alliance**	G2 S2
*37.307.01	*Arctostaphylos montana*	
*37.307.02	*Arctostaphylos montana - Adenostoma fasciculatum*	
*37.314.00	***Arctostaphylos montereyensis* (Monterey manzanita chaparral) Provisional Alliance**	G1 S1
*37.315.00	***Arctostaphylos morroensis* (Morro manzanita chaparral) Alliance**	G1 S1
*37.304.00	***Arctostaphylos myrtifolia* (Ione manzanita chaparral) Alliance**	G1 S1
*37.304.01	*Arctostaphylos myrtifolia*	

*37.316.00	***Arctostaphylos pajaroensis* (Pajaro manzanita chaparral) Alliance**	G1 S1
*37.316.01	*Arctostaphylos pajaroensis*	
37.303.00	***Arctostaphylos patula* (Green leaf manzanita chaparral) Alliance**	G5 S4
37.303.01	*Arctostaphylos patula*	
37.303.02	*Arctostaphylos patula - Quercus vacciniifolia*	
*37.310.00	***Arctostaphylos pringlei ssp. drupacea* (Pink-bract manzanita chaparral) Alliance**	G3 S3
*37.310.02	*Arctostaphylos pringlei ssp. drupacea*	
*37.310.01	*Arctostaphylos pringlei ssp. drupacea - Arctostaphylos pungens*	
*37.318.00	***Arctostaphylos pumila* (Sandmat manzanita chaparral) Provisional Alliance**	G1 S1
*37.306.01	*Arctostaphylos sensitiva - Vaccinium ovatum - Chrysolepis chrysophylla var. minor*	
*37.306.02	*Arctostaphylos sensitiva - Arctostaphylos glandulosa*	
*37.320.00	***Arctostaphylos silvicola* (Silverleaf manzanita chaparral) Provisional Alliance**	G1 S1
*37.319.00	***Arctostaphylos stanfordiana* (Stanford manzanita chaparral) Provisional Alliance**	G3 S3?
37.305.00	***Arctostaphylos viscida* (White leaf manzanita chaparral) Alliance**	G4 S4 (some associations are of high priority for inventory)
37.305.01	*Arctostaphylos viscida*	
37.305.05	*Arctostaphylos viscida - Heteromeles arbutifolia - Toxicodendron diversilobum*	
37.305.07	*Arctostaphylos viscida - Quercus wislizeni*	
*37.305.03	*Arctostaphylos viscida / Salvia sonomensis*	
37.305.06	*Arctostaphylos viscida ssp. pulchella*	
37.305.02	*Arctostaphylos viscida - Adenostoma fasciculatum*	
*37.305.04	*(Arctostaphylos viscida - Adenostoma fasciculatum) / Salvia sonomensis*	
35.120.00	***Artemisia arbuscula ssp. arbuscula* (Little sagebrush scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
35.120.07	*Artemisia arbuscula*	
*35.120.05	*Artemisia arbuscula - Eriogonum microthecum*	
35.120.06	*Artemisia arbuscula / Carex exserta*	
35.120.08	*Artemisia arbuscula / Castilleja applegatei*	
35.120.09	*Artemisia arbuscula / Castilleja schizotrichia*	
35.120.10	*Artemisia arbuscula / Eriogonum nudum - Monardella odoratissima*	
*35.120.03	*Artemisia arbuscula / Festuca idahoensis*	
35.120.04	*Artemisia arbuscula / Leptodactylon pungens*	
35.120.02	*Artemisia arbuscula / Stenotus acaulis - Geum canescens*	
35.120.11	*Artemisia arbuscula / Stenotus acaulis - Linanthus pungens*	
35.120.12	*Artemisia arbuscula / Stenotus acaulis - Tetradymia canescens*	
*35.120.01	*Artemisia arbuscula / Trifolium andersonii ssp. monoense*	
35.121.00	***Artemisia arbuscula ssp. longicaulis* (Lahontan sagebrush scrub) Provisional Alliance**	G5 S4?
32.010.00	***Artemisia californica* (California sagebrush scrub) Alliance**	G5 S5
32.010.01	*Artemisia californica*	
45.455.02	*Artemisia californica - Malosma laurina*	
32.010.15	*Artemisia californica - Baccharis pilularis / Leymus condensatus*	
32.010.08	*Artemisia californica - Ceanothus ferrisiae*	
32.010.11	*Artemisia californica - Diplacus aurantiacus*	
32.010.07	*Artemisia californica - Eriogonum cinereum*	
32.010.03	*Artemisia californica - Keckiella cordifolia*	
32.010.09	*Artemisia californica - Lepidospartum squamatum*	
32.010.02	*Artemisia californica - Lotus scoparius*	
32.010.10	*Artemisia californica - Malosma laurina*	
32.010.04	*Artemisia californica - Salvia leucophylla*	

32.110.00	***Artemisia californica - Eriogonum fasciculatum*** **(California sagebrush - California buckwheat scrub) Alliance**	G4 S4
32.110.05	*Artemisia californica - Eriogonum fasciculatum*	
32.110.07	*Artemisia californica - Eriogonum fasciculatum - Ephedra californica*	
32.110.06	*Artemisia californica - Eriogonum fasciculatum - Malosma laurina*	
32.110.01	*Artemisia californica - Eriogonum fasciculatum - Rhus ovata*	
32.110.02	*Artemisia californica - Eriogonum fasciculatum - Salvia apiana*	
32.110.03	*Artemisia californica - Eriogonum fasciculatum - Salvia leucophylla*	
32.110.04	*Artemisia californica - Eriogonum fasciculatum - Salvia mellifera*	
32.120.00	***Artemisia californica - Salvia mellifera*** **(California sagebrush - black sage scrub) Alliance**	G4 S4
32.120.01	*Artemisia californica - Salvia mellifera*	
32.120.03	*Artemisia californica - Salvia mellifera - Baccharis sarothroides*	
32.010.12	*Artemisia californica / Amsinckia menziesii*	
32.010.13	*Artemisia californica / Eschscholzia californica*	
32.010.14	*Artemisia californica / Leymus condensatus*	
*35.150.00	***Artemisia cana*** **(Silver sagebrush scrub) Alliance**	G5 S3
*35.150.06	*Artemisia cana - Muhlenbergia richardsonis*	
*35.150.01	*Artemisia cana / cold*	
*35.150.02	*Artemisia cana / dry graminoid*	
*35.150.05	*Artemisia cana / Iris missouriensis - Juncus arcticus var. balticus*	
*35.150.04	*Artemisia cana / Juncus arcticus var. balticus*	
*35.150.07	*Artemisia cana / mesic (Poa secunda - Poa cusickii)*	
*35.150.03	*Artemisia cana / warm*	
*35.130.00	***Artemisia nova*** **(Black sagebrush scrub) Alliance**	G4 S3
*35.130.01	*Artemisia nova*	
*35.130.03	*Artemisia nova - Ambrosia salsola*	
*35.130.02	*Artemisia nova - Echinocereus engelmannii*	
*35.140.00	***Artemisia rothrockii*** **(Rothrock's sagebrush) Alliance**	G3 S3
*35.140.02	*Artemisia rothrockii / Monardella odoratissima*	
*35.140.01	*Artemisia rothrockii / Penstemon heterodoxus*	
35.110.00	***Artemisia tridentata*** **(Big sagebrush) Alliance**	G5 S5
35.110.02	*Artemisia tridentata*	
35.110.11	*Artemisia tridentata - Artemisia nova*	
35.110.12	*Artemisia tridentata - Chrysothamnus viscidiflorus*	
35.110.05	*Artemisia tridentata - Coleogyne ramosissima*	
35.110.06	*Artemisia tridentata - Encelia virginensis*	
35.110.13	*Artemisia tridentata - Ephedra nevadensis*	
35.110.01	*Artemisia tridentata - Ericameria nauseosa*	
35.110.14	*Artemisia tridentata - Ericameria teretifolia*	
35.110.09	*Artemisia tridentata - Eriogonum fasciculatum*	
35.110.10	*Artemisia tridentata - Eriogonum wrightii*	
35.110.07	*Artemisia tridentata - Purshia tridentata*	
35.110.15	*Artemisia tridentata - Purshia tridentata / Hesperostipa comata*	
35.110.04	*Artemisia tridentata - Symphoricarpos longiflorus*	
35.111.00	***Artemisia tridentata ssp. vaseyana*** **(Mountain big sagebrush) Alliance**	G5 S5
35.111.02	*Artemisia tridentata ssp. vaseyana*	
35.111.03	*Artemisia tridentata ssp. vaseyana - Purshia tridentata / Festuca idahoensis*	
35.111.01	*Artemisia tridentata ssp. vaseyana / Carex exserta*	
35.111.04	*Artemisia tridentata ssp. vaseyana / Monardella odoratissima*	
36.310.00	***Atriplex canescens*** **(Fourwing saltbush scrub) Alliance**	G5 S4
36.310.01	*Atriplex canescens*	
36.310.02	*Atriplex canescens - Krascheninnikovia lanata*	

36.320.00	***Atriplex confertifolia* (Shadscale scrub) Alliance**	G5 S4
36.320.10	*Atriplex confertifolia*	
36.320.09	*Atriplex confertifolia - Grayia spinosa - Encelia virginensis var. actoni*	
36.320.03	*Atriplex confertifolia - Ambrosia dumosa*	
36.320.06	*Atriplex confertifolia - Atriplex canescens*	
36.320.04	*Atriplex confertifolia - Coleogyne ramosissima*	
36.320.02	*Atriplex confertifolia - Ephedra nevadensis*	
36.320.05	*Atriplex confertifolia - Gutierrezia microcephala - Tetradymia axillaris*	
36.320.08	*Atriplex confertifolia - Krascheninnikovia lanata*	
36.320.07	*Atriplex confertifolia - Lycium andersonii*	
36.320.11	*Atriplex confertifolia / cryptogramic crust*	
36.330.00	***Atriplex hymenelytra* (Desert holly scrub) Alliance**	G5 S4
36.330.01	*Atriplex hymenelytra*	
36.330.02	*Atriplex hymenelytra - Ambrosia dumosa*	
36.330.06	*Atriplex hymenelytra - Encelia farinosa*	
36.330.03	*Atriplex hymenelytra - Larrea tridentata - Ambrosia dumosa*	
36.330.04	*Atriplex hymenelytra - Tidestromea oblongifolia*	
36.330.05	*Atriplex hymenelytra / rock*	
36.370.00	***Atriplex lentiformis* (Quailbush scrub) Alliance**	G4 S4
36.370.01	*Atriplex lentiformis*	
36.340.00	***Atriplex polycarpa* (Allscale scrub) Alliance**	G5 S4
36.340.04	*Atriplex polycarpa*	
36.340.01	*Atriplex polycarpa - Atriplex confertifolia*	
36.340.05	*Atriplex polycarpa sparse playa*	
*36.350.00	***Atriplex spinifera* (Spinescale scrub) Alliance**	G3 S3
*36.350.01	*Atriplex spinifera*	
*36.350.03	*Atriplex spinifera - Picrothamnus desertorum*	
*36.350.02	*Atriplex spinifera / annual herb*	
*63.520.00	***Baccharis emoryi* (Emory’s baccharis thickets) Provisional Alliance**	G3 S2?
32.060.00	***Baccharis pilularis* (Coyote brush scrub) Alliance**	G5 S5 (some associations are of high priority for inventory)
32.060.23	*Baccharis pilularis*	
32.060.06	*Baccharis pilularis - Lupinus arboreus*	
32.060.05	*Baccharis pilularis - Artemisia californica*	
32.060.19	*Baccharis pilularis - Artemisia californica - Heteromeles arbutifolia*	
32.060.18	*Baccharis pilularis - Artemisia californica - Toxicodendron / Monardella villosa*	
32.060.14	*Baccharis pilularis - Ceanothus thyrsiflorus*	
32.060.25	*Baccharis pilularis - Corylus cornuta*	
32.060.16	*Baccharis pilularis - Frangula californica - Rubus parviflorus*	
*32.060.12	*Baccharis pilularis - Holodiscus discolor*	
32.060.29	*Baccharis pilularis - Lotus scoparius*	
32.060.26	*Baccharis pilularis - Prunus ilicifolia*	
32.060.15	*Baccharis pilularis - Rubus ursinus / weedy herb*	
32.060.27	*Baccharis pilularis - Salvia mellifera*	
32.060.17	*Baccharis pilularis - Toxicodendron diversilobum*	
32.060.07	*Baccharis pilularis / Ammophila arenaria*	
32.060.20	*Baccharis pilularis / Annual Grass - Herb*	
*32.060.13	*Baccharis pilularis / Carex obnupta - Juncus patens*	
*32.060.11	*Baccharis pilularis / Danthonia californica*	
*32.060.02	*Baccharis pilularis / Deschampsia caespitosa*	
32.060.24	*Baccharis pilularis / Dudleya farinosa*	
*32.060.01	*Baccharis pilularis / Eriophyllum staechadifolium*	
*32.060.03	*Baccharis pilularis / Leymus triticoides*	
*32.060.10	*Baccharis pilularis / Nassella pulchra*	
32.060.21	*Baccharis pilularis / Native Grass (Mixed)*	

*32.060.04	*Baccharis pilularis / Polystichum munitum*	
32.060.08	*Baccharis pilularis / Scrophularia californica*	
32.060.28	*Gaultheria shallon - Baccharis pilularis - Ceanothus thyrsiflorus*	
63.510.00	***Baccharis salicifolia*** **(Mulefat thickets) Alliance**	G5 S4
63.510.01	*Baccharis salicifolia*	
63.510.05	*Baccharis salicifolia - Arundo donax*	
63.510.02	*Baccharis salicifolia - Lepidospartum squamatum - Hazardia squarrosa*	
63.510.06	*Baccharis salicifolia - Pluchea sericea*	
63.510.03	*Baccharis salicifolia - Sambucus mexicana*	
63.510.07	*Baccharis salicifolia - Tamarix ramosissima*	
63.510.04	*Baccharis salicifolia / Stachys albens*	
*63.530.00	***Baccharis sergiloides*** **(Broom baccharis thickets) Alliance**	G4 S3
*63.530.01	*Baccharis sergiloides - Prunus fasciculata*	
*63.530.02	*Baccharis sergiloides - Prunus fasciculata - Rhus trilobata*	
*63.530.03	*Baccharis sergiloides / Muhlenbergia rigens*	
*63.620.00	***Betula glandulosa*** **(Resin birch thickets) Provisional Alliance**	G5 S2?
*63.610.00	***Betula occidentalis*** **(Water birch thicket) Alliance**	G4 S2
*63.610.01	*Betula occidentalis / Salix spp.*	
32.180.00	***Broom (Cytisus scoparius and Others)*** **(Broom patches) Semi-natural Stands**	
32.180.01	*Genista monspessulana*	
*32.180.02	*Spartium junceum*	
*91.126.00	***Cassiope mertensiana*** **(White mountain heather heath) Provisional Alliance**	G5 S3?
*33.110.00	***Castela emoryi*** **(Crucifixion thorn stands) Special Stands**	G2 S1
37.209.00	***Ceanothus cordulatus*** **(Mountain white thorn chaparral) Alliance**	G4 S4
37.209.01	*Ceanothus cordulatus*	
37.208.00	***Ceanothus crassifolius*** **(Hoary leaf ceanothus chaparral) Alliance**	G4 S4
37.208.01	*Ceanothus crassifolius*	
37.208.02	*Ceanothus crassifolius - Adenostoma fasciculatum*	
37.208.04	*Ceanothus crassifolius - Adenostoma fasciculatum - Rhus ovata*	
37.208.05	*Ceanothus crassifolius - Adenostoma fasciculatum - Salvia mellifera*	
37.208.03	*Ceanothus crassifolius - Adenostoma fasciculatum - Malosma Laurina*	
37.208.06	*Ceanothus crassifolius - Adenostoma fasciculatum - Xylococcus bicolor*	
37.208.07	*Ceanothus crassifolius - Cercocarpus montanus*	
37.208.08	*Ceanothus crassifolius - Malosma laurina*	
37.211.00	***Ceanothus cuneatus*** **(Wedge leaf ceanothus chaparral, Buck brush chaparral) Alliance**	G4 S4
37.211.01	*Ceanothus cuneatus*	
37.211.06	*Ceanothus cuneatus - Adenostoma fasciculatum*	
37.211.10	*Ceanothus cuneatus - Adenostoma fasciculatum - Salvia mellifera - Malosma laurina*	
37.211.08	*Ceanothus cuneatus - Eriodictyon californicum - (Fremontodendron californicum)*	
37.211.09	*Ceanothus cuneatus - Frangula californica - Arctostaphylos pungens*	
37.211.02	*Ceanothus cuneatus / Calocedrus decurrens*	
37.211.03	*Ceanothus cuneatus / Elymus elymoides*	
37.211.11	*Ceanothus cuneatus / Eriophyllum lanatum*	
*37.211.05	*Ceanothus cuneatus / Plantago erecta*	
*37.212.00	***Ceanothus greggii*** **(Cup leaf ceanothus chaparral) Alliance**	G4 S3
*37.212.01	*Ceanothus greggii*	
*37.212.03	*Ceanothus greggii - Adenostoma fasciculatum*	

37.206.00	***Ceanothus integerrimus* (Deer brush chaparral) Alliance**	G4 S4 (some associations are of high priority for inventory)
37.206.01	*Ceanothus integerrimus*	
37.206.04	*Ceanothus integerrimus - Arctostaphylos viscida*	
*37.206.05	*Ceanothus integerrimus - Quercus garryana var. fruticosa*	
37.206.03	*Ceanothus integerrimus / Lithocarpus densiflorus - Arbutus menziesii*	
37.206.02	*Ceanothus integerrimus / Quercus chrysolepis / Elymus glaucus*	
37.205.00	***Ceanothus leucodermis* (Chaparral white thorn chaparral) Alliance**	G4 S4
37.205.01	*Ceanothus leucodermis*	
37.205.02	*Ceanothus leucodermis / Toxicodendron diversilobum*	
37.201.00	***Ceanothus megacarpus* (Big pod ceanothus chaparral) Alliance**	G4 S4
37.201.01	*Ceanothus megacarpus*	
37.201.02	*Ceanothus megacarpus - Adenostoma fasciculatum*	
37.201.04	*Ceanothus megacarpus - Adenostoma sparsifolium*	
37.201.05	*Ceanothus megacarpus - Cercocarpus montanus*	
37.201.06	*Ceanothus megacarpus - Malosma laurina*	
37.201.09	*Ceanothus megacarpus - Prunus ilicifolia*	
37.203.01	*Ceanothus megacarpus - Rhamnus ilicifolia*	
37.201.08	*Ceanothus megacarpus - Salvia mellifera*	
*37.207.00	***Ceanothus oliganthus* (Hairy leaf ceanothus chaparral) Alliance**	G3 S3
*37.207.01	*Ceanothus oliganthus*	
*37.207.02	*Ceanothus oliganthus - Adenostoma fasciculatum*	
*37.207.03	*Ceanothus oliganthus - Adenostoma fasciculatum - Xylococcus bicolor*	
*37.207.04	*Ceanothus oliganthus - Adenostoma sparsifolium*	
*37.207.05	*Ceanothus oliganthus - Arctostaphylos glandulosa*	
*37.207.06	*Ceanothus oliganthus - Eriodictyon crassifolium*	
*37.207.07	*Ceanothus oliganthus - Heteromeles arbutifolia - Rhus ovata*	
*37.207.08	*Ceanothus oliganthus - Quercus berberidifolia*	
*37.215.00	***Ceanothus papillosus* (Wart leaf ceanothus chaparral) Alliance**	G3 S3
*37.215.01	*Ceanothus papillosus - Adenostoma fasciculata*	
37.214.00	***Ceanothus spinosus* (Greenbark ceanothus chaparral) Alliance**	G4 S4
37.214.01	*Ceanothus spinosus*	
37.214.02	*Ceanothus spinosus - Ceanothus megacarpus*	
37.204.00	***Ceanothus thyrsiflorus* (Blue blossom chaparral) Alliance**	G4 S4
37.204.01	*Ceanothus thyrsiflorus - Baccharis pilularis - Toxicodendron diversilobum*	
37.204.02	*Ceanothus thyrsiflorus - Rubus ursinus*	
37.204.03	*Ceanothus thyrsiflorus - Vaccinium ovatum - Rubus parviflorus*	
37.210.00	***Ceanothus velutinus* (Tobacco brush or snow bush chaparral) Alliance**	G5 S4
37.210.01	*Ceanothus velutinus*	
37.210.02	*Ceanothus velutinus - Prunus emarginata - Artemisia tridentata*	
*37.216.00	***Ceanothus verrucosus* (Wart-stemmed ceanothus chaparral) Provisional Alliance**	G2 S2
*63.300.00	***Cephalanthus occidentalis* (Button willow thickets) Alliance**	G5 S2
*63.300.01	*Cephalanthus occidentalis*	
*76.300.00	***Cercocarpus intricatus* (Small leaf mountain mahogany scrub) Provisional Alliance**	G4 S3?
*76.300.01	*Cerocarpus intricatus*	
76.200.00	***Cercocarpus ledifolius* (Curl leaf mountain mahogany scrub) Alliance**	G5 S4
76.200.03	*Cercocarpus ledifolius*	
76.200.01	*Cercocarpus ledifolius - Artemisia tridentata*	
76.200.02	*Cercocarpus ledifolius / Symphoricarpos rotundifolia*	

76.100.00	***Cercocarpus montanus* (Birch leaf mountain mahogany chaparral) Alliance**	G5 S4
76.100.06	*Cercocarpus montanus - Adenostoma fasciculatum*	
76.100.17	*Cercocarpus montanus - Adenostoma fasciculatum - Diplacus aurantiacus*	
76.100.04	*Cercocarpus montanus - Arctostaphylos glauca*	
76.100.16	*Cercocarpus montanus - Ceanothus cuneatus*	
76.100.15	*Cercocarpus montanus - Ceanothus cuneatus - Fraxinus dipetala*	
76.100.09	*Cercocarpus montanus - Ceanothus cuneatus - Quercus john-tuckeri*	
76.100.05	*Cercocarpus montanus - Ceanothus spinosus*	
37.600.01	*Cercocarpus montanus - Eriogonum fasciculatum*	
37.600.02	*Cercocarpus montanus - Eriogonum fasciculatum - Eriogonum wrightii*	
76.100.10	*Cercocarpus montanus - Fremontodendron californicum*	
76.100.11	*Cercocarpus montanus - Juniperus californica*	
76.100.12	*Cercocarpus montanus - Malosma laurina - Artemisia californica*	
76.100.14	*Cercocarpus montanus - Prunus ilicifolia*	
76.100.13	*Cercocarpus montanus - Prunus ilicifolia - Adenostoma sparsifolium*	
76.100.03	*Cercocarpus montanus var. glaber*	
37.610.01	*Cercocarpus montanus var. macrourus*	
37.610.02	*Cercocarpus montanus var. minutiflorus*	
*37.417.00	***Chrysolepis chrysophylla* (Golden chinquapin thickets) Alliance**	G2 S2
*37.417.02	*Chrysolepis chrysophylla - Arctostaphylos glandulosa*	
*37.417.01	*Chrysolepis chrysophylla / Vaccinium ovatum*	
*37.700.00	***Chrysolepis sempervirens* (Bush chinquapin chaparral) Alliance**	G4 S3
*37.700.01	*Chrysolepis sempervirens*	
33.020.00	***Coleogyne ramosissima* (Black brush scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
*33.020.01	*Coleogyne ramosissima*	
33.020.02	*Coleogyne ramosissima - Atriplex confertifolia*	
33.020.10	*Coleogyne ramosissima - Atriplex hymenelytra - Tetradymia axillaris*	
33.020.03	*Coleogyne ramosissima - Ephedra nevadensis*	
33.020.05	*Coleogyne ramosissima - Eriogonum fasciculatum*	
33.020.06	*Coleogyne ramosissima - Eriogonum fasciculatum - Larrea tridentata*	
33.020.11	*Coleogyne ramosissima - Grayia spinosa*	
33.020.12	*Coleogyne ramosissima - Guiterrezia microcephala*	
33.020.07	*Coleogyne ramosissima - Larrea tridentata - Ambrosia dumosa*	
33.020.08	*Coleogyne ramosissima - Lycium andersonii*	
33.020.09	*Coleogyne ramosissima - Salazaria mexicana*	
*43.100.00	***Coreopsis gigantea* (Giant coreopsis scrub) Alliance**	G3 S3?
*43.100.01	*Coreopsis gigantea - Artemisia californica - Eriogonum cinereum*	
*43.100.02	*Coreopsis gigantea - Ericameria ericoides - Encelia californica*	
*80.100.00	***Cornus sericea* (Red osier thickets) Alliance**	G4 S3?
*80.100.02	*Cornus sericea*	
*80.100.03	*Cornus sericea - Salix exigua*	
*80.100.04	*Cornus sericea - Salix lasiolepis*	
*80.100.01	*Cornus sericea / Senecio triangularis*	
*37.950.00	***Corylus cornuta var. californica* (Hazelnut scrub) Alliance**	G3 S2?
*37.950.01	*Corylus cornuta / Polystichum munitum*	
*33.050.00	***Cylindropuntia bigelovii* (Teddy bear cholla patches) Alliance**	G4 S3
*33.050.01	*Cylindropuntia bigelovii*	
*38.110.00	***Dasiphora fruticosa* (Shrubby cinquefoil scrub) Alliance**	G5 S3?
*38.110.01	*Dasiphora fruticosa*	
*38.110.02	*Dasiphora fruticosa / Danthonia intermedia*	
*38.110.04	*Dasiphora fruticosa / Danthonia unispicata*	
*38.110.03	*Dasiphora fruticosa / Potentilla breweri*	

*38.110.05	*Dasiphora fruticosa / Veratrum californicum*	
*43.110.00	***Deinandra clementina - Eriogonum giganteum* (Island buckwheat - Island tar plant scrub) Provisional Alliance**	G3? S3?
37.750.00	***Dendromecon rigida* (Bush poppy scrub) Alliance**	G4 S4
37.750.01	*Dendromecon rigida*	
*32.082.00	***Diplacus aurantiacus* (Bush monkeyflower scrub) Alliance**	G3 S3?
*32.082.01	*Diplacus aurantiacus*	
*32.050.00	***Encelia californica* (California brittle bush scrub) Alliance**	G4 S3
*32.050.02	*Encelia californica*	
*32.050.01	*Encelia californica - Artemisia californica*	
*32.050.03	*Encelia californica - Artemisia californica - Salvia mellifera - Baccharis pilularis*	
*32.050.04	*Encelia californica - Eriogonum cinereum*	
*32.050.05	*Encelia californica - Malosma laurina - Salvia mellifera*	
*32.050.06	*Encelia californica - Rhus integrifolia*	
33.030.00	***Encelia farinosa* (Brittle bush scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
33.030.05	*Encelia farinosa - coastal sage scrub*	
33.030.01	*Encelia farinosa - warm desert*	
33.030.07	*Encelia farinosa - Ambrosia dumosa - Fouquieria splendens*	
33.030.08	*Encelia farinosa - Ambrosia dumosa - Salvia greatae*	
33.030.09	*Encelia farinosa - Ambrosia dumosa - Senna armata*	
33.030.04	*Encelia farinosa - Artemisia californica*	
*33.030.03	*Encelia farinosa - Eriogonum fasciculatum - Agave deserti*	
33.030.06	*Encelia farinosa - Mirabilis californica*	
*33.030.02	*Encelia farinosa - Peucephyllum schottii*	
*33.025.00	***Encelia virginensis* (Virgin River brittle brush scrub) Alliance**	G4 S3
*33.025.01	*Encelia virginensis*	
*33.025.02	*Encelia virginensis - Salvia dorrii*	
*33.270.00	***Ephedra californica* (California joint fir scrub) Alliance**	G3 S3
*33.270.01	*Ephedra californica*	
*33.270.02	*Ephedra californica - Ambrosia salsola*	
*33.270.04	*Ephedra californica - Gutierrezia californica / Eriastrum pluriflorum*	
*33.270.03	*Ephedra californica / annual - perennial herb*	
*33.275.00	***Ephedra funerea* (Death Valley joint fir scrub) Provisional Alliance**	G3? S2?
33.280.00	***Ephedra nevadensis* (Nevada joint fir scrub) Alliance**	G4 S4
33.280.01	*Ephedra nevadensis*	
33.280.02	*Ephedra nevadensis - Atriplex confertifolia*	
33.280.05	*Ephedra nevadensis - Ericameria cooperi*	
33.280.04	*Ephedra nevadensis - Lycium andersonii*	
33.280.03	*Ephedra nevadensis - Salazaria mexicana*	
33.285.00	***Ephedra viridis* (Mormon tea scrub) Alliance**	G4 S4
33.285.01	*Ephedra viridis - Artemisia tridentata*	
*38.125.00	***Ericameria linearifolia* (Narrowleaf goldenbush scrub) Provisional Alliance**	G3 S3?
35.310.00	***Ericameria nauseosa* (Rubber rabbitbrush scrub) Alliance**	G5 S5
35.310.01	*Ericameria nauseosa - Juniperus californica / annual to perennial herb*	
35.310.02	*Ericameria nauseosa / Sporobolus airoides*	
*38.130.00	***Ericameria palmeri* (Palmer’s goldenbush scrub) Provisional Alliance**	G3 S3?

*35.340.00	***Ericameria paniculata* (Black-stem rabbitbrush scrub) Alliance**	G4 S3
*35.340.01	*Ericameria paniculata*	
*35.340.03	*Ericameria paniculata - Ambrosia eriocentra*	
*35.340.02	*Ericameria paniculata - Ambrosia salsola*	
*35.320.00	***Ericameria parryi* (Parry's rabbitbrush scrub) Alliance**	G4 S3
*35.320.01	*Ericameria parryi / Gayophytum diffusum*	
35.330.00	***Ericameria teretifolia* (Needleleaf rabbitbrush scrub) Alliance**	G4 S4
35.330.01	*Ericameria teretifolia*	
37.080.00	***Eriodictyon californicum* (California yerba santa scrub) Alliance**	G4 S4
35.080.01	*Eriodictyon californicum / herbaceous*	
*37.090.00	***Eriodictyon crassifolium* (Thick leaf yerba santa scrub) Provisional Alliance**	G3 S3
*32.035.00	***Eriogonum cinereum* (Ashy buckwheat scrub) Alliance**	G3 S3
*32.035.01	*Eriogonum cinereum*	
32.040.00	***Eriogonum fasciculatum* (California buckwheat scrub) Alliance**	G5 S5 (some associations are of high priority for inventory)
32.040.02	*Eriogonum fasciculatum*	
*32.070.01	*Eriogonum fasciculatum - (Lepidospartum squamatum) alluvial fan*	
32.040.05	*Eriogonum fasciculatum - Ambrosia dumosa*	
*32.040.03	*Eriogonum fasciculatum - Artemisia tridentata*	
32.040.08	*Eriogonum fasciculatum - Bebbia juncea*	
32.040.10	*Eriogonum fasciculatum - Cylindropuntia californica*	
32.040.18	*Eriogonum fasciculatum - Encelia farinosa*	
32.040.09	*Eriogonum fasciculatum - Gutierrezia sarothrae*	
32.040.19	*Eriogonum fasciculatum - Lotus scoparius*	
32.040.11	*Eriogonum fasciculatum - Rhus ovata*	
32.040.06	*Eriogonum fasciculatum - Salazaria mexicana*	
32.100.00	***Eriogonum fasciculatum - Salvia apiana* (California buckwheat - white sage scrub) Alliance**	G4 S4 (some associations are of high priority for inventory)
*32.100.01	*Eriogonum fasciculatum - Salvia apiana*	
32.040.17	*Eriogonum fasciculatum - Salvia mellifera*	
32.040.07	*Eriogonum fasciculatum - Salvia mellifera - Malosma laurina*	
32.040.01	*Eriogonum fasciculatum - Scrophularia californica - Phacelia ramosissima*	
32.040.12	*Eriogonum fasciculatum - Simmondsia chinensis - Cylindropuntia californica*	
32.040.16	*Eriogonum fasciculatum var. foliolosum - Hesperoyucca whipplei*	
32.040.13	*Eriogonum fasciculatum var. foliolosum - Juniperus californica*	
32.040.15	*Eriogonum fasciculatum var. polifolium / Eriastrum pluriflorum*	
*32.045.00	***Eriogonum heermannii* (Heermann's buckwheat patches) Provisional Alliance**	G2 S2?
*32.041.00	***Eriogonum wrightii* (Wright's buckwheat patches) Alliance**	G3 S3
*32.041.01	*Eriogonum wrightii - Eriophyllum confertiflorum / Monardella antonina ssp. benitensis*	
*32.041.02	*Eriogonum wrightii - Juniperus californica*	
*32.041.03	*Eriogonum wrightii - Lessingia filaginifolia*	
*61.580.00	***Forestiera pubescens* (Desert olive patches) Alliance**	G3 S2
*61.580.01	*Forestiera pubescens*	
*61.580.02	*Forestiera pubescens - Sambucus nigra*	
37.920.00	***Frangula californica* (California coffee berry scrub) Alliance**	G4 S4 (some associations are of high priority for inventory)
*37.920.04	*Frangula californica spp. tomentella / Hoita macrostachya*	
37.920.02	*Frangula californica ssp. tomentella*	
37.920.03	*Frangula californica ssp. tomentella / Cirsium fontinale var. campylon - Mimulus guttatus*	
*37.920.01	*Frangula californica - Baccharis pilularis / Scrophularia californica*	

*39.040.00	***Garrya elliptica* (Coastal silk tassel scrub) Provisional Alliance**	G3? S3?
*33.180.00	***Grayia spinosa* (Spiny hop sage scrub) Alliance**	G5 S3
*33.180.02	*Grayia spinosa - Atriplex confertifolia*	
*33.180.06	*Grayia spinosa - Ephedra viridis*	
*33.180.03	*Grayia spinosa - Larrea tridentata*	
*33.180.04	*Grayia spinosa - Lycium andersonii*	
*33.180.07	*Grayia spinosa - Picrothamnus desertorum / Achnatherum hymenoides*	
*33.180.05	*Grayia spinosa / Eriogonum ovalifolium*	
*32.042.00	***Gutierrezia californica* (California match weed patches) Provisional Alliance**	G3? S3?
*32.042.01	*Gutierrezia californica / Annual - perennial grass - herb*	
*32.043.00	***Gutierrezia sarothrae* (Broom snake weed scrub) Provisional Alliance**	G3 S3
*32.055.00	***Hazardia squarrosa* (Sawtooth golden bush scrub) Alliance**	G3 S3
*32.055.02	*Hazardia squarrosa - Artemisia californica*	
*32.055.01	*Hazardia squarrosa / Nassella pulchra - Deinandra fasciculata*	
*37.911.00	***Heteromeles arbutifolia* (Toyon chaparral) Alliance**	G5 S3
*37.911.02	*Heteromeles arbutifolia - Artemisia californica*	
*37.911.03	*Heteromeles arbutifolia - Malosma laurina*	
*37.911.04	*Heteromeles arbutifolia - Quercus berberidifolia - Cercocarpus montanus - Fraxinus dipetala*	
*37.911.01	*Heteromeles arbutifolia / serpentine*	
*39.100.00	***Holodiscus discolor* (Ocean spray brush) Alliance**	G4 S3
*39.100.03	*Holodiscus discolor - Arctostaphylos patula*	
*39.100.04	*Holodiscus discolor - Keckiella corymbosa*	
*39.100.06	*Holodiscus discolor - Sambucus racemosa*	
*39.100.02	*Holodiscus discolor / Achnatherum occidentalis - Eriogonum nudum*	
*39.100.01	*Holodiscus discolor / Mimulus suksdorfii*	
*39.100.05	*Holodiscus discolor / Sedum obsusatum ssp. boreale - Cryptogramma acrostichoides*	
*33.190.00	***Hyptis emoryi* (Desert lavender scrub) Alliance**	G4 S3
*33.190.01	*Hyptis emoryi*	
*33.190.02	*Hyptis emoryi - Psorothamnus schottii*	
32.044.00	***Isocoma menziesii* (Menzies's golden bush scrub) Alliance**	G4? S4? (some associations are of high priority for inventory)
32.044.03	*Isocoma menziesii - Lupinus albifrons*	
*32.044.01	*Isocoma menziesii / Astragalus miguelensis - Atriplex californica - Lasthenia californica*	
32.044.02	*Isocoma menziesii / Distichlis spicata - Paraphalis incurva*	
*33.340.00	***Justicia californica* (Chuparosa patches) Provisional Alliance**	G2 S2?
*45.406.00	***Kalmia microphylla* (Alpine laurel heath) Provisional Alliance**	G4 S3?
*32.065.00	***Keckiella antirrhinoides* (Bush penstemon scrub) Alliance**	G3 S3
*32.065.01	*Keckellia antirrhinoides*	
*32.065.02	*Keckellia antirrhinoides - Artemisia californica*	
*32.065.03	*Keckellia antirhinoides - Eriogonum fasciculatum*	
*32.065.04	*Keckiella antirrhinoides - Mixed Chaparral*	
*33.100.00	***Koeberlinia spinosa* (Crown-of-thorns stands) Special Stands**	G2 S1
*36.500.00	***Krascheninnikovia lanata* (Winterfat scrubland) Alliance**	G4 S2
*36.500.01	*Krascheninnikovia lanata*	

33.010.00	***Larrea tridentata* (Creosote bush scrub) Alliance**	G5 S5 (some associations are of high priority for inventory)
33.140.04	*Larrea tridentata*	
33.010.08	*Larrea tridentata - Ambrosia salsola*	
33.010.17	*Larrea tridentata - Atriplex confertifolia*	
33.010.16	*Larrea tridentata - Atriplex hymenelytra*	
33.010.12	*Larrea tridentata - Atriplex polycarpa*	
33.010.10	*Larrea tridentata - Ephedra nevadensis*	
*33.010.07	*Larrea tridentata - Krameria grayi - Pleuraphis rigida*	
*33.010.13	*Larrea tridentata - Pleuraphis rigida*	
*33.010.14	*Larrea tridentata - Pleuraphis rigida - Lycium andersonii*	
33.010.19	*Larrea tridentata / cryptogamic crust*	
33.010.09	*Larrea tridentata / Eriogonum inflatum*	
33.010.06	*Larrea tridentata / wash*	

33.140.00	***Larrea tridentata - Ambrosia dumosa* (Creosote bush - white burr sage scrub) Alliance**	G5 S5 (some associations are of high priority for inventory)
33.140.42	*Larrea tridentata - Ambrosia dumosa*	
33.140.09	*Larrea tridentata - Ambrosia dumosa - / Atriplex hymenelytra*	
33.140.40	*Larrea tridentata - Ambrosia dumosa - Amphipappus fremontii*	
33.140.37	*Larrea tridentata - Ambrosia dumosa - Atriplex canescens*	
33.140.39	*Larrea tridentata - Ambrosia dumosa - Atriplex confertifolia*	
33.140.45	*Larrea tridentata - Ambrosia dumosa - Atriplex confertifolia - Psorothamnus arborescens*	
33.140.38	*Larrea tridentata - Ambrosia dumosa - Atriplex polycarpa*	
33.140.36	*Larrea tridentata - Ambrosia dumosa - Bebbia juncea*	
33.140.46	*Larrea tridentata - Ambrosia dumosa - Cylindropuntia acanthocarpa*	
33.140.18	*Larrea tridentata - Ambrosia dumosa - Cylindropuntia ramosissima*	
*33.140.33	*Larrea tridentata - Ambrosia dumosa - Echinocactus polycephalus*	
33.140.32	*Larrea tridentata - Ambrosia dumosa - Encelia farinosa*	
*33.140.31	*Larrea tridentata - Ambrosia dumosa - Encelia virginensis*	
*33.140.30	*Larrea tridentata - Ambrosia dumosa - Ephedra californica*	
*33.140.29	*Larrea tridentata - Ambrosia dumosa - Ephedra funerea*	
33.140.20	*Larrea tridentata - Ambrosia dumosa - Ephedra nevadensis*	
33.140.47	*Larrea tridentata - Ambrosia dumosa - Ephedra viridis*	
33.140.48	*Larrea tridentata - Ambrosia dumosa - Ericameria cooperi*	
33.140.28	*Larrea tridentata - Ambrosia dumosa - Eriogonum fasciculatum*	
33.140.27	*Larrea tridentata - Ambrosia dumosa - Eriogonum inflatum*	
33.140.44	*Larrea tridentata - Ambrosia dumosa - Fouquieria splendens*	
*33.140.10	*Larrea tridentata - Ambrosia dumosa - Galium angustifolium - Lyrocarpa coulteri*	
33.140.26	*Larrea tridentata - Ambrosia dumosa - Grayia spinosa*	
33.140.25	*Larrea tridentata - Ambrosia dumosa - Gutierrezia sarothrae*	
33.140.23	*Larrea tridentata - Ambrosia dumosa - Krameria erecta*	
33.140.22	*Larrea tridentata - Ambrosia dumosa - Krameria grayii*	
33.140.21	*Larrea tridentata - Ambrosia dumosa - Lepidium fremontii*	
33.140.19	*Larrea tridentata - Ambrosia dumosa - Lycium andersonii*	
33.140.49	*Larrea tridentata - Ambrosia dumosa - Olneya tesota*	
33.140.43	*Larrea tridentata - Ambrosia dumosa - Opuntia basilaris*	
*33.140.24	*Larrea tridentata - Ambrosia dumosa - Petalonyx thurberi*	
*33.140.17	*Larrea tridentata - Ambrosia dumosa - Pleuraphis rigida*	
33.140.15	*Larrea tridentata - Ambrosia dumosa - Psorothamnus arborescens*	
*33.140.08	*Larrea tridentata - Ambrosia dumosa - Psorothamnus emoryi - sandy*	
33.140.16	*Larrea tridentata - Ambrosia dumosa - Psorothamnus fremontii*	
*33.140.07	*Larrea tridentata - Ambrosia dumosa - Psorothamnus schottii*	
33.140.50	*Larrea tridentata - Ambrosia dumosa - Psorothamnus spinosus*	
33.140.14	*Larrea tridentata - Ambrosia dumosa - Salazaria mexicana*	
33.140.13	*Larrea tridentata - Ambrosia dumosa - Senna armata*	
33.140.12	*Larrea tridentata - Ambrosia dumosa - Viguiera parishii*	
33.140.11	*Larrea tridentata - Ambrosia dumosa - Yucca schidigera*	
*33.140.35	*Larrea tridentata - Ambrosia dumosa / Crytogrammic crust*	
*33.140.34	*Larrea tridentata - Ambrosia dumosa / Dalea mollissima*	

33.027.00	***Larrea tridentata - Encelia farinosa*** **(Creosote bush - brittle bush scrub) Alliance**	G5 S4
33.027.05	*Larrea tridentata - Encelia farinosa*	
33.027.03	*Larrea tridentata - Encelia farinosa - Ambrosia dumosa*	
33.027.02	*Larrea tridentata - Encelia farinosa - Bebbia juncea*	
33.027.04	*Larrea tridentata - Encelia farinosa - Fouquieria splendens*	
33.027.06	*Larrea tridentata - Encelia farinosa - Peucephyllum schottii*	
33.027.07	*Larrea tridentata - Encelia farinosa - Pleurocoronis pluriseta*	
*32.070.00	***Lepidospartum squamatum*** **(Scale broom scrub) Alliance**	G3 S3
*32.070.09	*Lepidospartum squamatum - Artemisia californica*	
*32.070.04	*Lepidospartum squamatum - Atriplex canescens*	
*32.070.05	*Lepidospartum squamatum - Baccharis salicifolia*	
*32.070.02	*Lepidospartum squamatum - Eriodictyon crassifolium - Hesperoyucca whipplei*	
*32.070.08	*Lepidospartum squamatum - Eriodictyon trichocalyx - Hesperoyucca whipplei*	
*32.070.06	*Lepidospartum squamatum - Eriogonum fasciculatum*	
*32.070.07	*Lepidospartum squamatum / Amsinckia menziesii*	
*32.070.03	*Lepidospartum squamatum / ephemeral annuals*	
*73.110.00	***Lithocarpus densiflorus var. echinoides*** **(Shrub tanoak chaparral) Alliance**	G3 S3
*73.110.01	*Lithocarpus densiflorus var. echinoides / Arctostaphylos nevadensis*	
*73.110.02	*Lithocarpus densiflorus var. echinoides / Pteridium aquilinum*	
52.240.00	***Lotus scoparius*** **(Deer weed scrub) Alliance**	G5 S5
52.240.01	*Lotus scoparius*	
32.081.00	***Lupinus albifrons*** **(Silver bush lupine scrub) Alliance**	G4 S4
32.081.01	*Lupinus albifrons*	
32.081.03	*Lupinus albifrons - Senecio flaccidus var. douglasii*	
32.081.02	*Lupinus albifrons coastal*	
32.080.00	***Lupinus arboreus*** **(Yellow bush lupine scrub) Alliance**	G4 S4 (within native range), some associations are of high priority for inventory
32.080.02	*Lupinus arboreus*	
*32.080.03	*Lupinus arboreus - Ericameria ericoides*	
32.080.04	*Lupinus arboreus / Anthoxanthum odoratum*	
32.080.01	*Lupinus arboreus / Bromus diandrus*	
32.080.05	*Lupinus arboreus / Scrophularia californica*	
*32.160.00	***Lupinus chamissonis - Ericameria ericoides*** **(Silver dune lupine - mock heather scrub) Alliance**	G3 S3
*32.160.01	*Ericameria ericoides*	
*32.160.02	*Lupinus chamissonis*	
*32.160.03	*Lupinus chamissonis - Ericameria ericoides*	
*33.360.00	***Lycium andersonii*** **(Anderson's boxthorn scrub) Alliance**	G4 S3
*33.360.02	*Lycium andersonii*	
*33.360.01	*Lycium andersonii - Simmondsia chinensis - Pleuraphis rigida*	
*33.365.00	***Lycium californicum*** **(California desert-thorn) Provisional Alliance**	G2? S2?
45.450.00	***Malacothamnus fasciculatus*** **(Bush mallow scrub) Alliance**	G4 S4
45.450.01	*Malacothamnus fasciculatus*	
45.450.02	*Malacothamnus fasciculatus - Ceanothus megacarpus*	
45.450.03	*Malacothamnus fasciculatus - Ceanothus spinosus*	
45.450.04	*Malacothamnus fasciculatus - Malosma laurina*	
45.450.05	*Malacothamnus fasciculatus - Salvia leucophylla*	
45.450.06	*Malacothamnus fasciculatus - Salvia mellifera*	

45.455.00	***Malosma laurina* (Laurel sumac scrub) Alliance**	G4 S4
45.455.01	*Malosma laurina*	
45.455.03	*Malosma laurina - Eriogonum cinereum*	
45.455.04	*Malosma laurina - Eriogonum fasciculatum*	
45.455.06	*Malosma laurina - Eriogonum fasciculatum - Salvia apiana*	
45.455.07	*Malosma laurina - Eriogonum fasciculatum - Salvia mellifera*	
45.455.08	*Malosma laurina - Rhus ovata - Ceanothus megacarpus*	
45.455.09	*Malosma laurina - Salvia mellifera*	
45.455.10	*Malosma laurina - Tetracoccus dioicus*	
*33.290.00	***Menodora spinescens* (Spiny menodora scrub) Alliance**	G4 S3
*33.290.01	*Menodora spinescens - Atriplex confertifolia*	
*33.290.02	*Menodora spinescens - Ephedra nevadensis*	
*37.930.00	***Morella californica* (Wax myrtle scrub) Alliance**	G3 S3
*37.930.01	*Morella californica*	
*33.080.00	***Nolina (bigelovii, parryi)* (Nolina scrub) Alliance**	G3 S2
*33.080.02	*Nolina bigelovii*	
*33.080.01	*Nolina parryi*	
*32.150.00	***Opuntia littoralis* (Coast prickly pear scrub) Alliance**	G4 S3
*32.150.01	*Opuntia littoralis - Eriogonum fasciculatum - Malosma laurina*	
*32.150.02	*Opuntia littoralis - mixed coastal sage scrub*	
*33.150.00	***Parkinsonia microphylla* (Foothill palo verde desert scrub) Alliance**	G4 S1
45.402.00	***Phyllodoce breweri* (Mountain heather mats) Alliance**	G4 S4?
45.402.02	*Phyllodoce breweri - Cassiope mertensiana - Juncus parryi*	
45.402.01	*Phyllodoce breweri - Juncus parryi*	
45.405.01	*Phyllodoce breweri - Vaccinium caespitosum*	
*45.404.00	***Phyllodoce empetriformis* (Mountain heather mats) Provisional Alliance**	G5 S2?
*63.710.00	***Pluchea sericea* (Arrow weed thickets) Alliance**	G3 S3
*63.710.01	*Pluchea sericea*	
*63.710.02	*Pluchea sericea - Allenrolfea occidentalis*	
*63.710.03	*Pluchea sericea - Atriplex canescens*	
37.900.00	***Prunus emarginata* (Bitter cherry thickets) Provisional Alliance**	G4 S4
*33.300.00	***Prunus fasciculata* (Desert almond scrub) Alliance**	G4 S3
*33.300.01	*Prunus fasciculata*	
*33.300.06	*Prunus fasciculata - (Viguiera reticulata - Mortonia utahensis) limestone*	
*33.300.05	*Prunus fasciculata - Ambrosia eriocentra*	
*33.300.04	*Prunus fasciculata - Purshia stansburiana*	
*33.300.03	*Prunus fasciculata - Rhus trilobata*	
*33.300.02	*Prunus fasciculata - Salazaria mexicana*	
*33.220.00	***Prunus fremontii* (Desert apricot scrub) Alliance**	G4 S3
*33.220.01	*Prunus fremontii*	
*37.910.00	***Prunus ilicifolia* (Holly leaf cherry chaparral) Alliance**	G3 S3 (some associations are of high priority for inventory)
*37.910.03	*Prunus ilicifolia ssp. ilicifolia*	
*37.910.05	*Prunus ilicifolia ssp. ilicifolia - Ceanothus cuneatus*	
*37.910.06	*Prunus ilicifolia ssp. ilicifolia - Fraxinus dipetala*	
*37.910.02	*Prunus ilicifolia ssp. ilicifolia - Heteromeles arbutifolia*	
*37.910.07	*Prunus ilicifolia ssp. ilicifolia - Toxicodendron diversilobum / grass*	
*37.910.01	*Prunus ilicifolia ssp. Ilicifolia / Sanicula crassicaulis*	
*37.910.04	*Prunus ilicifolia ssp. lyonii*	

*37.905.00	***Prunus virginiana* (Choke cherry thickets) Provisional Alliance**	G4 S2?
*33.240.00	***Purshia stansburiana* (Stansbury cliff rose scrub) Alliance**	G3 S3
*33.240.01	*Purshia stansburiana*	
*35.200.00	***Purshia tridentata* (Bitter brush scrub) Alliance**	G4 S3
*35.200.03	*Purshia tridentata - Artemisia tridentata - Symphoricarpos rotundifolia*	
*35.200.01	*Purshia tridentata - Artemisia tridentata - Tetradymia canescens*	
*35.200.02	*Purshia tridentata - Artemisia tridentata / Achnatherum hymenoides*	
*35.200.04	*Purshia tridentata / Achnatherum nelsonii*	
*35.200.05	*Purshia tridentata / Eriogonum umbellatum*	
37.407.00	***Quercus berberidifolia* (Scrub oak chaparral) Alliance**	G4 S4 (some associations are of high priority for inventory)
37.407.02	*Quercus berberidifolia*	
37.406.01	*Quercus berberidifolia - Arctostaphylos glauca*	
37.406.05	*Quercus berberidifolia - Ceanothus cuneatus*	
37.406.02	*Quercus berberidifolia - Ceanothus integerrimus*	
37.407.05	*Quercus berberidifolia - Ceanothus leucodermis*	
*37.406.03	*Quercus berberidifolia - Ceanothus oliganthus*	
37.407.07	*Quercus berberidifolia - Ceanothus spinosus*	
37.406.06	*Quercus berberidifolia - Ceanothus tomentosus*	
37.407.06	*Quercus berberidifolia - Cercocarpus montanus*	
37.407.09	*Quercus berberidifolia - Fraxinus dipetela - Heteromeles arbutifolia*	
37.407.04	*Quercus berberidifolia - Heteromeles arbutifolia*	
37.407.08	*Quercus berberidifolia - southern mixed chaparral*	
37.407.01	*Quercus berberidifolia / Aesculus californica*	
37.409.00	***Quercus berberidifolia - Adenostoma fasciculatum* (Scrub oak - chamise chaparral)**	G4 S4
37.409.03	*Quercus berberidifolia - Adenostoma fasciculatum*	
37.407.03	*Quercus berberidifolia - Adenostoma fasciculatum - Arctostaphylos glandulosa*	
37.409.01	*Quercus berberidifolia - Adenostoma fasciculatum - Ceanothus crassifolius*	
37.409.02	*Quercus berberidifolia - Adenostoma fasciculatum - Ceanothus greggii*	
*37.413.00	***Quercus chrysolepis* (Canyon live oak chaparral) Alliance**	G3 S3
*37.413.01	*Quercus chrysolepis*	
37.415.00	***Quercus cornelius-mulleri* (Muller oak chaparral) Alliance**	G4 S4
37.415.04	*Quercus cornelius-mulleri - Adenostoma sparsifolium - Ceanothus greggii*	
37.415.05	*Quercus cornelius-mulleri - Adenostoma sparsifolium - Cercocapus montanus*	
37.415.03	*Quercus cornelius-mulleri - Cercocapus montanus*	
37.415.02	*Quercus cornelius-mulleri - Eriogonum fasciculatum - Ericameria linearifolia*	
37.415.01	*Quercus cornelius-mulleri - Rhus ovata*	
37.415.06	*Quercus cornelius-mulleri -Coleogyne ramosissima*	
37.405.00	***Quercus durata* (Leather oak chaparral) Alliance**	G4 S4 (some associations are of high priority for inventory)
37.405.02	*Quercus durata*	
37.405.03	*Quercus durata - Adenostoma fasciculatum - Quercus wislizeni*	
*37.405.14	*Quercus durata - Adenostoma fasciculatum / Salvia sonomensis*	
*37.405.01	*Quercus durata - Arctostaphylos glandulosa*	
*37.405.06	*Quercus durata - Arctostaphylos glauca - Artemisia californica / Grass*	
*37.405.07	*Quercus durata - Arctostaphylos glauca - Garrya congdonii / Melica torreyana*	
37.405.04	*Quercus durata - Arctostaphylos glauca / Pinus sabiniana*	
*37.405.08	*Quercus durata - Arctostaphylos pungens / Pinus sabiniana*	
37.405.10	*Quercus durata - Cercocarpus montanus*	
*37.405.12	*Quercus durata - Frangula californica - Arctostaphylos glauca*	
37.405.11	*Quercus durata - Heteromeles arbutifolia - Umbellularia californica*	
*37.405.13	*Quercus durata / Allium falcifolium - Streptanthus batrachopus*	
37.405.09	*Quercus durata / Pinus sabiniana*	

37.411.00	***Quercus garryana* (Brewer oak scrub) *Alliance***	G4 S4
37.411.03	*Quercus garryana shrub*	
37.411.04	*Quercus garryana / Festuca californica*	
37.411.05	*Quercus garryana - Arctostaphylos patula*	
37.411.06	*Quercus garryana - Cercocarpus montanus*	
37.418.00	***Quercus john-tuckeri* (Tucker oak chaparral) Alliance**	G4 S4
37.418.04	*Quercus john-tuckeri*	
37.418.01	*Quercus john-tuckeri - Adenostoma fasciculatum*	
37.418.05	*Quercus john-tuckeri - Juniperus californica - Ericameria linearifolia*	
37.418.02	*Quercus john-tuckeri - Juniperus californica - Fraxinus dipetala*	
37.418.03	*Quercus john-tuckeri - Quercus wislizeni - Garrya flavescens*	
*37.416.00	***Quercus pacifica* (Island scrub oak chaparral) Alliance**	G3 S3
*37.416.01	*Quercus pacifica*	
*37.419.00	***Quercus palmeri* (Palmer oak chaparral) Alliance**	G3 S2?
*37.419.01	*Quercus palmeri - Eriogonum fasciculatum*	
*37.419.02	*Quercus palmeri - Eriogonum wrightii*	
*37.412.00	***Quercus sadleriana* (Sadler oak or deer oak brush fields) Alliance**	G3 S3
*37.412.01	*Quercus sadleriana*	
*71.095.00	***Quercus turbinella* (Sonoran live oak scrub) Alliance**	G4 S1
*71.095.02	*Quercus turbinella - Baccharis sergiloides*	
*71.095.01	*Quercus turbinella / Pinus monophylla*	
37.414.00	***Quercus vacciniifolia* (Huckleberry oak chaparral) Alliance**	G4 S4
37.414.01	*Quercus vacciniifolia*	
37.414.03	*Quercus vacciniifolia - Arctostaphylos patula*	
37.414.02	*Quercus vacciniifolia - Chrysolepis sempervirens*	
37.420.00	***Quercus wislizeni* (Interior live oak chaparral) *Alliance***	G4 S4
37.420.05	*Quercus wislizen - Cercocarpus montanus - Arctostaphylos glandulosa*	
37.420.01	*Quercus wislizeni*	
37.420.02	*Quercus wislizeni - Arctostaphylos glandulosa*	
37.403.01	*Quercus wislizeni - Ceanothus leucodermis*	
37.403.02	*Quercus wislizeni - Ceanothus leucodermis - Arctostaphylos glandulosa*	
37.403.03	*Quercus wislizeni - Ceanothus leucodermis / Pinus coulteri*	
37.420.03	*Quercus wislizeni - Cercocarpus montanus*	
37.420.04	*Quercus wislizeni - Cercocarpus montanus - Adenostoma sparsifolium*	
37.404.01	*Quercus wislizeni - Quercus berberidifolia*	
37.404.02	*Quercus wislizeni - Quercus berberidifolia - Fraxinus dipetala*	
37.402.01	*Quercus wislizeni - Quercus chrysolepis shrub*	
*63.425.00	***Rhododendron neoglandulosum* (Western Labrador-tea thickets) Alliance**	G4 S2?
*63.425.01	*Rhododendron neoglandulosum*	
*63.425.02	*Rhododendron neoglandulosum - Kalmia microphylla / Pinus contorta*	
*63.310.00	***Rhododendron occidentale* (Western azalea patches) Provisional Alliance**	G3 S2?
*37.803.00	***Rhus integrifolia* (Lemonade berry scrub) Alliance**	G3 S3
*37.803.01	*Rhus integrifolia*	
*37.803.02	*Rhus integrifolia - Adenostoma fasciculatum - Artemisia californica*	
*37.803.03	*Rhus integrifolia - Artemisia californica - Eriogonum cinereum*	
*37.803.04	*Rhus integrifolia - Opuntia spp - Eriogonum cinereum*	
*37.803.05	*Rhus integrifolia - Salvia mellifera - Artemisia californica*	

37.801.00	***Rhus ovata* (Sugarbush chaparral) Alliance**		G4 S4 (some associations are of high priority for inventory)
37.801.01	*Rhus ovata*		
37.801.02	*Rhus ovata - Salvia leucophylla - Artemisia californica*		
*37.801.03	*Rhus ovata - Ziziphus parryi*		
*37.802.00	***Rhus trilobata* (Basket bush thickets) Provisional Alliance**		G4 S3?
*37.960.00	***Ribes quercetorum* (Oak gooseberry thickets) Provisional Alliance**		G2 S2?
*63.907.00	***Rosa californica* (California rose briar patches) Alliance**		G3 S3
*63.907.02	*Rosa californica*		
*63.907.01	*Rosa californica - Baccharis pilularis*		
*63.907.03	*Rosa californica / Schoenoplectus spp.*		
*63.320.00	***Rosa woodsii* (Interior rose thickets) Provisional Alliance**		G5 S3
*63.901.00	***Rubus (parviflorus, spectabilis, ursinus)* (Coastal brambles) Alliance**		G4 S3
*63.901.01	*Gaultheria shallon - Rubus spectabiis - Rubus parviflorus*		
*63.901.03	*Rubus parviflorus*		
*63.901.02	*Rubus parviflorus - Rubus spectabilis - Rubus ursinus*		
*63.901.04	*Rubus spectabilis*		
*63.901.05	*Rubus ursinus*		
63.906.00	***Rubus armeniacus* (Himalayan black berry brambles) Semi-natural Stands**		
63.906.01	*Rubus armeniacus*		
63.906.02	*Rubus armeniacus - Rubus ursinus*		
33.310.00	***Salazaria mexicana* (Bladder sage scrub) Alliance**		G4 S4
33.310.01	*Salazaria mexicana*		
33.310.03	*Salazaria mexicana - Ambrosia salsola - Eriogonum fasciculatum*		
33.310.02	*Salazaria mexicana - Viguieria reticulata - Atriplex confertifolia*		
*61.213.00	***Salix bebbiana* (Bebb's willow thickets) Alliance**		G4 S2?
*61.213.01	*Salix bebbiana / mesic forb type*		
*61.215.00	***Salix breweri* (Brewer willow thickets) Alliance**		G2 S2
*61.215.01	*Salix breweri / Muhlenbergia asperifolia*		
*61.112.00	***Salix eastwoodiae* (Sierran willow thickets) Alliance**		G3 S3
*61.112.01	*Salix eastwoodiae*		
*61.112.02	*Salix eastwoodiae / Carex scopulorum*		
*61.112.03	*Salix eastwoodiae / Oreostemma alpigenum*		
*63.160.02	*Salix eastwoodiae / Senecio triangularis*		
61.209.00	***Salix exigua* (Sandbar willow thickets) Alliance**		G5 S4 (some associations are of high priority for inventory)
61.209.01	*Salix exigua*		
61.209.07	*Salix exigua - (Saix lasiolepis) - Rubus discolor*		
61.209.02	*Salix exigua - Arundo donax*		
*61.209.06	*Salix exigua - Brickellia californica*		
61.209.03	*Salix exigua - Salix melanopsis*		
61.209.04	*Salix exigua / Baccharis sergiloides*		
61.209.05	*Salix exigua / Juncus spp.*		
*61.212.00	***Salix geyeriana* (Geyer willow thickets) Alliance**		G4 S2?
*61.212.01	*Salix geyeriana / grass*		
*61.212.02	*Salix geyeriana / mesic graminoid*		

*61.203.00	***Salix hookeriana* (Coastal dune willow thickets) Alliance**	G4 S3
*61.203.01	*Salix hookeriana*	
*61.203.02	*Salix hookeriana / Rubus ursinus*	
*61.118.00	***Salix jepsonii* (Jepson willow thickets) Alliance**	G3 S3
*61.118.01	*Salix jepsonii*	
*61.118.04	*Salix jepsonii - Cornus sericea*	
*61.118.03	*Salix jepsonii - Paxistima myrsinites*	
*61.118.02	*Salix jepsonii / Senecio triangularis*	
61.201.00	***Salix lasiolepis* (Arroyo willow thickets) Alliance**	G4 S4 (some associations are of high priority for inventory)
*61.201.01	*Salix lasiolepis*	
61.201.04	*Salix lasiolepis - Salix lucida*	
61.201.02	*Salix lasiolepis / Artemisia douglasiana*	
61.201.05	*Salix lasiolepis / Baccharis pilularis - Rubus ursinus*	
61.201.06	*Salix lasiolepis / Baccharis salicifolia*	
61.201.07	*Salix lasiolepis / Malosma laurina*	
61.201.08	*Salix lasiolepis / Rosa californica*	
61.201.03	*Salix lasiolepis / Rubus spp.*	
*61.113.00	***Salix lemmonii* (Lemmon's willow thickets) Alliance**	G4 S3
*61.113.01	*Salix lemmonii*	
*61.113.02	*Salix lemmonii / Carex spp.*	
*61.113.04	*Salix lemmonii / mesic forb*	
*61.113.03	*Salix lemmonii / mesic graminoid*	
*61.204.01	*Salix lucida ssp. lasiandra / Urtica urens - Urtica dioica*	
*61.210.00	***Salix lutea* (Yellow willow thickets) Alliance**	G4 S3?
*61.210.01	*Salix lutea / mesic forbs*	
*61.210.02	*Salix lutea / mesic graminoids*	
*61.210.03	*Salix lutea / Poa pratensis*	
*61.210.04	*Salix lutea/ Rosa woodsii*	
*91.127.00	***Salix nivalis* (Snow willow mats) Provisional Alliance**	G4 S1?
61.115.00	***Salix orestera* (Sierra gray willow thickets) Alliance**	G4 S4 (some associations are of high priority for inventory)
*63.160.03	*Salix orestera / Allium validum*	
61.115.01	*Salix orestera / Calamagrostis muiriana*	
61.115.02	*Salix orestera / Senecio triangularis*	
61.115.03	*Salix orestera / tall forb*	
*61.116.00	***Salix petrophila* (Alpine willow turf) Alliance**	G5 S3
*61.116.01	*Salix petrophila*	
*61.116.03	*Salix petrophila - Calamagrostis muiriana*	
*61.116.02	*Salix petrophila - Calamagrostis muriana - Vaccinium caespitosum - Antennaria media*	
*61.119.00	***Salix planifolia* (Tea-leaved willow thickets) Provisional Alliance**	G4 S2?
*61.119.01	*Salix planifolia*	
*61.206.00	***Salix sitchensis* (Sitka willow thickets) Provisional Alliance**	G4 S3?
*32.030.00	***Salvia apiana* (White sage scrub) Alliance**	G4 S3
*32.030.01	*Salvia apiana - Artemisia californica*	
*32.030.02	*Salvia apiana - Encelia farinosa*	
*32.030.03	*Salvia apiana - Hesperoyucca whipplei*	
*33.320.00	***Salvia dorrii* (Desert purple sage scrub) Alliance**	G3 S2
*33.320.01	*Salvia dorrii*	

32.090.00	***Salvia leucophylla* (Purple sage scrub) Alliance**	G4 S4
32.090.03	*Salvia leucophylla*	
32.090.01	*Salvia leucophylla - Artemisia californica*	
32.090.04	*Salvia leucophylla - Artemisia californica - Eriogonum cinereum / Nassella spp.*	
32.090.05	*Salvia leucophylla - Eriogonum cinereum / annual herb*	
32.090.02	*Salvia leucophylla - Malosma laurina*	
32.020.00	***Salvia mellifera* (Black sage scrub) Alliance**	G4 S4 (some associations are of high priority for inventory)
32.020.03	*Salvia mellifera*	
32.020.04	*Salvia mellifera - Encelia californica*	
*32.020.08	*Salvia mellifera - Eriogonum cinereum*	
32.020.06	*Salvia mellifera - Eriogonum fasciculatum / Bromus rubens*	
32.020.07	*Salvia mellifera - Eriogonum fasciculatum var. foliolosum - Eriodictyon tomentosum*	
32.020.09	*Salvia mellifera - Lotus scoparius*	
32.020.01	*Salvia mellifera - Malosma laurina*	
*32.020.05	*Salvia mellifera - Opuntia littoralis*	
32.020.11	*Salvia mellifera - Rhus ovata*	
*63.410.00	***Sambucus nigra* (Blue elderberry stands) Alliance**	G3 S3
*63.410.01	*Sambucus nigra*	
*63.410.03	*Sambucus nigra - Heteromeles arbutifolia*	
*63.410.02	*Sambucus nigra / Leymus condensatus*	
*36.400.00	***Sarcobatus vermiculatus* (Greasewood scrub) Alliance**	G5 S4 (some associations are of high priority for inventory)
36.400.01	*Sarcobatus vermiculatus*	
*36.400.02	*Sarcobatus vermiculatus - Atriplex confertifolia*	
*33.005.00	***Simmondsia chinensis* (Jojoba scrub) Provisional Alliance**	G4 S3?
*33.005.01	*Simmondsia chinensis - Eriogonum fasciculatum - Opuntia parryi*	
*36.200.00	***Suaeda moquinii* (Bush seepweed scrub) Alliance**	G5 S3
*36.200.01	*Suaeda moquinii*	
*36.200.02	*Suaeda moquinii - Allenrolfea occidentalis*	
*36.200.03	*Suaeda moquinii - Atriplex canescens*	
63.810.00	***Tamarix spp.* (Tamarisk thickets) Semi-natural Stands**	
*33.350.00	***Tetracoccus hallii* (Hall's shrubby-spurge patches) Provisional Alliance**	G2 S1
*33.330.00	***Tidestromia oblongifolia* (Arizona honey sweet sparse scrub) Provisional Alliance**	G3 S3
37.940.00	***Toxicodendron diversilobum* (Poison oak scrub) Alliance**	G4 S4
37.940.02	*Toxicodendron diversilobum - Artemisia californica / Leymus condensatus*	
37.940.01	*Toxicodendron diversilobum - Baccharis pilularis - Rubus parviflorus*	
37.940.03	*Toxicodendron diversilobum - Diplacus aurantiacus*	
37.940.04	*Toxicodendron diversilobum - Philadelphus lewisii*	
37.940.05	*Toxicodendron diversilobum / Bromus hordeaceus - Micropus californicus*	
37.940.06	*Toxicodendron diversilobum / Bromus hordeaceus - Vicia villosa - Madia gracilis*	
37.940.08	*Toxicodendron diversilobum / herbaceous*	
37.940.07	*Toxicodendron diversilobum / Pteridium aquilinum*	
*45.405.00	***Vaccinium cespitosum* (Dwarf bilberry meadows and mats) Alliance**	G4? S3?
*45.405.03	*Vaccinium cespitosum - Calamagrostis muiriana*	
*45.405.04	*Vaccinium cespitosum - Carex filifolia*	
*45.405.00	*Vaccinium cespitosum - Carex nigricans*	
*45.405.02	*Vaccinium cespitosum - Kalmia microphylla*	
*45.410.00	***Vaccinium uliginosum* (Bog blue berry wet meadows) Alliance**	G4 S3
*45.410.01	*Vaccinium uliginosum*	

*45.410.03	*Vaccinium uliginosum / Aulacomnium palustre*	
*45.410.04	*Vaccinium uliginosum / Sphagnum teres*	
*45.410.02	*Vaccinium uliginosum ssp. occidentale / Bistorta bistortoides*	
*39.030.00	***Venegasia carpesioides*** **(Canyon sunflower scrub) Alliance**	G3 S3
*39.030.01	*Venegasia carpesioides*	
33.032.00	***Viguiera parishii*** **(Parish's goldeneye scrub) Alliance**	G4 S4 (some associations are of high priority for inventory)
33.032.03	*Viguiera parishii*	
*33.032.01	*Viguiera parishii - Agave deserti*	
33.032.04	*Viguiera parishii - Encelia farinosa*	
33.032.02	*Viguiera parishii - Eriogonum fasciculatum*	
*33.032.05	*Viguiera parishii - Salvia dorrii*	
*33.033.00	***Viguiera reticulata*** **(Net-veined goldeneye scrub) Alliance**	G3 S3?
*33.033.01	*Viguiera reticulata*	
33.070.00	***Yucca schidigera*** **(Mojave yucca scrub) Alliance**	G4 S4 (some associations are of high priority for inventory)
33.070.01	*Yucca schidigera*	
33.070.03	*Yucca schidigera - Ambrosia dumosa*	
33.070.04	*Yucca schidigera - Coleogyne ramosissima*	
*33.070.08	*Yucca schidigera - Cylindropuntia acanthocarpa*	
33.070.02	*Yucca schidigera - Ephedra nevadensis*	
33.070.07	*Yucca schidigera - Eriogonum fasciculatum*	
*33.070.11	*Yucca schidigera - Larrea tridentata - Agave deserti*	
33.070.05	*Yucca schidigera - Larrea tridentata - Ambrosia dumosa*	
33.070.06	*Yucca schidigera - Larrea tridentata - Ephedra nevadensis*	
*33.070.10	*Yucca schidigera - Larrea tridentata - Simmondsia chinensis*	
33.070.09	*Yucca schidigera - Viguiera parishii*	
33.070.12	*Yucca schidigera / Pleuraphis rigida*	
*33.225.00	***Ziziphus obtusifolia*** **(Graythorn patches) Special Stands**	G2 S2?

Herbaceous Alliances and Stands		Global & State Rank
*21.100.00	***Abronia latifolia - Ambrosia chamissonis*** **(Dune mat) Alliance**	G3 S3
*21.101.01	*Abronia latifolia - Erigeron glaucus*	
*21.101.02	*Abronia latifolia - Leymus mollis*	
*21.102.02	*Ambrosia chamissonis - Abronia maritima - Cakile maritima*	
*21.102.01	*Ambrosia chamissonis - Abronia umbellata*	
*21.100.03	*Ambrosia chamissonis - Eriophyllum staechadifolium (- Lupinus arboreus)*	
*21.102.03	*Ambrosia chamissonis - Malacothrix incana - Carpobrotus chilensis - Poa douglasii*	
*21.100.01	*Artemisia pycnocephala - Calystegia soldanella*	
*21.110.01	*Artemisia pycnocephala - Cardionema ramosissimum*	
*21.110.03	*Artemisia pycnocephala - Ericameria ericoides*	
*21.110.04	*Artemisia pycnocephala - Poa douglasii*	
21.110.02	*Artemisia pycnocephala - Polygonum paronychia*	
21.125.01	*Cakile maritima - Abronia maritima*	
21.102.04	*Cakile maritima - Ambrosia chamissonis - Carpobrotus edulis*	
*21.100.06	*Poa douglasii - Lathyrus littoralis*	
33.065.00	***Ambrosia psilostachya*** **(Western ragweed meadows) Provisional Alliance**	G4 S4?
*41.120.00	***Achnatherum hymenoides*** **(Indian rice grass grassland) Alliance**	G4 S1
*41.120.01	*Achnatherum hymenoides - Leptodactylon pungens*	
*41.120.02	*Achnatherum hymenoides - Sphaeralcea ambigua*	

*41.090.00	***Achnatherum speciosum*** **(Desert needlegrass grassland) Alliance**	G4 S2
*41.090.01	*Achnatherum speciosum*	
42.003.00	***Aegilops triuncialis*** **(Barbed goatgrass patches) Provisional Semi-natural Stands**	
42.003.01	*Aegilops triuncialis - Hemizonia congesta*	
42.030.00	***Agropyron cristatum*** **(Crested wheatgrass rangelands) Semi-natural Stands**	
45.106.00	***Agrostis (gigantea, stolonifera) - Festuca arundinacea*** **(Bent grass - tall fescue meadows) Semi-natural Stands**	
45.106.01	*Agrostis gigantea*	
45.106.02	*Agrostis stolonifera*	
45.106.03	*Agrostis stolonifera - Festuca arundinacea*	
*42.006.00	***Alopecurus geniculatus*** **(Water foxtail meadows) Provisional Alliance**	G3? S3?
42.010.00	***Ammophila arenaria*** **(European beach grass swards) Semi-natural Stands**	
42.010.02	*Ammophila arenaria*	
42.010.03	*Ammophila arenaria - Cardionema ramosissimum*	
42.010.01	*Ammophila arenaria - Erechtites minima*	
42.010.04	*Ammophila arenaria - Lupinus variicolor*	
42.110.00	***Amsinckia (menziesii, tessellata)*** **(Fiddleneck fields) Alliance**	G4 S4
42.110.01	*Amsinckia menziesii - Erodium spp.*	
42.110.02	*Amsinckia menziesii - Vulpia bromoides - Plagiobothrys canescens*	
*52.214.00	***Anemopsis californica*** **(Yerba mansa meadows) Alliance**	G3 S2?
*52.214.01	*Anemopsis californica - Juncus arcticus var. mexicanus*	
*38.140.00	***Argentina egedii*** **(Pacific silverweed marshes) Alliance**	G4 S2
*38.140.01	*Argentina egedii*	
*38.140.03	*Argentina egedii - Eleocharis macrostachya*	
*38.140.02	*Argentina egedii - Alopecurus aequalis*	
*38.140.04	*Argentina egedii - Lotus uliginosus*	
*45.425.00	***Aristida purpurea*** **(Purple three-awn meadows) Provisional Alliance**	G4 S3?
35.160.00	***Artemisia dracunculus*** **(Wild tarragon patches) Alliance**	G4 S4
35.160.01	*Artemisia dracunculus*	
35.160.02	*Artemisia dracunculus - Pseudognaphalium canescens*	
*52.212.00	***Arthrocnemum subterminale*** **(Parish’s glasswort patches) Alliance**	G4 S2
*52.212.01	*Arthrocnemum subterminale*	
*52.212.03	*Arthrocnemum subterminale - Monanthocloe littoralis*	
*52.212.02	*Arthrocnemum subterminale - Sarcocornia pacifica*	
42.080.00	***Arundo donax (Giant reed breaks)*** **Semi-natural Stands**	
42.080.01	*Arundo donax*	
42.080.02	*Arundo donax - Salix exigua*	
52.211.00	***Atriplex prostrata - Cotula coronopifolia*** **(Fields of fat hen and brass buttons) Semi-natural Stands**	
52.211.01	*Atriplex prostrata*	
52.211.02	*Atriplex prostrata / annual grasses*	
52.211.03	*Atriplex prostrata / Distichlis spicata*	
52.211.04	*Atriplex prostrata / Schoenoplectus maritimus*	
52.211.05	*Atriplex prostrata / Sesuvium verrucosum*	
52.211.06	*Cotula coronopifolia*	
44.150.00	***Avena (barbata, fatua) (Wild oats grasslands)*** **Semi-natural Stands**	
44.150.01	*Avena barbata*	

44.150.02	*Avena barbata - Avena fatua*	
44.150.03	*Avena barbata - Bromus hordeaceus*	
44.150.04	*Avena fatua*	
52.106.00	***Azolla (filiculoides, mexicana)* (Mosquito fern mats) Provisional Alliance**	G4 S4
45.413.00	***Bistorta bistortoides - Mimulus primuloides* (Western bistort - primrose monkey flower meadows) Alliance**	G4 S4
45.413.02	*Bistorta bistortoides*	
42.011.00	***Brassica nigra and other mustards* (Upland mustards) Semi-natural Stands**	
42.011.01	*Brassica nigra*	
42.011.02	*Brassica nigra - Bromus diandrus*	
42.011.03	*Brassicas tournefortii / Ambrosia dumosa*	
42.011.04	*Raphanus sativus*	
42.026.00	***Bromus (diandrus, hordeaceus) - Brachypodium distachyon* (Annual brome grasslands) Semi-natural Stands**	
42.040.03	*Brachypodium distachyon*	
42.026.21	*Bromus diandrus*	
42.026.22	*Bromus diandrus - Avena spp.*	
42.026.11	*Bromus diandrus - Mixed herbs*	
42.026.20	*Bromus hordeaceus - Aira caryophyllea*	
42.026.23	*Bromus hordeaceus - Amsinckia menziesii - Hordeum murinum*	
42.026.08	*Bromus hordeaceus - Bromus tectorum*	
42.026.10	*Bromus hordeaceus - Dichelostemma multiflorum*	
42.026.09	*Bromus hordeaceus - Erodium botrys*	
42.040.02	*Bromus hordeaceus - Erodium botrys*	
42.026.13	*Bromus hordeaceus - Erodium botrys - Plagiobothrys fulvus*	
42.026.15	*Bromus hordeaceus - Holocarpha virgata - Lolium perenne*	
42.026.14	*Bromus hordeaceus - Holocarpha virgata - Taeniatherum caput - medusa*	
42.026.17	*Bromus hordeaceus - Leontodon taraxacoides*	
42.026.16	*Bromus hordeaceus - Limnanthes douglasii*	
42.026.18	*Bromus hordeaceus - Lupinus nanus - Trifolium spp.*	
42.026.07	*Bromus hordeaceus - Taeniatherum caput - medusae*	
42.026.02	*Bromus hordeaceus - Vulpia hirsuta*	
42.026.19	*Bromus hordeaceus (-Vicia villosa - Lolium multiflorum) - Trifolium hirtum*	
42.024.00	***Bromus rubens - Schismus (arabicus, barbatus)* (Red brome or Mediterranean grass grasslands) Semi-natural Stands**	
42.024.01	*Bromus rubens*	
42.024.02	*Bromus rubens - mixed herbs*	
42.024.03	*Schimus playa*	
42.020.00	***Bromus tectorum* (Cheatgrass grassland) Semi-natural Stands**	
42.020.01	*Bromus tectorum*	
42.020.02	*Bromus tectorum - Bromus diandrus*	
*52.112.00	***Bulboschoenus maritimus* (Salt marsh bulrush marshes) Alliance**	G4 S3
*52.112.03	*Bolboschoenus maritimus*	
*52.112.04	*Bolboschoenus maritimus / Sarcocornia pacifica (depressa)*	
*52.112.05	*Bolboschoenus maritimus / Sesuvium verrucosum*	
21.125.00	***Cakile (edentula, maritima)* (Sea rocket sands) Provisional Semi-natural Stands**	
*41.224.00	***Calamagrostis canadensis* (Bluejoint reed grass meadows) Alliance**	G5 S3
*41.224.01	*Calamagrostis canadensis*	
*41.224.02	*Calamagrostis canadensis - Carex utriculata*	
*41.224.03	*Calamagrostis canadensis - Dodecatheon redolens*	
*41.224.04	*Calamagrostis canadensis - Scirpus microcarpus*	

45.141.00	***Calamagrostis muiriana* (Shorthair reed grass meadows) Alliance**	G4 S4
45.141.02	*Calamagrostis muiriana - Oreostemma alpigenum*	
45.141.03	*Calamagrostis muiriana - Ptilagrostis kingii*	
45.141.04	*Calamagrostis muiriana - Trisetum spicatum*	
45.141.01	*Calamagrostis muriana - Juncus drummondii*	
*41.190.00	***Calamagrostis nutkaensis* (Pacific reed grass meadows) Alliance**	G4 S2
*41.190.03	*Calamagrostis nutkaensis*	
*41.190.01	*Calamagrostis nutkaensis - Baccharis pilularis*	
*41.190.02	*Calamagrostis nutkaensis - Carex obnupta. - Juncus spp.*	
41.211.00	***Calamagrostis purpurascens* (Fell-fields with purple reed grass) Alliance**	G4? S4?
41.211.02	*Calamagrostis purpurascens - Ericameria parryi var. monocephala - Linanthus pungens*	
41.211.01	*Calamagrostis purpurascens - Linanthus pungens*	
41.211.03	*Calamagrostis purpurascens / Ribes cereum*	
*45.416.00	***Camassia quamash* (Small camas meadows) Alliance**	G4? S3?
*45.416.01	*Camassia quamash / Sphagnum subsecundum*	
*45.168.00	***Carex (aquatilis, lenticularis)* (Water sedge and Lakeshore sedge meadows) Alliance**	G5 S3
*45.168.01	*Carex aquatilis*	
*45.168.04	*Carex aquatilis - Carex lenticularis*	
*45.168.02	*Carex lenticularis / Aulacomnium palustre*	
*45.168.03	*Carex lenticularis / Perideridia parishii*	
52.121.00	***Carex (utriculata, vesicaria)* (Beaked sedge and blister sedge meadows) Alliance**	G5 S4
52.120.01	*Carex utriculata*	
52.121.01	*Carex utriculata - Mimulus primuloides*	
45.110.22	*Carex vernacula - Antennaria media*	
45.170.01	*Carex vesicaria*	
*45.142.00	***Carex barbarae* (White-root beds) Alliance**	G2? S2?
*45.142.01	*Carex barbarae*	
*45.150.00	***Carex breweri* (Brewer sedge mats) Alliance**	G4 S3
*45.150.01	*Carex breweri*	
*45.150.03	*Carex breweri - Cistanthe umbellata*	
*45.150.02	*Carex breweri - Poa wheeleri*	
*45.160.00	***Carex congdonii* (Congdon's sedge talus) Provisional Alliance**	G2 S2
*45.160.01	*Arnica amplexicaulis - Carex congdonii*	
*45.165.00	***Carex densa* (Dense sedge marshes) Provisional Alliance**	G2? S2?
*45.165.02	*Carex densa - Juncus xiphioides*	
*45.165.03	*Carex densa - Lolium perenne - Juncus spp.*	
*45.169.00	***Carex douglasii* (Douglas' sedge meadows) Provisional Alliance**	G4? S2?
45.140.00	***Carex filifolia* (Shorthair sedge turf) Alliance**	G4 S4
45.140.06	*Carex filifolia*	
45.140.09	*Carex filifolia - Calamagrostis muiriana*	
45.140.10	*Carex filifolia - Cistanthe monosperma*	
45.140.05	*Carex filifolia - Erigeron algidus*	
45.140.11	*Carex filifolia - Erigeron petiolaris*	
45.140.08	*Carex filifolia - Penstemon heterodoxus*	
45.140.07	*Carex filifolia - Saxifraga aprica*	
45.140.01	*Carex filifolia - Trisetum spicatum*	
*45.145.00	***Carex helleri* (Heller's sedge fell-fields) Alliance**	G4 S2
*45.145.03	*Carex helleri - Saxifraga tolmiei - Luzula divaricata*	
*45.145.06	*Carex helleri - Arabis platysperma - Penstemon heterodoxus*	

*45.145.05	*Carex helleri - Eriogonum incanum - Raillardella argentea*	
*45.145.04	*Carex helleri - Poa suksdorfii*	
*45.115.00	***Carex heteroneura*** **(Different-nerve sedge patches) Provisional Alliance**	G3? S3?
*45.115.01	*Carex heteroneura - Achillea millefolium*	
*45.175.00	***Carex integra*** **(Small-fruited sedge meadows) Provisional Alliance**	G4? S2?
*45.162.00	***Carex jonesii*** **(Jones's sedge turf) Alliance**	G4 S3
*45.162.02	*Carex jonesii*	
*45.162.01	*Carex jonesii - Bistorta bistortoides*	
*45.162.03	*Carex jonesii / Sphagnum subsecundum*	
*45.166.00	***Carex lasiocarpa*** **(Slender sedge meadows) Provisional Alliance**	G5? S3?
*45.166.01	*Carex lasiocarpa*	
*45.178.00	***Carex limosa*** **(Shore sedge fens) Alliance**	G4? S2?
*45.178.02	*Carex limosa - Menyanthes trifoliata*	
*45.110.03	*Carex limosa - Mimulus primuloides*	
*45.178.01	*Carex limosa / Drepanocladus sordidus*	
*45.179.00	***Carex luzulina*** **(Woodland sedge fens) Provisional Alliance**	G3 S2?
*45.181.00	***Carex microptera*** **(Small-winged sedge meadows) Provisional Alliance**	G4 S2?
45.130.00	***Carex nebrascensis*** **(Nebraska sedge meadows) Alliance**	G5 S4
45.130.01	*Carex nebrascensis*	
45.130.02	*Carex nebrascensis - Ptilagrostis kingii*	
*45.164.00	***Carex nigricans*** **(Showy sedge sod) Provisional Alliance**	G4 S3?
*45.182.00	***Carex nudata*** **(Torrent sedge patches) Alliance**	G3 S3
*45.182.01	*Carex nudata*	
*45.183.00	***Carex obnupta*** **(Slough sedge swards) Alliance**	G4 S3
*45.183.01	*Carex obnupta*	
*45.183.02	*Carex obnupta - Juncus lescurii*	
*45.183.03	*Carex obnupta - Juncus patens*	
*45.184.00	***Carex pansa*** **(Sand dune sedge swaths) Provisional Alliance**	G4? S3?
*45.120.00	***Carex scopulorum*** **(Sierra alpine sedge turf) Alliance**	G4 S3
*45.120.01	*Carex scopulorum*	
*45.120.07	*Carex scopulorum - Allium validum*	
*45.120.04	*Carex scopulorum - Eleocharis quinquefolia*	
*45.120.03	*Carex scopulorum - Eriophorum crinigerum*	
*45.120.08	*Carex scopulorum - Mimulus primuloides*	
*45.120.02	*Carex scopulorum - Pedicularis groenlandica*	
*45.120.06	*Carex scopulorum / Aulacomnium palustre*	
*45.120.05	*Carex scopulorum / Oreostemma alpigenum*	
*45.180.00	***Carex serratodens*** **(Twotooth sedge seeps) Provisional Alliance**	G3 S3?
*45.190.00	***Carex simulata*** **(Short-beaked sedge meadows) Alliance**	G4 S3
*45.190.01	*Carex simulata*	
*45.190.04	*Carex simulata - Carex utriculata*	
*45.190.05	*Carex simulata - Carex vesicaria*	
*45.190.02	*Carex simulata / Aulacomnium palustre*	
*45.190.03	*Carex simulata / Philonotis fontana*	

*45.155.00	***Carex spectabilis*** **(Showy sedge sod) Alliance**	G4 S3
*45.155.02	*Carex spectabilis - Senecio triangularis*	
*45.155.01	*Carex spectabilis - Sibbaldia procumbens*	
*45.185.00	***Carex straminiformis*** **(Mount Shasta sedge meadows) Provisional Alliance**	G3? S3?
*45.186.00	***Carex subnigricans*** **(Dark alpine sedge turf) Alliance**	G4 S3
*45.186.01	*Carex subnigricans - Antennaria media*	
*45.186.05	*Carex subnigricans - Deschampsia caespitosa*	
*45.186.03	*Carex subnigricans - Dodecatheon alpinum*	
*45.186.02	*Carex subnigricans - Oreostemma alpigenum*	
*45.186.04	*Carex subnigricans - Pedicularis attollens*	
21.200.00	***Carpobrotus edulis or other Ice Plants*** **(Ice plant mats) Semi-natural Stands**	
42.042.00	***Centaurea (solstitialis, meletensis)*** **(Yellow star-thistle fields) Semi-natural Stands**	
42.042.01	*Centaurea melitensis - Brassica nigra*	
42.042.02	*Centaurea solstitialis*	
42.040.04	*Centaurea spp. - Brachypodium distachyon.*	
42.043.00	***Centaurea (virgata)*** **(Knapweed and purple-flowered star-thistle fields) Provisional Semi-natural Stands**	
*44.160.00	***Centromadia (pungens)*** **(Tar plant fields) Alliance**	G2? S2?
*44.160.02	*Centromadia pungens - Downingia bella*	
*44.160.01	*Centromadia pungens ssp. laevis*	
*42.100.00	***Cirsium fontinale*** **(Fountain thistle seeps) Alliance**	G1 S1
*42.100.01	*Cirsium fontinale var. campylon - Carex serratodens - Hordeum brachyantherum*	
*42.100.02	*Cirsium fontinale var. campylon - Hemizonia congesta var. luzulifolia*	
*42.100.03	*Cirsium fontinale var. campylon - Mimulus guttatus - Stachys pycnantha*	
45.311.00	***Cistanthe (umbellata) - Gayophytum (diffusum)*** **(Pussypaws - groundsmoke openings) Alliance**	G4 S4
45.311.01	*Astragalus bolanderi - (Cistanthe umbellatum)*	
45.311.02	*Cistanthe umbellatum - Achnatherum occidentalis*	
45.311.03	*Cistanthe - Castilleja arachnoidea*	
45.311.04	*Polygonum douglasii - Gayophytum dffusum*	
45.556.00	***Conium maculatum - Foeniculum vulgare*** **(Poison hemlock or fennel patches) Semi-natural Stands**	
45.556.01	*Conium maculatum*	
45.556.02	*Foeniculum vulgare*	
42.070.00	***Cortaderia (jubata, selloana)*** **(Pampas grass patches) Semi-natural Stands**	
46.100.00	***Cressa truxillensis - Distichlis spicata*** **(Alkali weed - Salt grass playas and sinks) Alliance**	G4 S4
46.100.02	*Chamaesyce hooveri - Bolboschoenus maritimus*	
46.100.03	*Neostapfia colusana - Malvella leprosa*	
46.100.04	*Neostapfia colusana - Polypogon maritimus*	
46.100.05	*Orcuttia pilosa*	
42.044.00	***Cynosurus echinatus*** **(Annual dogtail grasslands) Semi-natural Stands**	
42.044.07	*Cynosurus echinatus - Arrhenatherum elatius / Dichelostemma capitatum*	
42.044.01	*Cynosurus echinatus - Bromus hordeaceus - Avena fatua*	
42.044.02	*Cynosurus echinatus - Bromus hordeaceus - Madia elegans*	
42.044.04	*Cynosurus echinatus - Bromus hordeaceus - Taeniatherum caput-medusae*	
42.044.03	*Cynosurus echinatus - Bromus hordeaceus - Taraxacum officinale*	
42.044.05	*Cynosurus echinatus - Lagophylla ramosissima*	

*41.050.00	***Danthonia californica* (California oat grass prairie) Provisional Alliance**	G4 S3
*41.050.05	*Danthonia californica*	
*41.050.04	*Danthonia californiaca - Aira caryophyllea*	
*41.050.01	*Danthonia californica - Arrhenatherum elatius*	
*41.050.02	*Danthonia californica - Elymus elymoides*	
*41.050.03	*Danthonia californica - Muhlenbergia filiformis*	
*41.051.00	***Danthonia intermedia* (Wild mountain oat grass meadows) Alliance**	G4? S3?
*41.051.01	*Danthonia intermedia - Antennaria rosea*	
*41.051.02	*Danthonia intermedia - Ptilagrostis kingii*	
*51.200.00	***Darlingtonia californica* (California pitcher plant fens) Alliance**	G4? S3
*51.200.01	*Darlingtonia californica*	
*44.161.00	***Deinandra fasciculata* (Clustered tarweed fields) Alliance**	G3? S3?
*44.161.01	*Deinandra fasciculata - annual grass-herb*	
*44.161.02	*Deinandra fasciculata - Hordeum depressum - Atriplex coronata var. notatior*	
41.220.00	***Deschampsia caespitosa* (Tufted hair grass meadows) Alliance**	G5 S4? (some associations are of high priority for inventory)
*41.220.08	*Deschampsia caespitosa*	
*41.220.05	*Deschampsia caespitosa - Anthoxanthum odoratum*	
41.220.12	*Deschampsia caespitosa - Bistorta bistortoides*	
*41.220.02	*Deschampsia caespitosa - Cardamine breweri*	
41.220.01	*Deschampsia caespitosa - Carex nebrascensis*	
41.220.09	*Deschampsia caespitosa - Danthonia californica*	
*41.220.13	*Deschampsia caespitosa - Horkelia marinensis*	
*41.220.14	*Deschampsia caespitosa - Lilaeopsis masonii*	
41.220.11	*Deschampsia caespitosa - Perideridia parishii*	
41.220.03	*Deschampsia caespitosa - Senecio scorzonella*	
41.220.04	*Deschampsia caespitosa - Senecio scorzonella - Achillea millefolium*	
41.220.07	*Deschampsia caespitosa - Solidago multiradiata*	
*41.220.10	*Deschampsia caespitosa - Trifolium longipes*	
*41.220.15	*Deschampsia caespitosa var. holciformis*	
*22.100.00	***Dicoria canescens - Abronia villosa* (Desert dunes) Alliance**	G3 S2
*22.100.01	*Dicoria canescens*	
41.200.00	***Distichlis spicata* (Salt grass flats) Alliance**	G5 S4 (some associations are of high priority for inventory)
41.200.14	*Distichlis spicata - Agrostis viridis*	
*41.200.11	*Distichlis spicata - Ambrosia chamissonis*	
41.200.15	*Distichlis spicata - Atriplex triangularis*	
41.200.16	*Distichlis spicata - Bromus diandrus*	
41.200.17	*Distichlis spicata - Cotula coronopifolia*	
*41.200.07	*Distichlis spicata - Frankenia salina - Jaumea carnosa*	
41.200.18	*Distichlis spicata - Hordeum murninum*	
*41.200.06	*Distichlis spicata - Jaumea carnosa*	
41.200.05	*Distichlis spicata - Juncus arcticus ssp. balticus (J. arcticus ssp. mexicanus)*	
*41.200.02	*Distichlis spicata - Juncus cooperi*	
41.200.19	*Distichlis spicata - Leymus triticoides / Lupinus (albifrons, arboreus)*	
41.200.10	*Distichlis spicata - Parapholis strigosa*	
*41.200.20	*Distichlis spicata - Sarcocornia pacifica*	
*41.200.01	*Distichlis spicata / Allenrolfea occidentalis*	
41.200.13	*Distichlis spicata / annual grasses*	
*41.200.04	*Distichlis spicata / Chrysothamnus albidus*	
*41.200.03	*Distichlis spicata / Sarcobatus vermiculatus*	
*52.115.00	***Dulichium arundinaceum* (Three-way sedge meadows) Provisional Alliance**	G3? S1
*52.115.01	*Dulichium arundinaceum*	

*45.231.00	***Eleocharis acicularis* (Needle spike rush stands) Alliance**	G4? S3?
*45.231.01	*Eleocharis acicularis - Eryngium castrense*	
*45.231.03	*Navarretia spp. - (Eleocharis acicularis - Eryngium alismaefolium)*	
*45.231.02	*Plagiobothrys mollis - (Eleocharis acicularis - Eryngium mathiasiae)*	
45.230.00	***Eleocharis macrostachya* (Pale spike rush marshes) Alliance**	G4 S4 (some associations are of high priority for inventory)
45.230.01	*Eleocharis macrostachya*	
*45.230.07	*Eleocharis macrostachya - (Pleuropogon californicus)*	
*45.230.02	*Eleocharis macrostachya - Callitriche hermaphroditica*	
*45.230.04	*Eleocharis macrostachya - Eryngium aristulatum ssp. Parishii*	
*45.230.05	*Eleocharis macrostachya - Lasthenia glaberrima*	
*45.230.06	*Eleocharis macrostachya - Marsilea vestita*	
*45.230.03	*Eleocharis macrostachya - Sagittaria montevidensis*	
45.220.00	***Eleocharis quinqueflora* (Few-flowered spike rush marshes) Alliance**	G4 S4 (some associations are of high priority for inventory)
45.220.01	*Eleocharis quinqueflora*	
*45.220.02	*Eleocharis quinqueflora - Mimulus primuloides*	
*45.220.03	*Eleocharis quinqueflora / Aulacomnium palustre*	
*45.220.04	*Eleocharis quinqueflora / Campylium stellatum*	
*45.220.05	*Eleocharis quinqueflora / Drepanocladus aduncus - Drepanocladus sordidus*	
*45.220.06	*Eleocharis quinqueflora / Philonotis fontana*	
*41.640.00	***Elymus glaucus* (Blue wild rye meadows) Alliance**	G3? S3?
*41.640.01	*Elymus glaucus*	
*41.640.03	*Elymus glaucus - Carex feta*	
*41.640.02	*Elymus glaucus - Carex pellita*	
*41.640.04	*Elymus glaucus - Heracleum lanatum*	
41.650.00	***Elymus multisetus* (Big squirreltail patches) Provisional Alliance**	G4 S4?
*38.120.00	***Ericameria discoidea - Hulsea algida* (Fell-fields with California heath-goldenrod and Pacific alpine gold) Alliance**	G3? S3?
*38.120.02	*Ericameria discoidea - Linanthus pungens*	
*38.120.01	*Ericameria discoidea - Minuartia nuttallii*	
*38.120.04	*Hulsea algida*	
*38.120.05	*Hulsea algida - Ericameria discoidea - Phacelia hastata*	
*38.120.06	*Hulsea algida - Muhlenbergia richardsonis - Achnatherum pinetorum*	
*42.004.00	***Eryngium aristulatum* (California button-celery patches) Alliance**	G3 S3?
*42.004.01	*Eryngium aristulatum - Lupinus bicolor*	
43.200.00	***Eschscholzia (californica)* (California poppy fields) Alliance**	G4 S4
43.200.01	*Eschoscholzia californica*	
*91.170.00	***Festuca brachyphylla* (Alpine fescue fell-fields) Alliance**	G4? S3?
*91.170.02	*Festuca brachyphylla - Penstemon davidsonii*	
*91.170.01	*Festuca brachyphylla - Eriogonum ovalifolium*	
*41.250.00	***Festuca idahoensis* (Idaho fescue grassland) Alliance**	G4 S3?
*41.250.03	*Festuca idahoensis - Achillea millefolium*	
*41.250.01	*Festuca idahoensis - Bromus carinatus*	
*41.250.02	*Festuca idahoensis - Festuca rubra*	
*41.255.00	***Festuca rubra* (Red fescue grassland) Alliance**	G4 S3?
*41.255.01	*Festuca rubra*	
*52.500.00	***Frankenia salina* (Alkali heath marsh) Alliance**	G4 S3
*52.500.02	*Frankenia salina*	
*52.500.01	*Frankenia salina - Limonium californicum - Monanthochloe littoralis - Sarcocornia pacifica*	

*52.500.03	*Frankenia salina / Agrostis avenacea*	
*52.500.04	*Frankenia salina / Distichlis spicata*	
*52.500.06	*Suaeda taxifolia / Hordeum murinum*	
*41.222.00	***Glyceria (elata, striata)*** **(Manna grass meadows) Alliance**	G4 S3?
*41.222.01	*Glyceria elata*	
*41.222.03	*Glyceria elata - Lotus longifolius*	
*41.222.02	*Glyceria elata - Scirpus microcarpus*	
*41.222.04	*Glyceria striata*	
*41.223.00	***Glyceria occidentalis*** **(Northwest manna grass marshes) Provisional Alliance**	G3? S3?
*52.206.00	***Grindelia (stricta)*** **(Gum plant patches) Provisional Alliance**	G3? S3?
42.050.00	***Holcus lanatus - Anthoxanthum odoratum*** **(Common velvet grass - sweet vernal grass meadows) Semi-natural Stands**	
42.050.08	*Holcus lanatus*	
42.050.09	*Holcus lanatus - Anthoxanthum odoratum*	
*42.052.00	***Hordeum brachyantherum*** **(Meadow barley patches) Alliance**	G4 S3?
*42.052.01	*Hordeum brachyantherum*	
*42.052.04	*Hordeum brachyantherum - Poa pratensis*	
*42.052.02	*Hordeum brachyantherum - Polypogon monspeliensis*	
*42.052.03	*Hordeum brachyantherum - Senecio triangularis*	
*52.117.00	***Hydrocotyle (ranunculoides, umbellata)*** **(Mats of floating pennywort) Alliance**	G4 S3?
*52.117.01	*Hydrocotyle ranunculoides*	
*52.117.02	*Hydrocotyle ranunculoides - Schoenoplectus pungens*	
45.401.00	***Iris missouriensis*** **(Western blue flag patches) Provisional Alliance**	G5 S4
*52.109.00	***Isoetes (bolanderi, echinospora, howellii, nuttallii, occidentalis)*** **(Quillwort beds) Provisional Alliance**	G3 S3?
*45.568.00	***Juncus (oxymeris, xiphioides)*** **(Iris-leaf rush seeps) Provisional Alliance**	G2? S2?
45.562.00	***Juncus arcticus (var. balticus, mexicanus)*** **(Baltic and Mexican rush marshes) Alliance**	G5 S4
45.562.07	*Juncus arcticus var. balticus*	
91.120.21	*Juncus arcticus var. balticus*	
45.562.05	*Juncus arcticus var. balticus - Argentina egedii*	
45.562.04	*Juncus arcticus var. balticus - Carex praegracilis*	
45.562.01	*Juncus arcticus var. balticus - Conium maculatum*	
45.562.06	*Juncus arcticus var. balticus - Lepidium latifolium*	
45.562.02	*Juncus arcticus var. mexicanus*	
*45.563.00	***Juncus cooperi*** **(Cooper's rush marsh) Alliance**	G3 S3
*45.563.01	*Juncus cooperi*	
45.561.00	***Juncus effusus*** **(Soft rush marshes) Alliance**	G4 S4?
45.561.01	*Juncus effusus*	
*45.569.00	***Juncus lescurii*** **(Salt rush swales) Alliance**	G3 S2?
*45.569.01	*Juncus lescurii*	
*45.569.02	*Juncus (lescurii) - Distichlis spicata*	
*45.567.00	***Juncus nevadensis*** **(Sierra rush marshes) Alliance**	G3? S3?
*45.567.01	*Juncus nevadensis*	
*45.567.02	*Juncus nevadensis - Carex leporinella*	
*45.567.03	*Juncus nevadensis - Eleocharis quinqueflora*	

45.566.00	***Juncus parryi* (Parry's rush outcrops) Alliance**	G4 S4
45.566.01	*Juncus parryi - Eriogonum incanum*	
45.564.00	***Juncus patens* (Western rush marshes) Provisional Alliance**	G4? S4?
*91.115.00	***Kobresia myosuroides* (Pacific bog sedge meadows) Alliance**	G5 S1
*91.115.01	*Kobresia myosuroides - Thalictrum alpinum*	
44.108.00	***Lasthenia californica - Plantago erecta - Vulpia microstachys* (California goldfields - Dwarf plantain - Six-weeks fescue flower fields) Alliance**	G4 S4 (some associations are of high priority for inventory)
44.109.03	*Lasthenia californica*	
*44.109.01	*Lasthenia californica - Atriplex coronata var. notatior*	
*44.109.04	*Lasthenia californica - Lupinus bicolor - Layia platyglossa - Bromus spp.*	
*44.108.01	*Lasthenia californica - Plantago erecta - Hesperevax sparsiflora*	
*52.500.05	*Lasthenia ferrisiae - Lasthenia conjugens*	
44.108.02	*Plantago erecta - Lolium perenne lichen-rocky*	
*44.108.08	*Vulpia microstachys - Elymus elymoides - Achnatherum lemmonii*	
*44.109.05	*Vulpia microstachys - Lasthenia californica - Agrostis elliottiana*	
44.108.05	*Vulpia microstachys - Mimulus guttatus - Pentagramma triangularis*	
*44.108.09	*Vulpia microstachys - Navarretia tagetina*	
44.109.06	*Vulpia microstachys - Parvisedum pumilum - Lasthenia californica*	
*44.108.04	*Vulpia microstachys - Plantago erecta*	
44.108.03	*Vulpia microstachys - Plantago erecta - Calycadenia (truncata, multiglandulosa)*	
*44.108.10	*Vulpia microstachys - Selaginella hansenii*	
*44.108.11	*Vulpia microstachys - Selaginella hansenii - Lupinus nanus*	
*44.108.07	*Vulpia microstachys - Selaginella hansenii - Lupinus spectabilis*	
*44.119.00	***Lasthenia fremontii - Distichlis spicata* (Fremont's goldfields - Saltgrass alkaline vernal pools) Alliance**	G4 S3
*44.119.01	*Downingia bella - Lilaea scilloides*	
*44.119.02	*Downingia cuspidata - Myosurus minimus*	
*44.119.03	*Downingia insignis - Psilocarphus brevissimus*	
*44.119.04	*Downingia pulchella - Cressa truxillensis*	
*44.119.05	*Downingia pulchella - Distichlis spicata*	
*44.119.07	*Lasthenia fremontii - Pleuropogon californicus*	
*44.119.09	*Lasthenia platycarpha - Lepidium latipes*	
*44.119.10	*Limnanthes douglasii ssp. rosea - Pleuropogon californicus*	
*44.119.06	*Hordeum (depressum, murinum spp. leporinum)*	
*44.119.11	*Lasthenia fremontii - Distichlis spicata*	
*42.007.00	***Lasthenia fremontii - Downingia (bicornuta)* (Fremont's goldfields - Downingia vernal pools) Alliance**	G3 S3
*42.007.02	*Downingia (bicornuta, cuspidata)*	
*42.007.01	*Downingia bicornuta*	
*42.007.06	*Eryngium (vaseyi, castrense)*	
*42.007.08	*Lasthenia californica - Downingia bicornuta*	
*42.007.07	*Lasthenia fremontii*	
*42.007.03	*Lasthenia fremontii - Downingia bicornuta*	
*42.007.04	*Lasthenia fremontii - Downingia ornatissima*	
*42.007.05	*Ranunculus bonariensis - Holocarpha virgata*	
*44.140.00	***Lasthenia glaberrima* (Smooth goldfields vernal pool bottoms) Alliance**	G3 S3
*44.119.08	*Lasthenia glaberrima - Atriplex persistens*	
*44.140.01	*Lasthenia glaberrima - Downingia bicornuta*	
*44.140.05	*Lasthenia glaberrima - Downingia insignis*	
*44.140.06	*Lasthenia glaberrima - Lupinus bicolor*	
*44.140.02	*Lasthenia glaberrima - Pleuropogon californicus*	
*44.140.03	*Lasthenia glaberrima - Pogogyne douglasii*	
*44.140.04	*Lasthenia glaberrima - Trifolium variegatum*	

*42.002.00	***Layia fremontii - Achyrachaena mollis*** **(Fremont's tidy-tips - Blow wives vernal pools) Alliance**	G3 S3?
*42.002.01	*Layia fremontii - Achyrachaena mollis*	
*42.002.02	*Layia fremontii - Lasthenia californica - Achyrachaena mollis*	
*42.002.03	*Layia fremontii - Leontodon taraxacoides - Plagiobothrys greenei*	
*42.002.04	*Plagiobothrys austina - Achyrachaena mollis*	
52.105.00	***Lemna (minor) and Relatives*** **(Duckweed blooms) Provisional Alliance**	G5 S4?
52.205.00	***Lepidium latifolium*** **(Perennial pepper weed patches) Semi-natural Stands**	
52.205.02	*Lepidium latifolium*	
52.205.01	*Lepidium latifolium - Distichlis spicata.*	
*41.020.00	***Leymus cinereus*** **(Ashy ryegrass meadows) Alliance**	G4 S2
*41.265.00	***Leymus condensatus*** **(Giant wild rye grassland) Alliance**	G3 S3
*41.265.01	*Leymus condensatus*	
*41.260.00	***Leymus mollis*** **(Sea lyme grass patches) Alliance**	G4 S2
*41.260.03	*Leymus mollis - Abronia latifolia - (Cakile sp.)*	
*41.260.02	*Leymus mollis - Ammophila arenaria*	
*41.260.01	*Leymus mollis - Carpobrotus edulis*	
*41.080.00	***Leymus triticoides*** **(Creeping rye grass turfs) Alliance**	G4 S3
*41.080.01	*Leymus triticoides*	
*41.080.05	*Leymus triticoides - Anemopsis californica*	
*41.080.02	*Leymus triticoides - Bromus spp. - Avena spp.*	
*41.080.04	*Leymus triticoides - Carduus pycnocephalus - Geranium dissectum*	
*41.080.03	*Leymus triticoides - Lolium perenne*	
*41.080.06	*Leymus triticoides - Poa secunda*	
41.321.00	***Lolium perenne*** **(Perennial rye grass fields) Semi-natural Stands**	
41.321.01	*Lolium perenne*	
41.321.07	*Lolium perenne*	
41.321.02	*Lolium perenne - Bromus hordeaceus*	
41.321.03	*Lolium perenne - Centaurium muehlenbergii*	
41.321.08	*Lolium perenne - Convolvulus arvensis*	
41.321.09	*Lolium perenne - Festuca arundinacea*	
41.321.04	*Lolium perenne - Hemizonia congesta*	
41.321.05	*Lolium perenne - Hordeum marinum - Ranunculus californicus*	
41.321.10	*Lolium perenne - Lepidium latifolium*	
41.321.06	*Lolium perenne - Leymus triticoides*	
41.321.11	*Lolium perenne - Lotus corniculatus*	
41.321.12	*Zigadenus fremontii (- Lolium perenne)*	
52.230.00	***Lotus purshianus*** **(Spanish clover fields) Provisional Alliance**	G4? S4?
52.118.00	***Ludwigia (hexapetala, peploides)*** **(Water primrose wetlands) Provisional Semi-natural Stands**	
*41.275.00	***Melica torreyana*** **(Torrey's melic grass patches) Provisional Alliance**	G2 S2?
*41.275.01	*Melica torreyana*	
*44.111.00	***Mimulus (guttatus)*** **(Common monkey flower seeps) Alliance**	G4? S3?
*44.111.01	*Mimulus guttatus*	
*44.111.03	*Mimulus guttatus - (Mimulus spp.)*	
*44.111.02	*Mimulus guttatus - Vulpia microstachys*	
*44.111.04	*Mimulus lewisii*	
*45.413.03	*Mimulus primuloides*	

*44.113.00	***Montia fontana - Sidalcea calycosa* (Water blinks - Annual checkerbloom vernal pools) Alliance**	G2 S2
*44.113.01	*Montia fontana - Sidalcea calycosa*	
41.276.00	***Muhlenbergia filiformis* (Pullup muhly meadows) Provisional Alliance**	G4? S4?
41.277.00	***Muhlenbergia richardsonis* (Mat muhly meadows) Provisional Alliance**	G4? S4?
*41.278.00	***Muhlenbergia rigens* (Deer grass beds) Alliance**	G3 S2?
*41.278.01	*Muhlenbergia rigens*	
*41.140.00	***Nassella cernua* (Nodding needle grass grassland) Provisional Alliance**	G4 S3?
*41.110.00	***Nassella lepida* (Foothill needle grass grassland) Provisional Alliance**	G3? S3?
*41.150.00	***Nassella pulchra* (Purple needle grass grassland) Alliance**	G4 S3?
*41.150.04	*Nassella pulchra*	
*41.150.02	*Nassella pulchra - Avena fatua*	
*41.150.05	*Nassella pulchra - Avena spp. - Bromus spp.*	
*41.150.10	*Nassella pulchra - Distichlis spicata - Bromus spp.*	
*41.150.06	*Nassella pulchra - Erodium spp. - Avena barbata*	
*41.150.11	*Nassella pulchra - Leontodon taraxicoides*	
*41.150.01	*Nassella pulchra - Lolium perenne (-Trifolium spp.)*	
*41.150.12	*Nassella pulchra - Lolium perenne - Astragalus gambelianus - Lepidium nitidum*	
*41.150.13	*Nassella pulchra - Lolium perenne - Calystegia collina*	
*41.150.09	*Nassella pulchra - Melica californica - annual grass*	
*41.150.03	*Nassella pulchra - Sanicula bipinnatifida*	
*41.150.14	*Nassella pulchra / Baccharis pilularis*	
*41.150.07	*Nassella pulchra / Hazardia squarrosa*	
*52.110.00	***Nuphar lutea* (Yellow pond-lily mats) Provisional Alliance**	G5 S3?
*52.119.00	***Oenanthe sarmentosa* (Water-parsley marsh) Alliance**	G4 S2?
*52.119.01	*Oenanthe sarmentosa*	
*45.418.00	***Oxypolis occidentalis* (Western cowbane meadows) Alliance**	G3 S3
*45.418.02	*Oxypolis occidentalis - Bistorta bistortoides*	
*45.418.03	*Oxypolis occidentalis - Carex amplifolia*	
*45.418.04	*Oxypolis occidentalis - Eleocharis montevidensis*	
*45.418.05	*Oxypolis occidentalis - Senecio triangularis*	
*45.418.06	*Oxypolis occidentalis / Philonotis fontana*	
*91.122.00	***Oxyria digyna* (Mountain sorrel patches) Provisional Alliance**	G4 S3?
*42.095.00	***Panicum urvilleanum* (Desert panic grass patches) Alliance**	G3 S1
*42.095.01	*Panicum urvilleanum*	
42.085.00	***Pennisetum setaceum* (Fountain grass swards) Semi-natural Stands**	
42.085.01	*Pennisetum setaceum - Coreopsis gigantea - Hesperoyucca whipplei - Malosma laurina*	
*45.414.00	***Penstemon heterodoxus* (Heretic penstemon patches) Provisional Alliance**	G4? S3?
*91.120.02	*Antennaria alpina - Penstemon heterodoxus*	
45.415.00	***Penstemon newberryi* (Mountain pride patches) Alliance**	G4 S4
45.415.03	*Penstemon newberryi - Streptanthus tortuosus - Sedum obtusatum ssp. boreale - Muhlenbergia montana*	
45.415.04	*Penstemon newberryi - Streptanthus tortuosus / Selaginella watsonii*	
45.415.02	*Penstemon newberryi - Streptanthus tortuosus / Spiraea densiflora*	

42.207.00	***Persicaria lapathifolia - Xanthium strumarium* (Smartweed - cocklebur patches) Provisional Alliance**	G4 S4
42.051.00	***Phalaris aquatica* (Harding grass swards) Semi-natural Stands**	
42.051.02	*Phalaris aquatica*	
42.051.03	*Phalaris aquatica - Avena barbata*	
42.051.01	*Phalaris aquatica - Bromus hordeaceus - Centaurea solstitialis*	
*91.123.00	***Phlox covillei* (Coville's phlox fell-fields) Alliance**	G4 S3
*91.123.03	*Astragalus kentrophyta - Draba oligosperma*	
*91.123.04	*Draba oligosperma - Poa glauca ssp. Rupicola*	
*91.120.36	*Festuca minutiflora - Penstemon davidsonii*	
*91.120.06	*Ivesia muirii*	
*91.123.01	*Phlox covillei - Elymus elymoides - Podistera nevadensis*	
*91.123.02	*Phlox covillei - Elymus elymoides - Podistera nevadensis - Erigeron pygmaeus*	
*91.123.09	*Phlox covillei - Eriogonum gracilipes*	
*91.123.05	*Phlox covillei - Eriogonum incanum*	
*91.123.07	*Phlox (covillei) - Ivesia shockleyi*	
*91.123.08	*Phlox covillei - Linum lewisii*	
*91.120.08	*Podistera nevadensis - Arenaria kingii*	
*91.123.06	*Podistera nevadensis - Erigeron pygmaeus*	
*91.150.00	***Phlox pulvinata* (Cushion phlox fell-fields) Alliance**	G4 S3
*91.150.02	*Phlox pulvinata - Anelsonia eurycarpa*	
*91.150.03	*Phlox pulvinata - Ericameria suffruticosa - Ipomopsis congesta*	
*91.150.05	*Phlox pulvinata - Festuca brachyphylla*	
*91.150.06	*Phlox pulvinata - Ivesia gordonii*	
*91.150.04	*Phlox pulvinata - Lupinus argenteus var. montigenus*	
41.061.00	***Phragmites australis* (Common reed marshes) Alliance**	G5 S4?
41.061.01	*Phragmites australis*	
41.061.02	*Phragmites australis - Scirpus spp.*	
43.300.00	***Plagiobothrys nothofulvus* (Popcorn flower fields) Alliance**	G4 S4
43.300.01	*Plagiobothrys nothofulvus - Daucus pusillus - Bromus hordeaceus*	
*41.610.00	***Pleuraphis jamesii* (James' galleta shrub-steppe) Alliance**	G3 S2
*41.610.03	*Pleuraphis jamesii / Ephedra nevadensis*	
*41.610.01	*Pleuraphis jamesii / Eriogonum fasciculatum*	
*41.610.02	*Pleuraphis jamesii / Lycium andersonii*	
*41.030.00	***Pleuraphis rigida* (Big galleta shrub-steppe) Alliance**	G3 S2
*41.030.01	*Pleuraphis rigida*	
*41.030.04	*Pleuraphis rigida - Dalea mollissima*	
*41.030.02	*Pleuraphis rigida / Acamptopappus sphaerocephalus*	
*41.030.06	*Pleuraphis rigida / Ambrosia dumosa*	
*41.030.05	*Pleuraphis rigida / Atriplex canescens*	
*41.030.07	*Pleuraphis rigida / Ephedra californica*	
*41.030.03	*Pleuraphis rigida / Ericameria cooperi*	
*41.030.08	*Pleuraphis rigida / Larrea tridentata*	
42.060.00	***Poa pratensis* (Kentucky blue grass turf) Semi-natural Stands**	
42.060.05	*Poa pratensis*	
42.060.01	*Poa pratensis - Carex (nebrascensis, pellita)*	
42.060.04	*Poa pratensis - Juncus patens - Luzula comosa*	
42.060.02	*Poa pratensis - Potentilla gracilis*	
42.060.07	*Poa pratensis ssp. pratensis*	
42.060.06	*Poa pratensis ssp.agassizensis*	
*41.180.00	***Poa secunda* (Curly blue grass grassland) Alliance**	G4 S3?
*41.180.04	*Poa secunda - Danthonia unispicata*	

*41.180.03	*Poa secunda ssp. juncifolia*	
*41.180.02	*Poa secunda ssp. secunda*	
*41.040.00	***Pseudoroegneria spicata* (Bluebunch wheat grass grassland) Alliance**	G4 S2
41.225.00	***Ptilagrostis kingii* (King's needle grass meadows) Alliance**	G4 S4
41.225.01	*Ptilagrostis kingii*	
41.225.02	*Ptilagrostis kingii - Oreostemma alpigenum*	
91.120.25	*Ptilagrostis kingii - Senecio scorzonella*	
*52.202.00	***Ruppia (cirrhosa, maritima)* (Ditch-grass or widgeon-grass mats) Alliance**	G4? S2
*52.202.02	*Ruppia cirrhosa - algae*	
*52.215.00	***Sarcocornia pacifica (Salicornia depressa)* (Pickleweed mats) Alliance**	G4 S3
*52.215.12	*Sarcocornia pacific - Lepidium latifolium*	
*52.215.04	*Sarcocornia pacifica*	
*52.215.22	*Sarcocornia pacifica - Jaumea carnosa - Batis maritima*	
*52.215.06	*Sarcocornia pacifica - Atriplex prostrata*	
*52.215.07	*Sarcocornia pacifica - Bolboschoenus maritimus*	
*52.215.15	*Sarcocornia pacifica - Brassica nigra*	
*52.215.16	*Sarcocornia pacifica - Cotula coronopifolia*	
*52.215.17	*Sarcocornia pacifica - Crypsis schoenoides*	
*52.215.01	*Sarcocornia pacifica - Cuscuta salina - Spartina densiflora*	
*52.215.02	*Sarcocornia pacifica - Distichlis spicata*	
*52.215.08	*Sarcocornia pacifica - Distichlis spicata*	
*52.215.18	*Sarcocornia pacifica - Echinochloa crus-galli - Polygonum - Xanthium strumarium*	
*52.215.09	*Sarcocornia pacifica - Frankenia salina*	
*52.215.21	*Sarcocornia pacifica - Frankenia salina - Suaeda taxifolia*	
*52.215.10	*Sarcocornia pacifica - Grindelia stricta*	
*52.215.11	*Sarcocornia pacifica - Jaumea carnosa*	
*52.215.03	*Sarcocornia pacifica - Jaumea carnosa - Distichlis spicata*	
*52.215.20	*Sarcocornia pacifica - Sesuvium verrucosum*	
*52.215.13	*Sarcocornia pacifica - Spartina foliosa*	
*52.215.14	*Sarcocornia pacifica / algae*	
*52.215.19	*Sarcocornia pacifica/annual grasses (Polypogon, Hordeum, Lolium)*	
*91.124.00	***Saxifraga nidifica* (Pink saxifrage patches) Provisional Alliance**	G4? S3?
*91.124.03	*Polygonum minimum*	
*91.124.02	*Rhodiola integrifolia - Selaginella watsonii*	
*91.125.00	***Saxifraga tolmiei* (Patches of Tolmie's alpine saxifrage) Provisional Alliance**	G4 S3?
52.122.00	***Schoenoplectus acutus* (Hardstem bulrush marsh) Alliance**	G5 S4
52.122.01	*Schoenoplectus acutus*	
52.122.02	*Schoenoplectus acutus - Apocynum cannibinum*	
52.122.03	*Schoenoplectus acutus - Typha angustifolia*	
52.102.02	*Schoenoplectus acutus - Typha domingensis*	
52.122.04	*Schoenoplectus acutus - Typha latifolia*	
52.122.05	*Schoenoplectus acutus - Typha latifolia - Phragmites australis*	
52.122.06	*Schoenoplectus acutus - Xanthium strumarium*	
*52.111.00	***Schoenoplectus americanus* (American bulrush marsh) Alliance**	G5 S3
*52.111.04	*Schoenoplectus americanus*	
*52.111.05	*Schoenoplectus americanus - Eleocharis rostellata*	
*52.111.02	*Schoenoplectus americanus / Argentina egedii*	
*52.111.03	*Schoenoplectus americanus / Lepidium latifolium*	
*52.111.06	*Schoenoplectus americanus / Schoenoplectus californicus - Schoenoplectus acutus*	
52.114.00	***Schoenoplectus californicus* (California bulrush marsh) Alliance**	G5 S4?
52.114.02	*Schoenoplectus californicus*	
52.114.03	*Schoenoplectus californicus - Apocynum cannabinum*	

52.114.04	*Schoenoplectus californicus - Eichhornia crassipes*	
52.114.01	*Schoenoplectus californicus - Schoenoplectus acutus*	
52.114.06	*Schoenoplectus californicus - Schoenoplectus acutus / Rosa californica*	
52.114.05	*Schoenoplectus californicus - Typha latifolia*	
*52.113.00	***Scirpus microcarpus* (Small-fruited bulrush marsh) Alliance**	G4 S2
*52.113.01	*Scirpus microcarpus*	
*52.113.02	*Scirpus microcarpus - Oxypolis occidentalis*	
*52.113.03	*Scirpus microcarpus - Scirpus congdonii*	
43.400.00	***Sedum spathulifolium* (Coast Range stonecrop draperies) Provisional Alliance**	G4? S4?
*42.062.00	***Selaginella bigelovii* (Bushy spikemoss mats) Alliance**	G4 S3
*42.062.01	*Selaginella bigelovii / Eriogonum fasciculatum*	
45.419.00	***Senecio triangularis* (Herb-rich meadows) Alliance**	G4 S4
45.419.04	*Senecio triangularis - Athyrium filix-femina*	
45.419.01	*Senecio triangularis - Lupinus latifolius*	
45.419.05	*Senecio triangularis - Lupinus polyphyllus*	
*52.210.00	***Sesuvium verrucosum* (Western sea-purslane marshes) Alliance**	G3? S2
*52.210.01	*Sesuvium verrucosum*	
*52.210.02	*Sesuvium verrucosum - Cotula coronopifolia*	
*52.210.03	*Sesuvium verrucosum - Distichlis spicata*	
*52.210.04	*Sesuvium verrucosum - Lolium perenne*	
45.420.00	***Solidago canadensis* (Canada goldenrod patches) Provisional Alliance**	G4? S4?
*52.010.00	***Sparganium (angustifolium)* (Mats of bur-reed leaves) Alliance**	G4 S3?
*52.010.01	*Sparganium angustifolium*	
*41.070.00	***Spartina (alterniflora, densiflora)* (Smooth or Chilean cordgrass marshes) Semi-natural Stands**	
41.070.02	*Spartina densiflora*	
*52.020.00	***Spartina foliosa* (California cordgrass marsh) Alliance**	G3 S3
*52.020.02	*Spartina foliosa*	
*52.020.01	*Spartina foliosa - Sarcocornia pacifica*	
*52.030.00	***Spartina gracilis* (Alkali cordgrass marsh) Alliance**	GU S1
*52.030.01	*Spartina gracilis - Sporobolus airoides*	
*41.010.00	***Sporobolus airoides* (Alkali sacaton grassland) Alliance**	G4 S2
*41.010.01	*Sporobolus airoides*	
*41.010.03	*Sporobolus airoides / Allenrolfea occidentalis*	
*41.010.02	*Sporobolus airoides / Ericameria nauseosa*	
*52.107.00	***Stuckenia (pectinata) - Potamogeton spp.* (Pondweed mats) Alliance**	G3G5 S3?
*52.107.02	*Potomogeton spp.*	
*52.107.01	*Stuckenia pectinata*	
*41.600.00	***Swallenia alexandrae* (Patches of Eureka Valley dune grass) Special Stands**	G1 S1
*45.171.00	***Torreyochloa pallida* (Floating mats of weak manna grass) Alliance**	G3 S3?
*45.171.01	*Torreyochloa pallida*	
*45.171.02	*Torreyochloa pallida - Isoetes bolanderi*	
*45.135.00	***Triantha occidentalis - Narthecium californicum* (Western false asphodel - California bog asphodel fens) Alliance**	G2? S2?
*45.135.01	*Triantha occidentalis - Rhynchospora alba*	
*45.135.02	*Triantha occidentalis / Sphagnum teres*	

*45.135.03	*Triantha occidentalis - Narthecium californicum*	
*45.426.00	***Trifolium longipes* (Long-stalk clover meadows) Provisional Alliance**	G3? S3?
*42.005.00	***Trifolium variegatum* (White-tip clover swales) Alliance**	G3? S3?
*42.005.02	*Trifolium gracilentum - Hesperevax caulescens*	
*42.005.01	*Trifolium variegatum*	
*42.005.03	*Trifolium variegatum - Lolium perenne - Leontodon taraxacoides*	
*42.005.04	*Trifolium variegatum - Vulpia bromoides (Hypochaeris glabra - Leontodon taraxacoides)*	
*42.005.05	*(Trifolium variegatum - Vulpia bromoides) - Hypochaeris glabra - Leontodon taraxacoides*	
52.050.00	***Typha (angustifolia, domingensis, latifolia)* (Cattail marshes) Alliance**	G5 S5
52.050.01	*Typha angustifolia*	
52.050.02	*Typha angustifolia - Distichlis spicata*	
52.050.05	*Typha angustifolia - Typha latifolia - Typha domingensis*	
52.050.06	*Typha angustifolia - Typha latifolia - Typha domingensis / Distichlis spicata*	
52.050.07	*Typha angustifolia - Typha latifolia - Typha domingensis / Echinocloa crus-galli*	
52.050.08	*Typha angustifolia - Typha latifolia - Typha domingensis / Phragmites australis*	
52.050.09	*Typha angustifolia - Typha latifolia - Typha domingensis / Schoenoplectus americanus*	
52.050.03	*Typha domingensis*	
52.103.02	*Typha latifolia*	
52.050.04	*Typha latifolia - Typha angustifolia*	
45.423.00	***Veratrum californicum* (White corn lily patches) Alliance**	G5 S4
45.423.02	*Veratrum californicum*	
45.423.03	*Veratrum californicum - Bistorta bistortoides*	
45.423.04	*Veratrum californicum - Juncus nevadensis*	
45.423.01	*Veratrum californicum - Senecio triangularis*	

EXHIBIT 13

EPA United States Environmental Protection Agency

http://water.epa.gov/scitech/methods/cwa/pollutants-background.cfm

Water: CWA Methods

Toxic and Priority Pollutants

Two lists have special significance to water quality regulatory programs in the Clean Water Act (CWA):

- list of toxic pollutants
- list of priority pollutants

List of Toxic Pollutants

Key Features

1. The Clean Water Act references the list of toxic pollutants at §307(a)(1) (also labelled §1317(a)(1)).
2. The list appears in the Code of Federal Regulations at 40 CFR 401.15
3. The list is an important starting point for EPA to consider, for example, in developing national discharge standards (such as effluent guidelines) or in national permitting programs (such as NPDES).
4. The list contains 65 entries. Many of the entries, such as "haloethers," are for groups of pollutants.

Connection between CWA §307(a)(1) and the List of Toxic Pollutants

1. Section 307(a)(1) says, "…the list of toxic pollutants or combination of pollutants subject to this Act shall consist of those toxic pollutants listed in table 1 of Committee Print Numbered 95-30 of the Committee on Public Works of the House of Representatives…"
2. Committee Print 95-30 (November 1977) is titled "Data Relating to H.R. 3199 (Clean Water Act of 1977)."
3. Table 1 is titled "Section 307—Toxic Pollutants." EPA incorporated Table 1 into the Code of Federal Regulations at §401.15.

History of the List of Toxic Pollutants

1. Source of the list: The list was negotiated among parties to a settlement agreement (NRDC et al. vs Train, 6 ELR 20588, D.D.C. June 9, 1976).
2. That settlement agreement is sometimes referred to as the Toxics Consent Decree, or the Flannery Decision (for presiding U.S. District Court Judge Thomas A. Flannery).
3. Congress subsequently ratified the Settlement Agreement and the list of toxic pollutants when they amended the CWA (Public Law 95-217) in 1977.
4. Note to readers: The Congressional Research Service prepared a paper in 1993 on Toxic Pollutants and Clean Water Act EXIT Disclaimer .
5. The list was first published on January 31, 1978 in the Federal Register (43 FR 4108).
6. In a final rule on July 31, 1979 (44 FR 44501), EPA published the list again and added the list to the CFR at 40 CFR 401.15.

Modifications

1. EPA removed three pollutants from the list in 1981, after determining that their chemical properties did not justify their inclusion:
   - *Dichlorodifluoromethane* and *trichlorofluoromethane* were de-listed on January 8, 1981 (46 FR 2266) at the request of E.I. duPont de Nemours and Co. because of low solubility in water and high volatility combined with low human and mammalian toxicity. *Bis(chloromethyl) ether* was de-listed on February 4, 1981 (46 FR 10723) based on data that indicated a half-life in water of 38 seconds at 20°C.
2. De-listing the three pollutants did not change the 65 entries because the three de-listed pollutants were specific compounds within entries for the groups Halomethanes (list entry 38) and Haloethers (list entry 37).

Priority Pollutants

Key Features

Key features of the list of priority pollutants and its relationship to the list of toxic pollutants:

1. The Priority Pollutants are a set of chemical pollutants EPA regulates, and for which EPA has published analytical test methods.
2. The Priority Pollutant list makes the list of toxic pollutants more usable, in a practical way, for the purposes assigned to EPA by the Clean Water Act. For example, the Priority Pollutant list is more practical for testing and for regulation in that chemicals are described by their individual chemical names. The list of toxic pollutants, in contrast, contains open-ended groups of pollutants, such as "chlorinated benzenes." That group contains hundreds of compounds; there is no test for the group as a whole, nor is it practical to regulate or test for all of these compounds.

Derivation

Starting with the list of toxic pollutants, EPA used four criteria to select and prioritize specific pollutants:

1. We included all pollutants specifically named on the list of toxic pollutants;
2. There had to be a chemical standard available for the pollutant, so that testing for the pollutant could be performed;
3. The pollutant had to have been reported as found in water with a frequency of occurrence of at least 2.5%, and
4. The pollutant had to have been produced in significant quantities, as reported in Stanford Research Institute's 1976 Directory of Chemical Producers, USA.

Number of Entries

Originally, there were 129. When three pollutants were removed from the list of toxic pollutants in 1981 (see above), they were also removed from the Priority Pollutant list.

1. Entry numbers 17, 49, and 50 were removed.
2. The last number on the list is still 129, although there are 126 entries.

Publication

Why is the Priority Pollutant list published at 40 CFR 423, Appendix A, rather than at section 401, or some other, more general section?

1. One of the first industrial categories for which EPA developed effluent regulations was the Steam Electric Power Generating Point Source Category. The Priority Pollutant list was included to support regulations for that category.
2. Although the other sections within part 423 apply only to Steam Electric Power Generating, the Priority Pollutant list in Appendix A is not limited in terms of its relevance to that one industrial category.
3. Some users find it helpful to think of Appendix A to Part 423 as a convenient storage place for the list, or as a matter of convenience for citation.
4. The list of Priority Pollutants can be found here.

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