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April 30, 2008

Attention: Karen Niiya
State Water Resources Control Board
Post Office Box 2000
1011 I Street, 14th Floor
Sacramento, CA 95814

Re: Draft North Coast Instream Flow Policy

Dear Ms. Niiya:

Please find attached hereto "A Critical Review of the December 2007 State Water Resoruces Control Board Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams and Supporting Documents." These comments on the Draft North Coast Instream Flow Policy have been prepared by the engineering firm of Wagner & Bonsignore, Consulting Civil Engineers. We appreciate the opportunity to inform the State Water Board members and staff on water resource and water right matters related to the five county north coast area identified in AB2121. Our comments transmitted herewith are included with the May 1, 2008 submittal by Wagner & Bonsignore Engineers and the law firms of Kronick, Moskovitz, Tiedemann & Girard, P.C. and Ellison, Schneider & Harris, LLC.

We thank you for your consideration.

Very truly yours,

WAGNER & BONSIGNORE
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A Critical Review of the December 2007 State Water Resources Control Board Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams and Supporting Documents

Prepared by

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April 30, 2008

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A Critical Review of the December 2007 State Water Resources Control Board Draft Policy for Maintaining Instream Flows in Northern California Coastal Streams and Supporting Documents

The following comments are in review of the "Policy for Maintaining Instream Flows in Northern California Coastal Streams" (Draft Policy), Substitute Environmental Document (SED), and Scientific Basis and Development of Alternatives Protecting Anadromous Salmonids (Scientific Basis) as well as data files and analyses from which these documents were developed that were provided by the State Water Resources Control Board (State Water Board) staff upon request of Wagner & Bonsignore Consulting Civil Engineers (Wagner & Bonsignore Engineers).

1.0 LIMITING FACTOR ANALYSIS WAS NOT CONDUCTED

A limiting factor analysis was not conducted to establish that wintertime flows are a factor limiting anadromous salmonid viability in the North Coast region. In fact, on page 2-1 of the Scientific Basis, it states "*… instream flows during* [the late spring, summer, and early fall] *are generally limiting anadromous salmonid rearing habitat and quality in the Policy area (e.g., SEC et al. 2004).*" Accordingly, the Draft Policy acknowledges that winter time flows affecting spawning, passage and incubation are generally <u>not</u> the limiting factors affecting anadromous salmonid viability, and yet the Draft Policy does not address the factors affecting summer rearing habitat including insufficient summertime flows (or excessive summertime flows on Dry Creek below Lake Sonoma) or assess when a change in wintertime passage or spawning opportunity would not impact overall viability.

The Napa River Basin Limiting Factors Analysis, by Stillwater Sciences and Dietrich (2002), states "*Empirical and theoretical evidence suggests that spawning gravel quality and quantity are rarely the primary factors limiting population levels of species such as steelhead and resident trout because a relatively limited amount of successful spawning is capable of seeding large amounts of rearing habitat (Elliot 1984*)" [page ES-16]. The Navarro Watershed Restoration Plan (1998) states "*the distribution of coho salmon does not appear to be limited strictly by habitat conditions, but is also related to the limited dispersion of adults into the watershed which may be more of a function of the small numbers of the returning adult population*" [page 4-29]. In addition to summertime flows and temperatures, other factors such as ocean temperatures, harvesting, logging practices, and construction of major dams all impact salmonid survival and the Scientific Basis does not establish that wintertime passage, spawning or incubation are limiting factors.

2.0 DRAFT POLICY REPRESENTS OVERLY RESTRICTIVE SCREENING CRITERIA

The Draft Policy puts forth "regional criteria" which are supposedly intended to identify projects that are protective of anadromous salmonid habitat. The regional criteria, however, were developed as one-size-fits-all criteria that are intended to identify, without site-specific study, those projects that would not impact anadromous salmonids. The regional criteria are so restrictive that most pending applications for water rights in the Policy area will fail and be forced into either a site-specific variance analysis (Section 4.1.8 of the Draft Policy) or an exception (Section 13.0 of the Draft Policy. Even then, the Policy direction for site-specific analyses presumes the regional criteria as the standard of protectiveness from which the variance analysis has a burden to refute.

2.1 Most Projects Would Fail Under the Draft Policy

There are several reasons, described in detail in this report, why most pending projects (as well as future projects) will fail the regional criteria claimed to be the measure of salmonid protectiveness by the Draft Policy. The minimum bypass requirement is one reason. Developed on larger streams to provide maximum spawning habitat, erroneously applied to small watersheds where salmonid habitat is not present, then inflated with the intent that the requirement exceed the optimum flow for spawning in 95 percent of sites studied, the minimum bypass requirement allows diversions during only a few days per year.

The maximum cumulative diversion (MCD) rate restriction is another reason why the Draft Policy would allow permitting of very few pending applications. The MCD was developed from a simplistic conceptual model that ignores geology and scale differences in small upland watersheds and includes an arbitrary 5 percent threshold without basis or sensitivity analysis. The maximum cumulative diversion requirement would not allow small reservoirs to be filled when flows are high, negating the very reason for storage.

These diversion restrictions will dramatically reduce project yield. This reduced yield, combined with costs of compliance such as moving dams offstream or constructing elaborate bypasses to effectively move them offstream, will cause many irrigation projects to become non-economic.

2.2 Variance Analysis is not a Solution

The Draft Policy provides for site-specific analyses to support a variance in the event that a pending application fails the regional criteria. However, the Draft Policy direction for a site-specific analysis makes clear that the regional criteria are the presumptive standard of protectiveness even under a variance. Recent experience with pending applications before the State Water Board has taught that the proposed regional criteria are likely to be applied as absolute requirements. Although the 2002 DFG-NMFS "Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams" (Draft Guidelines) were intended to "provide standard recommended protective terms and conditions to be followed in the absence of site-specific, biological, and hydrologic assessments," they have been applied as the sole measure of protectiveness. Accordingly, only a handful of projects have been permitted under the Draft Guidelines.

The Draft Policy fails to provide direction for how to conduct a biologically-based, site-specific analysis for salmonid protection. Useful direction for analysis might take the form of biologically-based criteria or it could take the form of scientific issues to be addressed. The direction in the Draft Policy for a variance analysis is little more than recapitulation of the regional criteria. Because most projects will not be able to meet the regional criteria and because the site-specific analysis presumes the regional criteria as the measure of protectiveness, most projects will fail and the backlog of pending water right applications will not be cleared.

3.0 DFG-NMFS 2002 DRAFT GUIDELINES ARE NOT A BASIS FOR THE DRAFT POLICY

In many respects, the 2007 Scientific Basis and Draft Policy resemble and rely upon the 2002 Draft Guidelines. For example, both presented regional screening criteria for identifying projects that clearly would not affect salmonids, without presenting biologically-based, site-specific criteria for identifying the threshold between protectiveness and non-protectiveness. When it came to the issue of maintenance of stream morphology suitable for salmonids (discussed in a following section of this report), the Scientific Basis acknowledged there was no clear basis for "*the level of change in channel morphological response that would adversely affect salmonid habitat and production*" and so adopted the 5 percent of 1.5-year flow concept posited in the Draft Guidelines.

This, however, cannot be justified because the Draft Guidelines were not formally adopted by the State Water Board. While this is acknowledged on page 1-2 of the Scientific Basis, on page 1-1, the Scientific Basis states "*<u>In developing the Policy</u>, Water Code section 1259.4 authorizes the State Water Board to consider the Draft "Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams," which were developed by the California Department of Fish and Game (DFG) and National Marine Fisheries Service (NMFS) in 2002, referred to from here forward as the "DFG-NMFS (2002) Draft Guidelines"* [emphasis added].

This seems to confirm that Water Code section 1259.4 is being interpreted by State Water Board staff to mean that the Draft Guidelines are to be used to develop the Draft Policy. However, this is not what the Water Code directs. It states "*Prior to the adoption of principles and guidelines pursuant to subdivision (a), the board may consider the 2002 "Guidelines for Maintaining Instream Flows to Protect Fisheries Resources Downstream of Water Diversions in Mid-California Coastal Streams" <u>for the purposes of water right administration</u>*" [emphasis added].

Water Code section 1259.4 doesn't direct use of the Draft Guidelines in developing the Policy. It says that the Draft Guidelines can be used for water right administration prior to adoption of the Policy. This is an important distinction because the Draft Guidelines were never formally adopted. The same problems that make the Draft Guidelines inapplicable to small watersheds make the Draft Policy inapplicable to small watersheds. There is no valid basis to use the Draft Guidelines or its concepts for developing or evaluating the Draft Policy.

4.0 NUMBER AND VOLUME OF UNAUTHORIZED STORAGE VOLUME WAS OVERSTATED

The report by Stetson Engineers Inc., entitled "Potential Indirect Environmental Impacts of Modification or Removal of Existing Unauthorized Dams" ("Unauthorized Dam Analysis") dated December 2007 is contained in Appendix E of the Substitute Environmental Document for the State Water Board's Draft Instream Flow Policy. The Unauthorized Dam Analysis sets forth the estimated number of unauthorized dams in the Policy area and the estimated amount of storage volume impounded by unauthorized dams. While the expressed purpose of the Unauthorized Dam Analysis is to disclose potential indirect impacts in the event that dam owners cannot comply with the Draft Policy, the information presented can be referenced for other evaluations related to the Draft Policy, and hence the importance of disclosing accurate information goes beyond the specific intent of the subject report.

Table ES-1 of the Unauthorized Dam Analysis indicates that the estimated onstream storage volume of existing unauthorized dams is 58,474 acre-feet. Subsequent tables in the Unauthorized Dam Analysis break this figure down between "unauthorized pending dams" (9,959 acre-feet) and "unauthorized non-filer dams" (48,515 acre-feet). Based on review of the information presented in the Unauthorized Dam Analysis, and review of supporting electronic data transmitted to Wagner & Bonsignore Engineers by the State Water Board staff on April 10, 2008, the computed impoundment volume associated with existing unauthorized onstream storage reservoirs within the Policy area has been greatly overstated. This overestimation results in an erroneous representation of watershed impairment by "pending applicants" and "non-filers" within the Policy area.

In addition to overstating the indirect effects of dam removal/modification, the erroneous values of unauthorized onstream storage may result in misperceptions as to the extent of potential impacts these existing facilities have had on sensitive instream resources. To the extent that misperceptions of existing unauthorized onstream storage influenced the development and scope of the Draft Policy, it is fair to question whether the entire the Policy is based on a false premise, and whether the implementation of the Policy will have any beneficial effect on instream resources whatsoever.

4.1 Error in Quantification of Pending Unauthorized Storage Volume

Section 3.1.2 of the Unauthorized Dam Analysis defines "Impoundment Dams" as those with onstream storage, those with both onstream and offstream storage, and dams with unknown storage locations. "Regulatory Dams" are defined as dams having no storage and only offstream storage. These definitions appear to be contradictory in that both "Impoundment Dams" and "Regulatory Dams" include offstream storage facilities. Table D.1. in Appendix D of the Unauthorized Dam Analysis adds to the confusion, as Footnote 6 is unclear as to how the "offstream" and "unknown storage location" components of the foregoing definition relate to the values listed in the column entitled "Estimated Onstream Storage." For this review, it was assumed that the column in Table

D.1. entitled “Estimated Onstream Storage” refers to existing reservoirs that actually impound water in an onstream facility.

Per Section 3.1.1 of the Unauthorized Dam Analysis there are 284 pending applications (that cover 518 unauthorized dams) within the Policy area; the pending applications are identified in Table D.1. Section 3.1.1 of the Unauthorized Dam Analysis states that the number of unauthorized dams named in these pending applications was estimated by assuming that a regulatory or impoundment dam had already been constructed at every point of diversion named in the pending water right applications, unless there was knowledge to the contrary. According to Table D.1, direct knowledge was asserted as to the status of dam construction for only 38 of the 284 pending applications. Based on Footnote 3 of Table D.1., no information was obtained regarding the status of dam construction for the remaining 246 applications, and therefore it was assumed that the dams named in those applications were existing.

Footnote 3 also references existing dams identified by the State Water Board’s illegal reservoir investigation of the Navarro River watershed in 1998, and the results of that investigation constitute many of the aforementioned 38 applications for which construction status was known. The State Water Board also conducted illegal reservoir investigations in the Russian River and Maacama Creek watersheds in recent years, yet information regarding the construction status of dams that were named in applications filed as a result of those investigations was not referenced in Table D.1. Footnote 3 also acknowledges that dams had not yet been constructed for the two pending applications of Redwood Valley County Water District, and therefore those dams were not included as unauthorized pending dams. However, there is no explanation as to how this fact was determined, or why similar information was not investigated for the remaining 246 pending applications.

In Table 7 of the Unauthorized Dam Analysis, unauthorized onstream storage volume is estimated to be 9,959 acre-feet for the entire Policy area (Table D.1. provides a breakdown of onstream storage volume on an individual application basis, with a total of 9,959.9 acre-feet for all applications). Review of this information indicates that this amount is overstated by at least 40 percent, due to the inappropriate inclusion of Applications 29706 and 30579. No onstream unauthorized reservoirs have been constructed for either Application, however, Table D.1. includes them in the total of existing unauthorized onstream storage. With the elimination of these two applications from Table D.1., the amount of unauthorized pending onstream storage is about 5,720 acre-feet, which is only about 57 percent of the 9,959.9 acre-feet reported by in the Unauthorized Dam Analysis.

For perspective, it is noteworthy that the 5,720 acre-feet of existing unauthorized storage is contained in about 308 onstream impoundment dams (based on Table D.1.), which on average equates to about 18.6 acre-feet per reservoir. There are over 3.1 million acres of watershed within the Policy area, therefore, on average there is only one unauthorized pending impoundment dam per 10,000± acres (about 15.6 square miles) of Policy area. If average seasonal runoff over the total Policy area is conservatively assumed to be

1 foot, total seasonal runoff would be 3.1 million acre-feet.[1] The 5,720 acre-feet of pending unauthorized storage represents only about 0.2 percent of the total seasonal runoff volume.

It is also noteworthy that the correct construction status of the two applications that were found to be grossly overstated could have been readily ascertained by a simple review of aerial photographs and State Water Board files. The apparent failure to verify the assumed data for the two largest applications renders the accuracy of other values in Table D.1. highly suspect.

4.2 Errors in Identification of "Non-Filers"

Non-filer dams are discussed in Section 4 of the Unauthorized Dam Analysis. Per Table 9 of the Unauthorized dam Analysis, it is concluded that the estimated number of non-filer dams within the Policy area totals 1,253, noting that two different databases for non-filer dams in Napa County differed by a factor of 2.1 (269 versus 126). The 1,253 total uses the larger of the two Napa County values "*To provide the most conservative (highest) estimate of indirect environmental impacts.*" Table 10 of the Unauthorized Dam Analysis indicates that the estimated onstream storage volume associated with non-filer dams totals 48,515 acre-feet within the Policy area.

In order to assess the reasonableness and accuracy of the methodology described in the Unauthorized Dam Analysis for quantifying non-filers, Wagner & Bonsignore Engineers evaluated supporting information for several specific watersheds within the Policy area as discussed in the following paragraphs.

4.2.1 Maacama Creek Watershed

Maacama Creek is a 70 square mile watershed in Sonoma County tributary to the Russian River, and one that has received much attention from the State Water Board's compliance staff in recent years. Non-filer dams are identified by a GIS ID number shown in the first column of the attached Table 4-1. The second column of Table 4-1 (attached) shows the reservoir surface area for each non-filer based on the GIS "polygon" data provided by the State Water Board staff. In accordance with the methodology described in the Unauthorized Dam Analysis, the purported volume of the non-filers was computed based on the assumption that the average depth of a reservoir is 15 feet (further commentary below). Based on this methodology, the total volume associated with non-filer dams in the Maacama Creek watershed would be 397 acre-feet.

The last column in Table 4-1 (attached) provides information contradicting the asserted non-filer status for 5 purported non-filers. According to State Water Board files, 4 of the

[1] Evaluation of historical USGS gage data indicates that seasonal runoff averages about 2 acre-feet per acre for watersheds above the following gages, collectively representing about half of the total Policy area: the Russian River nr Guerneville, Navarro River nr Navarro, Mattole River nr Petrolia, Napa River nr Napa, Noyo River nr Ft. Bragg, Garcia River nr Pt. Arena, Petaluma River at Petaluma, Salmon Creek at Bodega, and Albion River nr Comptche.

5 non-filers are licensed, permitted, or registered, and hence should not be included in the non-filer total. The fifth non-filer is an off-stream reservoir that has been verified by State Water Board staff as being offstream, and therefore should not be included in the non-filer total.[2] When the 5 incorrect non-filers are removed, the estimated total non-filer volume for the Maacama Creek watershed drops from 397 acre-feet to about 113 acre-feet, or about 28.5 percent of the total based on Unauthorized Dam Analysis methodology for this watershed.

4.2.2 Anderson Creek Watershed

Wagner & Bonsignore Engineers has conducted detailed hydrologic operational studies for Anderson Creek tributary to the Navarro River in Mendocino County. The specific scope of the analysis was Anderson Creek reckoned immediately downstream of the confluence with Con Creek, which is a watershed of 40.1 square miles. This watershed includes the "Anderson Creek Group" which is a group of 12 pending applications, under nine separate ownerships, that State Water Board staff has agreed to evaluate and process collectively.

Non-filer dams are identified by a GIS ID number shown in the first column of the attached Table 4-2. The second column of Table 4-2 (attached) shows the reservoir surface area for each non-filer based on the GIS "polygon" data provided. The purported volume of the non-filers was computed based on the assumption in the Unauthorized Dam Analysis that the average depth of a reservoir is 15 feet. Based on this methodology, the total volume associated with non-filer dams in the subject watershed would be 97.3 acre-feet.

The last column in Table 4-2 provides information contradicting the asserted non-filer status for 5 of the 7 purported non-filers. Three of the 7 non-filers are a permitted right, a pending application, and a registered stockpond, respectively. Two of the 7 non-filers are off-stream storage reservoirs. When the 5 incorrect non-filers are removed, the estimated total non-filer volume for the subject watershed drops from 97.3 acre-feet to about 32.5 acre-feet, or about 33 percent of total based on Unauthorized Dam Analysis methodology.

4.2.3 Fagan Creek Watershed

The Unauthorized Dam Analysis identifies three non-filers in the Fagan Creek watershed, tributary to the Napa River in the Carneros region of south Napa County. As shown in the attached Table 4-3, based on the acreages assigned to non-filer ponds in the GIS database and the assumption of an average depth of 15 feet, the estimated non-filer volume for Fagan Creek would be 69.2 acre-feet.

As listed in Table 4-3 (attached), the Unauthorized Dam Analysis assigned non-filer status to two water bodies situated on the Chardonnay Club Golf Course. It is Wagner & Bonsignore Engineers' understanding that water features on the Chardonnay Club Golf

[2] See State Water Board files for Application 30802.

Course are supplied by treated effluent obtained from the Napa Sanitation District, and hence should not be included in the non-filer total.[3] As shown in Table 4-3 (attached), when the two incorrect non-filers are removed from the data base, the estimated volume of unauthorized onstream non-filers in the Fagan Creek watershed drops from 69.2 acre-feet to 7.1 acre-feet, or about 10 percent of the total based on Unauthorized Dam Analysis methodology.

4.2.4 Conn Creek above Lake Hennessey

The Unauthorized Dam Analysis identifies 15 non-filers in the Conn Creek watershed, tributary to the City of Napa's Lake Hennessey in Napa Valley. As shown in the attached Table 4-4, based on the acreages assigned to non-filer reservoirs in the GIS database and the assumption of an average depth of 15 feet, the estimated non-filer volume for the subject watershed would be 354.9 acre-feet.

The last column in Table 4-4 provides information contradicting the asserted non-filer status for 5 purported non-filers. According to State Water Board files, 4 of the 5 non-filers are licensed or permitted, and hence should not be included in the non-filer total. The fifth non-filer is an off-stream reservoir that appears to be part of the Angwin Pacific Union College's wastewater treatment plant, and therefore should not be included in the non-filer total. When the 5 incorrect non-filers are removed, the estimated total non-filer volume for the subject watershed drops from 354.9 acre-feet to about 90.4 acre-feet, or about 25.5 percent of total based on Unauthorized Dam Analysis methodology for this watershed.

4.2.5 Watershed Tributary to Lake Sonoma

The Unauthorized Dam Analysis identifies 8 non-filers in the watershed tributary Lake Sonoma (Warm Springs Dam) located on Dry Creek, tributary to the Russian River in Sonoma County. As shown in the attached Table 4-5, based on the acreages assigned to non-filer reservoirs in the GIS database and the assumption of an average depth of 15 feet, the estimated non-filer volume for the subject watershed would be 779 acre-feet.

The last column in Table 4-5 (attached) provides information contradicting the asserted non-filer status for 3 purported non-filers. Review of the USGS 7.5-minute quad map indicates that the two of the non-filers are assigned to portions of Lake Sonoma (which is operated under rights granted to the Sonoma County Water Agency), and the third non-filer is assigned to a small pond that predates the construction of, and is now submerged by, Lake Sonoma. When the 3 incorrect non-filers are removed, the estimated total non-filer volume for the subject watershed drops from 779 acre-feet to 89 acre-feet, or about 11.4 percent of total based on Unauthorized Dam Analysis methodology for this watershed. The misidentification of a portion of Lake Sonoma as an unauthorized non-filer is a gross error and a troubling oversight in the GIS analysis.

[3] http://www.napasanitationdistrict.com/treatment/recycled.html

4.2.6 Napa River Flood Plain

Figure A.2 of the Unauthorized Dam Analysis shows the results of "GIS Study #1" identifying onstream reservoirs in Napa County. Non-filer onstream reservoirs are shown as brown polygons on Figure A.2, and two relatively large non-filer polygons are shown towards the southerly end of the County study area. The GIS data transmitted by the State Water Board assigns GIS Res ID Numbers 862 and 911 to the two polygons, and collectively the two have a surface area of 281.7 acres. Per the methodology described in the Unauthorized Dam Analysis, applying an average depth of 15 feet to these areas results in an estimated unauthorized storage volume of about 4,226 acre-feet (see attached Table 4-6), or about 42 percent of the unauthorized non-filer volume for Napa County shown in Table 10 of the Unauthorized Dam Analysis.

Based on aerial photographs and (numerous personal observations when crossing the Highway 29 bridge over the Napa River located immediately south of the alleged GIS onstream reservoirs), there are no reservoirs at the locations identified in the GIS data. The polygon areas shown for ID Nos. 862 and 911 appear to be a flood plain for the Napa River that may be farmed in the non-flood season. Accordingly, it appears that these two areas should not be considered unauthorized onstream non-filer storage reservoirs, and the volume of unauthorized non-filer storage for Napa County (and for the Policy area) should be reduced by 4,226 acre-feet. The misidentification of the Napa River flood plain as an unauthorized non-filer is a surprising oversight in the GIS analysis.

4.2.7 Summary

The table below summarizes the results of Wagner & Bonsignore Engineers' limited review of alleged non-filer on-stream storage volume discussed in the foregoing sections:

Location	**Volume per Unauthorized Dam Analysis (UDA)** (af)	**Corrected Volume**	
		Acre-feet	**As a % of UDA**
Maacama Creek watershed	397	113	28.5%
Anderson Creek watershed above Con Creek confluence	97.3	32.5	33.4%
Fagan Creek watershed	69.2	7.1	10.3%
Conn Creek watershed	359.4	90.4	25.5%
Lake Sonoma Watershed	779.0	89.0	11.4%
Napa River flood plain	4,226.1	0	0%
Total	**5,928**	**336**	**5.7%**

Based on the foregoing, of the 5,928 acre-feet of non-filer storage volume determined from the methodology in the Unauthorized Dam Analysis for these six watersheds, only 336 acre-feet are correct. The remaining 5,592 acre-feet is in error and should be deducted from the alleged total non-filer volume of 48,515 acre-feet presented in Table 10 of the Unauthorized Dam Analysis. It is troubling that in these six watersheds alone, the Unauthorized Dam Analysis overstated the amount attributed to non-filers by 94 percent, and several of the errors (misidentification of portions of Lake Sonoma and the Napa River flood plain as non-filer reservoirs) are particularly egregious. Accordingly, the accuracy of the identification of non-filer diverters within the entire Policy area as presented in the Unauthorized Dam Analysis is highly questionable. The magnitude and pervasiveness of errors provide ample justification for discounting the suitability of the Unauthorized Dam Analysis for support of the Draft Policy

4.3 Non-Filers Upstream of Permitted and Licensed Municipal Water Supply Reservoirs

Section 4.4.2 of the Draft Policy describes principles by which the State Water Board may consider approving an onstream dam on a Class II stream under Draft Policy. Among these principles is the condition that the subject dam be located upstream of an existing permitted or licensed reservoir that provides municipal water supply, and provided the existing municipal supply reservoir does not have fish passage facilities and it is not feasible to construct fish passage facilities.

There are at least 7 municipal supply reservoirs within the Policy area that could fall within the subject allowance:

Reservoir Name	County	Stream Name	Capacity* (af)	Dam Height* (ft)
Lake Mendocino	Mendocino	East Fork Russian River	122,400	164
Bell Canyon	Napa	Bell Canyon Creek	2,530	95
Lake Hennessey	Napa	Conn Creek	31,000	125
Milliken Reservoir	Napa	Milliken Creek	1,980	110
Rector Reservoir	Napa	Rector Creek	4,587	164
Kimball Reservoir	Napa	Kimball Creek	344	80
Lake Sonoma	Sonoma	Dry Creek	381,000	319

* Per DWR Bulletin 17-00, *Dams Within Jurisdiction of the State of California, July 2000.*

None of the foregoing facilities have fish passage facilities. Given the heights of the dams for the foregoing municipal supply reservoirs, construction of fish passage facilities would appear to be infeasible, and therefore onstream storage dams upstream of the these facilities would be allowed on Class II streams under the Draft Policy, provided the other principles are met.

The GIS data for Unauthorized Dam Analysis identifies a number of non-filers in the watersheds of the foregoing municipal reservoirs. The attached Tables 4-7 through 4-12 each quantifies the onstream non-filer volume in each tributary watershed (excluding Kimball Reservoir) based on the surface areas assigned to non-filer reservoirs in the GIS database and the assumption of an average depth of 15 feet. The table below summarizes non-filer volume for watersheds above the 7 municipal supply reservoirs:

Reservoir Name	**Watershed Non-filer Volume (af)**
Lake Mendocino	521.7
Bell Canyon	51.7
Lake Hennessey	1,086.0
Milliken Reservoir	6.8
Rector Reservoir	1.0
Kimball Reservoir	0
Lake Sonoma	779.0
Total	**2,446.2**

Because the Draft Policy provides a special dispensation from conformance with the regional criteria for projects upstream of municipal supply reservoirs, non-filer projects should not be included in the summation of non-filer diversions discussed in Section 4.2 of the Unauthorized Dams Analysis, therefore, notwithstanding the identification errors previous discussed the above the estimated onstream storage volume of 48,515 acre-feet shown in Table 10 of the Unauthorized Dam Analysis should have been reduced by at least 2,446.2 acre-feet (and more if pending unauthorized reservoirs were considered).

4.4 Inaccurate Methodology Used to Estimate Volume of Non-Filer Reservoirs

Section 3.2 of Unauthorized Dam Analysis describes a methodology used to estimate non-filer reservoir volumes based on GIS-determined reservoir surface areas. Non-filer reservoir volume (in units of acre-feet) was computed by multiplying the GIS reservoir surface area (in acres) times the "average depth" of the reservoir (in feet). A value of 15 feet was used for the average depth for all non-filer reservoirs based on an evaluation of information on file at the California Division of Safety of Dams (DSOD) for jurisdictional-size dams within the Policy area having a surface area of 10 acres or less. It appears that the average depth for each reservoir was determined by dividing DSOD's value of reservoir volume by DSOD's value of reservoir surface. The average of the average depths for some 50+ jurisdictional dams was computed to be 15 feet (see Figure 1 in Unauthorized Dam Analysis).

In order to assess the reasonableness of the foregoing approach, the same DSOD database was accessed and used to prepare the attached Table 10-1, which lists some basic physical parameters for all DSOD-jurisdictional dams within Napa, Sonoma, Mendocino, Marin and Humboldt Counties having a reservoir surface area of 10 acres or less. Table 10-1 (attached) includes DSOD's reckonings of "dam height" which is defined as the vertical dimension measured from the lowest outside limit of the dam to the dam crest, and "freeboard" which is the vertical distance from the dam crest to the certified water storage elevation (typically the spillway crest).[4] For purposes of this evaluation the parameter "jurisdictional height" on Table 10-1 (attached) is defined as the difference between the dam height and the freeboard, i.e. it is the vertical distance between the lowest outside limit of the dam and maximum water storage elevation. The table below summarizes average jurisdictional height and reservoir depth for the subject data set:

Parameter	Value
Average jurisdictional height (feet)	36
Average reservoir depth (feet)	16.0

The average depth of 16 feet is reasonably close to the 15-foot average depth used in the Unauthorized Dam Analysis. The difference between the two values may be due to differences in the specific dams sampled in each analysis.

With a few exceptions, the California Water Code defines a DSOD-jurisdictional dam as any artificial barrier that impounds water and which either has a jurisdictional height of 25 feet or more, or impounds 50 acre-feet or more.[5] A subsequent section in the Water Code allows that a dam that impounds 15 acre-feet or less, regardless of height, shall not be considered a DSOD-jurisdictional dam.[6] Although there are some exceptions, it can generally be concluded that DSOD jurisdictional dams impound relatively large volumes (50 acre-feet or more), and/or they are relatively high (25 feet or more). Conversely, non-jurisdictional dams impound less than 50 acre-feet and are relatively low in height, typically less than 25 feet, and therefore well below the aforementioned 36-foot average height for jurisdictional dams in the Policy area having reservoir areas of 10 acres and less.

The Unauthorized Dam Analysis did not quantify which non-filers were of DSOD jurisdictional size and which were not. By law, DSOD shall not approve the construction or enlargement of a jurisdictional dam until the dam applicant demonstrates evidence of adequate water rights.[7] County public works departments within the Policy area are well-acquainted with DSOD jurisdiction when considering grading permits for reservoir projects. Additionally, potential non-filer DSOD-jurisdictional sized impoundments would have been readily identifiable on aerial photographs used for four State Water Board watershed investigations conducted within the Policy area in recent years covering a sizable portion of the Policy area.[8] Accordingly, few if any of the non-filers are likely to be of State-jurisdictional size.

[4] California Department of Water Resources Bulletin 17-00, "Dams Within Jurisdiction of the State of California, July 2000."
[5] California Water Code Section 6002.
[6] California Water Code Section 6003.
[7] California Code of Regulations Title 23, Section 303.
[8] Per Appendix C.1 of Unauthorized Dam Analysis the four watershed investigations were Navarro River and Maacama River [sic] in 1998, Mendocino County Russian River in 2002, and Sonoma County (ongoing).

The Unauthorized Dam Analysis also did not consider any non-jurisdictional dams for estimating typical reservoir depth, and provided no basis for the assumption that the average depth of a reservoir impounded by a DSOD jurisdictional dam is representative of the average depth of reservoir impounded by a non-jurisdictional dam. Rather than rely on DSOD-jurisdictional dam data to estimate impoundment volume for non-jurisdictional dams and reservoirs, the Unauthorized Dam Analysis should have developed a separate dataset for non-jurisdictional facilities. The numerous Reports of License Inspection for existing right-holders contained in State Water Board files would have provided a readily available source for a non-jurisdictional dam dataset. Many of the inspection reports include as-built reservoir capacity maps based on topographic surveys conducted by State Water Board licensing staff. Also, according to Figure 2 in the Unauthorized Dam Analysis, about 92 percent of the unauthorized storage reservoirs in the Policy area have volumes of about 50 acre-feet or less, and thus are far more likely to be non-DSOD jurisdictional size facilities.

The attached Table 4-13 provides a summary of physical properties of 18 licensed non-jurisdictional reservoirs within the Policy area. This sampling is based on copies of State Water Board Reports of Inspection from Wagner & Bonsignore Engineers' files, and though it is a small sample relative to the total number of licensed non-jurisdictional projects in the Policy area, it presents a "cross-section" of projects. For example, reservoir volumes range from 2 to 44 acre-feet, and average 18.9 acre-feet; and jurisdictional heights range from 10 to 29.5 feet, and average 19.9 feet. As also shown in Table 4-13 (attached), the reservoir depth for the 18 non-jurisdictional reservoirs averaged 9.8 feet, or about 10 feet. Accordingly, an average reservoir depth of 10 feet, as indicated above, would be a more appropriate assumption for non-filer reservoirs than an average depth of 15 feet.

Applying the foregoing depth adjustment to Table 10 in the Unauthorized Dam Analysis would reduce the estimated non-filer storage volume by at least 33 percent, and this assumes that the actual number identified is correct, which based on the preceding discussion is now known to be a faulty assumption. Cursory review of just a few watersheds in the Policy area found enough errors that one can fairly assume that the errors in identifying existing illegal rights are pervasive to the Unauthorized Dam Analysis, assuring that the original estimate of 48,515 acre feet is grossly exaggerated. Based on the limited review of six watersheds described herein, the total amount of non-filer storage may be overstated by a factor of about 18, meaning there is less than 3,000 acre-feet impounded in non-filer reservoirs.

4.5 Non-Filer Characteristics Based on State Water Board Investigation

A revealing indication of the amount of water stored in non-filer reservoirs was provided by State Water Board staff on April 25, 2008, in response to an inquiry from Wagner & Bonsignore. Staff indicated that in 2005, as part of ongoing compliance and enforcement efforts, they reviewed records and aerial photography to identify unauthorized existing non-filer dams located within the Russian River watershed in Sonoma County. The investigation resulted in the identification of 842 potential reservoir sites. Of those, 250 have been found to either have another basis of right or were not a facility subject to the State Water Board's jurisdiction. To date, staff inspected 172 of the remaining reservoirs and found that 77 of those required an appropriative water right (95 did not require a water right). There are 420 potential sites still to be inspected. Of those, staff estimated that 90 percent likely hold less than 10 acre-feet.

The State Water Board staff determined in its investigation of the Russian River watershed that over 40 percent of the 842 potential sites reviewed and/or inspected were found to have another basis of right or did not require a water right permit. Staff were unable to readily provide information on the capacities of the 77 reservoirs. Of the remainder to be inspected, 90 percent have been estimated to impound 10 acre-feet and less; the average impoundment size of non-filers would be less than 10 acre-feet. Table 10 of the Unauthorized Dam Analysis estimates that there are 1,253 potential unauthorized non-filer dams within the Policy area, of which 1,076 are estimated to be on Class II and III streams and account for an estimated non-filer storage of 27,536 acre-feet, or about 26 acre-feet per reservoir on average. This per-reservoir value is about 2.5 times that determined by the State Water Board staff based on their investigation of the Russian River watershed (the non-filer storage volume is therefore probably less than 11,000 acre-feet). Thus there is a significant discontinuity between the non-filer total estimated from the GIS analysis and the State Water Board's own evaluation. This is further justification to conclude that the extent of estimated unauthorized storage asserted in the Unauthorized Dam Analysis is grossly overstated.

4.6 Conclusions

- Review of the Unauthorized Dam Analysis indicates that the volume of existing unauthorized storage within the Policy area, asserted to be 58,474 acre-feet, is greatly overstated. The overstated volume presents an inaccurate depiction of existing conditions, and may result in misperceptions as to the impact existing unauthorized storage facilities have had on instream resources. The overstated volume also provides an inaccurate foundation upon which to base an evaluation of indirect impacts associated with dam removal. In fact, if existing unauthorized diversions had been properly evaluated, it may well have been concluded that dam removal and/or retrofitting was not necessary at all.

- The assertion of 9,959.9 acre-feet of unauthorized pending onstream storage volume within the Policy area appears to be grossly overstated due to errors in accounting for two pending applications. Correcting for these two applications reduces the estimated unauthorized pending onstream storage to about 5,720 acre-feet.

- The supporting data for the Unauthorized Dam Analysis contains errors in the identification of non-filer diversions. A review of only 6 watersheds/ geographical areas revealed that the asserted non-filer volume of 5,928 acre-feet in these areas is actually only 336 acre-feet. Based on the nature and pervasiveness of non-filer errors in the few watersheds reviewed, it is reasonable to assume there is a systemic error in the GIS analysis for the Policy area as a whole, and consequently the assertion in the Unauthorized Dam Analysis that there is 48,515 acre-feet of non-filer storage volume throughout the Policy area is greatly overstated, possibly by a factor of 18.

- The total amount of non-filer onstream storage above municipal watersheds is estimated to be 2,246 acre-feet before correcting for misidentified non-filers. Because the Draft Policy allows for the approval of existing reservoirs on Class II streams upstream of municipal supply reservoirs, the amount of non-filer volume within these watersheds should not be included in the total unauthorized onstream storage volume (Tables 10 and 11) and should not be considered in the analysis of indirect impacts.

- The Unauthorized Dam Analysis improperly uses an average depth of 15 feet, associated with relatively large DSOD-jurisdictional dam projects, to estimate storage volumes for smaller non-jurisdictional non-filer projects. Evaluation of 18 licensed non-jurisdictional dams within the Policy area suggests that the average depth of non-jurisdictional facilities is closer to 10 feet. Use of the smaller value would reduce the volume associated with non-filer dams by 33 percent.

- Given the magnitude of actual and potential identification errors in the GIS analysis, coupled with the apparent lack of procedures for verifying the accuracy of assumed data, the State Water Board should conduct a thorough and detailed review of the Unauthorized Dam Analysis. The conclusions reached in the Analysis should not be relied upon for any other analyses associated with the Draft Policy until such verification is completed.

- The unauthorized storage volumes presented in Tables 7, 10 and 11 of the Unauthorized Dam Analysis are grossly overstated and imply that there are significant cumulative impacts associated with unauthorized reservoirs. With reference to the Limiting Factors Analysis discussion presented in Section 1.0 of these comments, there has not been a showing that existing unauthorized storage reservoirs have had significant cumulative effect because:

    1) The great majority of pending unauthorized diversions and non-filer diversions are for wet-season diversions to storage, and do not have a direct impact on fishery resources that have been diminished by lack of dry season flows and diversion of dry season flows in the late spring, summer and early fall;

    2) Tables 7, 10, and 11 aggregate unauthorized diversion for the Policy area as a whole and by political boundaries, i.e. on a county by county basis. Cumulative impacts should instead be evaluated on a watershed basis. A project tributary to the Napa River is not cumulatively impacting the Navarro River. Simply reporting the volume by county, or aggregating

the number into 1,253 projects and 48,515 acre feet, is meaningless in the context of cumulative impacts. The question is simple: cumulative of what?

3) In order to actually determine if the winter diversions are in fact a significant impact on fishery resources, and cumulatively so, the Substitute Environmental Document should identify where projects are located by stream, and evaluate the effects on a watershed basis.

TABLE 4-1

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Maacama Creek Watershed, Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)	Conflict
56	1.50	22.5	
1533	3.22	48.3	Off-stream as determined by SWRCB staff.
1620	8.71	130.7	A014735
1626	0.83	12.4	
1873	0.36	5.4	
2393	0.38	5.7	
2395	0.33	5.0	
2400	1.71	25.6	A021506
2401	0.47	7.0	
2404	0.50	7.5	
2405	0.40	6.0	
2424	0.16	2.4	
2425	0.14	2.1	
2441	0.49	7.3	
2445	0.92	13.8	
2446	0.59	8.9	D030743R
2473	4.67	70.1	A018138
2481	0.24	3.5	
2484	0.16	2.4	
2489	0.70	10.4	
Total		**397.0**	
Total w/o Conflicted		**113.4**	

Note:

(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-2

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Anderson Creek Watershed Reckoned Immediately Downstream of the Confluence with Con Creek, Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)	Conflict
160	0.25	3.8	Off-stream reservoir collecting sheetflow.
161	0.65	9.8	Off-stream reservoir collecting sheetflow.
1645	1.64	24.6	
1652	0.74	11.1	C005427
1821	0.36	5.3	S015554, A030718, A031003
1953	2.32	34.9	A028946, Off-stream
2755	0.53	7.9	
Total		**97.3**	
Total w/o Conflicted		**32.5**	

Note:
(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-3

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Fagan Creek Watershed, Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)	Conflict
532	0.47	7.1	
1047	3.91	58.6	Possible treated wastewater pond
1049	0.24	3.6	Possible treated wastewater pond
Total		**69.2**	
Total w/o Conflicted		**7.1**	

Note:
(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-4

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Conn Creek Watershed Upstream of Lake Hennessey Based on GIS Data Provided by State Water Board

NonFilerpolygon Database		NonFilerPoints Database			
Res ID	**Area (acres)**	**Res ID**	**Area (acres)**	**Estimated Volume (acre-feet)**	**Conflict**
407	2.02	40	1.91	28.7	Granite Lake, A008512A
409	6.07	42	6.17	92.5	Lake Newton, A008512A, A008801A
419	5.67	188	5.72	85.8	A029553, A014204
646	0.31	265	0.87	13.1	
647	1.31	271	1.35	20.3	
653	1.10	43	1.46	22.0	
664	0.30	-	-	4.6	
1158	2.51	26	3.49	52.3	A018055, Cooksley Lake
1159	0.37	31	0.51	7.7	
1160	0.13	190	0.13	2.0	
1162	0.45	194	0.48	7.2	
-	-	126	0.35	5.3	Angwin PUC Sewage Treatment
-	-	239	0.06	0.9	
-	-	242	0.29	4.3	
-	-	279	0.56	8.4	
Total				**354.9**	
Total w/o Conflicted				**90.4**	

Note:
(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-5

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Lake Sonoma Watershed Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)	Conflict
36	0.70	10.6	
1712	0.36	5.5	Part of Lake Sonoma
1935	0.19	2.8	
2055	2.02	30.3	
2057	44.86	672.9	Part of Lake Sonoma
2058	0.78	11.6	Part of Lake Sonoma
2059	2.75	41.3	
2170	0.27	4.0	
Total		**779.0**	
Total w/o Conflicted		**89.0**	

Note:

(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-6

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Wetlands Near the City of Napa, Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)	Conflict
862	215.6	3,233.9	Wetlands Area
911	66.1	992.2	Wetlands Area
Total		**4,226.1**	

Note:
(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-7

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Lake Mendocino Watershed Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)
4	0.62	9.4
5	2.56	38.4
7	0.53	7.9
8	2.72	40.8
11	0.20	3.0
12	0.59	8.8
13	0.70	10.5
1538	1.59	23.9
1539	1.59	23.8
1540	2.87	43.1
1541	2.01	30.2
1542	1.96	29.4
1543	2.18	32.7
1544	0.81	12.1
1844	2.56	38.4
1886	4.84	72.7
1889	0.72	10.9
1892	0.17	2.5
1894	0.16	2.3
1895	1.38	20.7
1910	0.43	6.4
2198	1.79	26.8
2200	0.29	4.3
2201	0.27	4.1
2203	0.78	11.7
2490	0.31	4.7
2507	0.14	2.1
Total		**521.7**

Note:

(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-8

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Bell Canyon Reservoir Watershed Based on GIS Data Provided by State Water Board

NonFilerpolygon Database		NonFilerPoints Database		
Res ID	**Area (acres)**	**Res ID**	**Area (acres)**	**Estimated Volume (acre-feet)**
414	0.24	-	-	3.6
657	0.57	76	1.12	16.8
658	0.54	77	0.38	5.7
660	1.27	80	1.22	18.2
661	0.09	112	0.21	3.1
662	0.28	120	0.29	4.3
Total				**51.7**

Note:

[1] Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-9

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Lake Hennessey Watershed Based on GIS Data Provided by State Water Board

NonFilerpolygon Database		NonFilerPoints Database		
Res ID	**Area (acres)**	**Res ID**	**Area (acres)**	**Estimated Volume (acre-feet)**
401	0.60	135	0.60	9.0
404	2.65	178	2.80	42.1
407	2.02	40	1.91	28.7
409	6.07	42	6.17	92.5
418	0.30	-	-	4.5
419	5.67	188	5.72	85.8
512	0.64	261	0.83	12.4
513	1.67	273	1.85	27.7
514	0.06	278	0.30	4.5
519	0.29	184	0.43	6.5
521	0.46	197	0.48	7.2
523	2.24	222	2.23	33.5
525	0.25	232	0.26	3.8
526	0.10	240	0.08	1.2
527	2.52	234	2.91	43.6
530	1.49	280	2.08	31.3
645	0.54	259	0.68	10.2
646	0.31	265	0.87	13.1
647	1.31	271	1.35	20.3
653	1.10	43	1.46	22.0
659	14.97	74	13.16	197.4
664	0.30	-	-	4.6
1158	2.51	26	3.49	52.3
1159	0.37	31	0.51	7.7
1160	0.13	190	0.13	2.0
1162	0.45	194	0.48	7.2
-	-	126	0.35	5.3
-	-	167	2.22	33.3
-	-	177	0.06	0.9
-	-	198	0.40	6.1
-	-	231	0.06	0.9
-	-	235	0.14	2.1
-	-	239	0.06	0.9
-	-	242	0.29	4.3
-	-	279	0.56	8.4
-	-	293	0.35	5.3
-	-	294	0.17	2.6
-	-	309	0.60	9.0
-	-	325	13.50	202.6
-	-	370	0.21	3.1
-	-	372	2.04	30.7
Total				**1,086.0**

Note:
(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-10

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Milliken Reservoir Watershed Based on GIS Data Provided by State Water Board

NonFilerpolygon Database		NonFilerPoints Database		
Res ID	**Area (acres)**	**Res ID**	**Area (acres)**	**Estimated Volume (acre-feet)**
1250	0.44	474	0.45	6.8
Total				**6.8**

Note:
(1) Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-11

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Rector Reservoir Watershed Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)
426	0.06	1.0
Total		**1.0**

Note:

[1] Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-12

Evaluation of Estimated Volume of Non-Filer Reservoirs Within the Lake Sonoma Watershed Based on GIS Data Provided by State Water Board

Res ID	Area (acres)	Estimated Volume (acre-feet)
36	0.70	10.6
1712	0.36	5.5
1935	0.19	2.8
2055	2.02	30.3
2057	44.86	672.9
2058	0.78	11.6
2059	2.75	41.3
2170	0.27	4.0
Total		**779.0**

Note:

[1] Estimated volume calculated as reservoir surface area in acres multiplied by an average depth of 15 feet.

TABLE 4-13

Summary of Parameters for 18 Licensed Reservoirs within the Draft Instream Flow Policy Area[1]

Application No.	Applicant Name	Reservoir Name	Reservoir Volume (af)	Reservoir Surface Area (ac)	Average Depth[2] (ft)	Jurisdictional Height[3] (ft)	Ratio of Average Depth to Jurisdictional Height	Report of Inspection Date
A013958, A016106	Arata Associates, LTD	-	35	4	8.8	22	0.40	11/7/56, 5/14/59, 11/20/1987
A014092	Powell	-	6.87	1.25	5.5	12.5	0.44	6/13/1960
A017591	Saintsbury	Lee Vineyard	24.3	2.5	9.7	ND	-	4/25/1962
A020733	Kuimelis-Orsi	-	16.53	1.86	8.9	ND	-	3/27/1967
A024609	Acacia Winery	-	11.44	1.4	8.2	15	0.54	6/11/1980
A024644	Gamble	-	11.4	1.2	9.5	29.5	0.32	6/6/89
A024764	Godward	-	24	1.83	13.1	23	0.57	10/2/1992
A025060	Oswald	Bosc Pond	11.3	1.44	7.8	11.5	0.68	7/6/1989
A025061A	Oswald	Main Reservoir	44	2.82	15.6	23	0.68	
A025887	Fitzgerald	A	34.1	3.52	9.7	24.5	0.40	6/17/1989
		B	17.4	1.59	10.9	23	0.48	
A026808	Cain	-	16	1.23	13.0	24.5	0.53	5/21/1987
A027706	Phelps	River Ranch	23.8	2.94	8.1	23	0.35	5/16/1990
A027746	Buena Vista Winery	-	12.04	1.56	7.7	12	0.64	8/13/1990
A027796	Mondavi	Heller	43.5	4.12	10.6	16.5	0.64	10/23/1989
A028640	Brucker et al	No. 2	2	0.239	8.4	18.7	0.45	8/26/93
A028786	Greenfield Ranch	-	8.3	0.85	9.8	22.8	0.43	8/25/93
A029305	Hambrecht	No.1	11	0.88	12.5	22.7	0.55	5/27/1999
		No. 2	7.6	0.71	10.7	23.4	0.46	
A029675	Bachman	-	17.87	2.45	7.3	10	0.73	6/30/1993
Average			**18.9**	**1.9**	**9.8**	**19.9**	**0.52**	

Notes:

(1) Source: copies of State Water Board Reports of Inspection in files of Wagner & Bonsignore Engineers, non-DSOD jurisdciational dams only.

(2) Average Depth is the Stroage Capacity divided by the Surface Area.

(3) Jurisdictional Height is the vertical distance from the lowest outside limit of the dam to the maxmum water storage elevation.

5.0 SMALL WATERSHEDS WERE NOT EVALUATED

The Draft Policy has taken scientific principles and analyses developed and applicable to large watersheds and applied requirements derived therefrom to watersheds of all sizes. This is problematic because most pending applications for onstream reservoirs are located on small watersheds, high in the basin, from which the effects on the downstream hydrology and biota important to anadromous salmonids is minimal.

The Scientific Basis included investigations of 13 “validation sites” ranging in watershed size from 0.25 square miles to 34 square miles. The Scientific Basis also drew upon scientific literature developed for larger streams and rivers where anadromous salmonids are present. The Scientific Basis did not study or account for the processes occurring in small watersheds where most of the pending applications are located. The Draft Policy then failed to propose requirements that recognize differences between large and small watersheds.

5.1 Most Onstream Storage Reservoirs are Located on Very Small Drainage Areas

Most applications pending before the State Water Board for onstream storage in the North Coast area are in watersheds far smaller than those studied in the Scientific Basis. Wagner & Bonsignore Engineers analyzed two samples of drainage area size associated with onstream storage. The first study included all water rights of record in the Maacama Creek basin. Maacama Creek has often been cited as a heavily impaired watershed, though the justification for this claim is not clear. The second study included all onstream reservoirs named in pending applications represented by Wagner & Bonsignore Engineers in the Policy area.

Figure 5-1 (attached) summarizes the drainage areas associated with onstream reservoirs as identified in the State Water Board eWRIMS database in the Maacama Creek drainage. The total number of onstream reservoirs, including pending and permitted/licensed, is 71. The median drainage area size is 53 acres (less than 0.1 sq. mi.). Ninety percent of the drainage areas are less than 320 acres (0.5 sq. mi.). All are less than 550 acres.

Figure 5-2 (attached) summarizes the drainage areas associated with all existing and proposed onstream reservoirs named in pending applications represented by Wagner & Bonsignore Engineers in the Policy area. The total number of onstream reservoirs in this sample is 124. This chart looks similar to the Maacama Creek basin chart. The major difference between the two samples is the large drainage areas associated with a few Wagner & Bonsignore Engineers client projects. Seven of the drainage areas larger than 560 acres are overlapping as they represent a string of seven reservoirs located along Arroyo San Jose Creek in Marin County within a golf course. If the six redundant drainage areas inside of the largest drainage area on the golf course are excluded, the median drainage area of this sample is only 40 acres. Ninety percent of the drainage areas in this study are smaller than 420 acres.

These samples make a compelling case that half of the pending applications for onstream storage involve drainage areas less than 0.09 sq. mile and 90 percent involve drainage areas well less than one square mile. Indeed, the idea that the erosional feature draining 53 acres is a "stream" can be misleading. While dams located across the low point in such a small drainage area may be "onstream" for water rights administration, they are not streams in the usual sense. They do not share many of the qualities associated with larger streams such as aquatic habitat and alluvial beds. The Draft Policy does not recognize differences in scale or the fact that most pending applications are on far smaller watersheds than studied in the Scientific Basis. To the contrary, the Scientific Basis develops criteria based on much larger watersheds and the Draft Policy adopts corresponding regional criteria to apply to all water right applications though the science doesn't apply to the facts on the ground.

5.2 Habitat Analysis Demonstrated Very Limited Spawning Opportunities in Small Watersheds

The Scientific Basis is largely devoted to a habitat analysis. The result of the habitat analysis was that opportunities for salmonid passage and/or spawning are very limited in watersheds of 2.75 square miles or less. This important conclusion was omitted or ignored in the Scientific Basis and Draft Policy.

Thirteen "validation sites" were selected in the Policy area near historical stream gaging stations to evaluate hydrologic and substrate condition suitability for anadromous salmonids. One field investigation was conducted at each site to survey the channel cross section at one or two transects. Using the survey information, a relationship between flow rate and depth, width and velocity of flow was estimated for each transect.

Simplified criteria for wintertime habitat suitability were developed by evaluating the life stage needs of steelhead, coho and Chinook salmon, as summarized in Table G-7. For example, the suitability criteria identify a minimum 0.8-foot depth for steelhead spawning. The habitat analysis then used the historical daily streamflow record; the estimated relationship between flow rate and depth, width and velocity of flow; and the suitability criteria to estimate the number of days that flow was suitable for passage and spawning. Appendix I is the culmination of that analysis.

The validation sites in Appendix I are ordered in increasing size of drainage area. The histograms on the left side of Figures I-2 through I-13 are passage; those on the right side are spawning. The Scientific Basis points out that spawning habitat was a more limiting factor than passage (page 6-1). The Scientific Basis also explains that steelhead have a greater range than coho or Chinook, that is, that steelhead can inhabit smaller, shallower streams. For these reasons, the histogram for steelhead spawning days (the upper right graph) is the indicator of concern in small watersheds.

Figure I-1, which is for the smallest drainage area validation site (EF Russian River tributary), indicates "*Spawning opportunities were not assessed*." More correctly that should state that the field investigation indicated an absence of spawning habitat.[9] Figure I-2, which is for the Dry Creek tributary validation site (with a drainage area of 1.2 sq. mi.), shows 3.5 total days per year as the average opportunity for steelhead spawning under unimpaired flow conditions.

The Scientific Basis, on page G-26, states that "… *it was assumed that a minimum of five days are needed for spawning in both large and small streams*." This implies but does not explicitly state that the five days must be consecutive for successful spawning. The literature indicates that consecutive days are essential for salmonid spawning. However, Appendix I and the Scientific Basis did not complete the evaluation of habitat suitability by investigating consecutiveness. Table 5-1 (attached) provides that evaluation as completed by Wagner & Bonsignore Engineers.[10]

Table 5-1 shows the number of spawning opportunities per year for the four validation sites with the smallest drainage areas: East Fork (EF) Russian River tributary (0.25 sq. mi. drainage area), Dry Creek tributary (1.19 sq. mi. drainage area), Dunn Creek (1.88 sq. mi. drainage area), and Carneros Creek (2.75 sq. mi. drainage area). Because of uncertainty in the number of consecutive days needed for spawning, the evaluation was performed under three separate assumptions. In the first case, it was assumed that five consecutive days are required for spawning. In the second case, it was assumed four consecutive days are required for spawning and in the third case it was assumed that three consecutive days are required.

As Table 5-1 shows, there were zero opportunities for spawning in either the EF Russian River tributary or the Dry Creek tributary. The results for Dunn Creek and Carneros Creek are mixed, depending on the transect used. Indeed, for Carneros Creek, according to Transect 1, there were no opportunities for spawning. According to Transect 2, and if 5 consecutive days are required for spawning, then there was only one opportunity in the four years investigated. Likewise for Dunn Creek, if 5 consecutive days are required for spawning, then according to Transect 1, there were no spawning opportunities and according to Transect 2 there was only one opportunity in the three years investigated.

The conclusion that can be drawn from the habitat analysis, and that should have been stated in the Scientific Basis, is that there is very limited opportunity for salmonid spawning in watersheds of 2.75 square miles or less. The Draft Policy ignored this crucial point.

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[9] The transect notes obtained from Stetson Engineers for this site state "*Does not look like a spawning* (sic)" and "*Passage xsect* (sic) *only*." Eric Oppenheimer of the State Water Board staff stated at the February 6, 2008 Public Workshop that there was no spawning habitat at the EF Russian River tributary validation site.

[10] This evaluation was conducted by Wagner & Bonsignore Engineers based on spreadsheets provided by R2 Resources Inc.

TABLE 5-1
Number of Spawning Opportunities Estimated by Habitat Analysis in Scientific Basis

Validation Site	Drainage area (sq. mi.)	Transect	Years studied	Number of spawning opportunities per year: Total opportunities based on 5 consecutive days required for one opportunity	Total opportunities based on 4 consecutive days required for one opportunity	Total opportunities based on 3 consecutive days required for one opportunity
EF Russian R tributary nr Potter Valley	0.25		3	0	0	0
Dry Cr tributary nr Hopland	1.19		2	0	0	0
Dunn Cr nr Rockport	1.88	Tr 1	3	0	1 opp / 3 yrs	2 opp / 3 yrs
		Tr 2	3	1opp / 3 yrs	2 opp / 3 yrs	4 opp / 3 yrs
Carneros Cr at Sattui	2.75	Tr 1	4	0	0	0
		Tr 2	4	1 opp / 4 yrs	3 opp / 4 yrs	4 opp / 4 yrs

Source: R2 Resource Consultants. Inc. spreadsheets.

FIGURE 5-1
Drainage area of onstream storage rights of record in Maacama Creek watershed

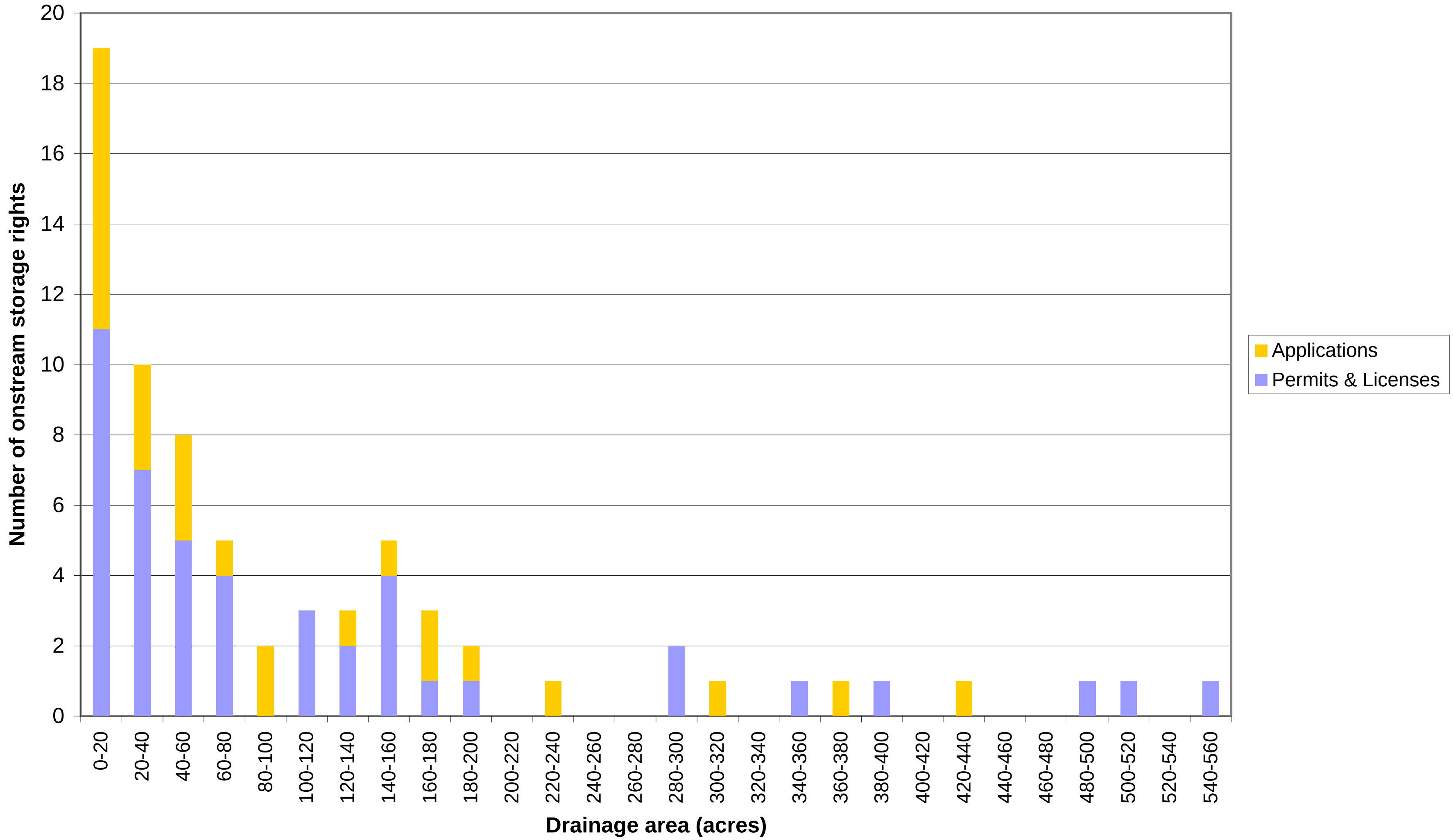
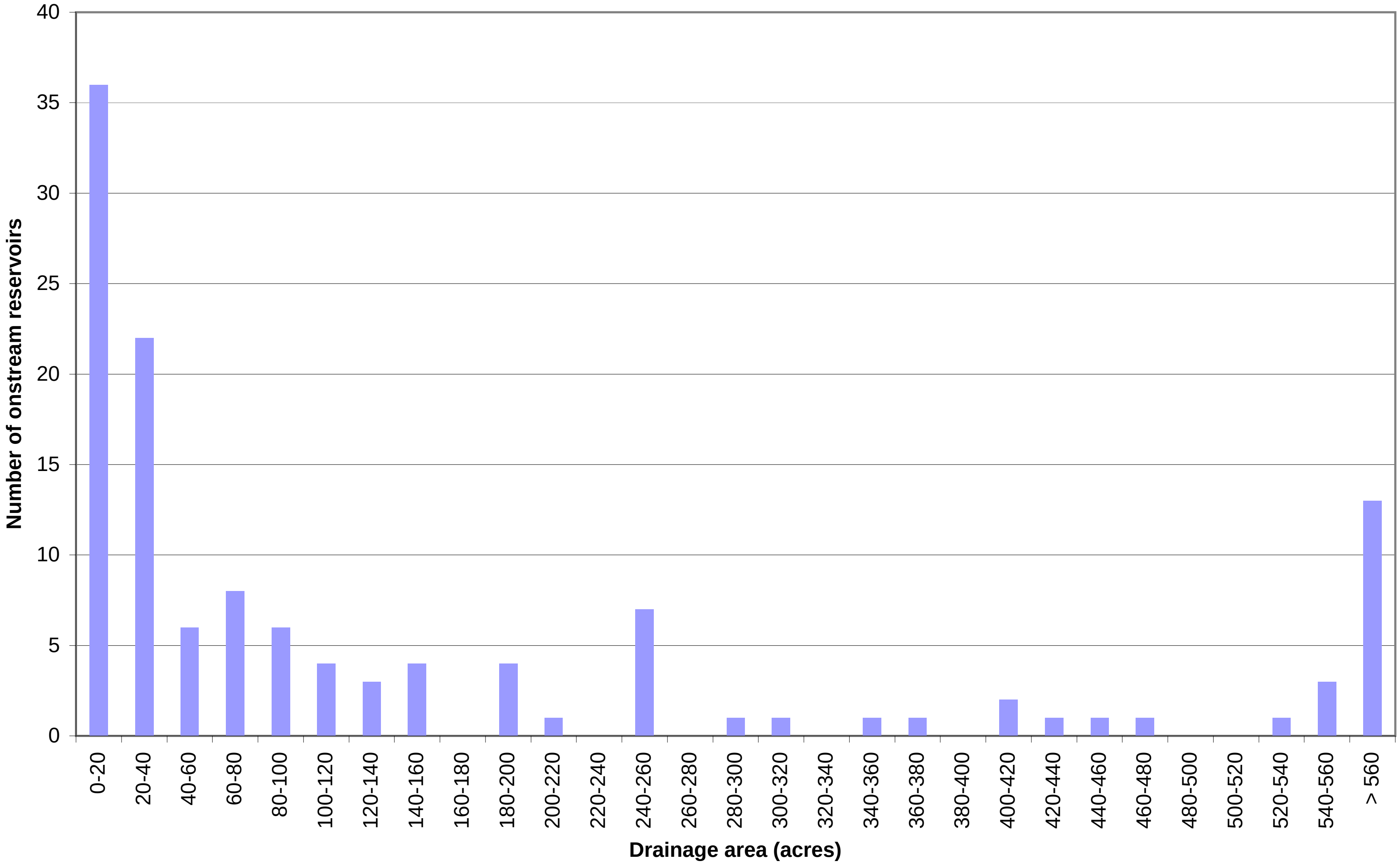


FIGURE 5-2
Drainage areas of existing and proposed onstream reservoirs named in pending applications represented by WBE and within draft Policy area



6.0 BYPASS REQUIREMENT IMPROPERLY DERIVED AND APPLIED

The bypass requirement (MBF3) was incorrectly derived and applied. Great effort went into to identifying optimum flows for salmonids, and then a good deal of effort went into an attempt to show that the optimum flows can be predicted from one variable alone (drainage area). That supposed relationship was then overridden by application of an envelope curve intended to exceed all optimum flow rates. Finally, the envelope curve (MBF3) was extended beyond the range of the data studied to apply to watersheds far smaller than those which support anadromous salmonids.

6.1 Estimation of "Optimum" Flow for Maximum Spawning Habitat is Suspect

The first step was to estimate an optimum[11] flow for anadromous salmonids. This process of selecting and surveying transects at each validation site, developing a relationship between flow and depth of flow at each transect, and developing a relationship between flow and width of channel suitable for passage and spawning are described and presented in Appendices G and H. Figure E-7 of the Scientific Basis (page E-17) illustrates an estimated relationship between flow and suitable width for spawning at a particular transect. The MBF4 flow, approximately 7 cfs, is the lowest flow at which 2 feet of suitable width occurs. The MBF3 flow, approximately 15 cfs, is the lowest flow at which the maximum suitable width for spawning occurs. Above approximately 26 cfs, the suitable width decreases because of excessive velocities.

This figure helps explain that the MBF3 is the minimum flow that provides the maximum habitat. In terms of protection, it is not a minimum, it is a maximum. MBF4, on the other hand, was developed based on provision of only an estimated 2-foot suitable width.

There were many steps involved in arriving at the estimated flow-habitat curves summarized in Appendix H for the validation sites. Each of these steps were an opportunity for error. The first step was to select a transect location in the field to represent that reach of the stream. Of course, stream cross-section is highly variable in the North Coast area. The selection of the specific cross-section influenced the relationship developed between flow and depth of flow.

Additional steps included surveying channel slope[12], developing an idealized cross section of 2-foot widths[13] (see Figure G-5), and estimating the Manning's roughness coefficient. Only one field trip was conducted to each validation site and this was done

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[11] "*Optimum*" is the terminology used in the spreadsheet Qopt-Qaa.xls in which the figures and equations in Appendix E of the Scientific Basis were assembled and created.

[12] From transect information provided by Stetson Engineers, it's interesting to note that after field-surveying a channel slope of 8 percent for the EF Russian River tributary validation site, the authors decided to instead use a 2.5 percent slope based on photographs in subsequent calculations.

[13]Another potential problem lay in application of Manning's equation to 2-foot widths (termed "*cells*" in the Scientific Basis) of the transect cross section. Since Manning's equation is not linear, this is a suspect procedure, which could bias the result. There was no evaluation of the bias resulting from, nor a reference to any peer-reviewed use of, Manning's equation in this manner.

in the dry season. This eliminated the ability to calibrate and verify the estimated relationship between flow, velocity, and depth at each transect.

The next step was to apply the criteria summarized in Table G-7 (pg. G-20) to identify at which flow rates there was sufficient depth and suitable velocity for each of the 2-foot wide segments of the transect cross section. The resulting estimation of suitable flow rates for passage and spawning are shown in Appendix H.

While the effort was large and the difficulties genuine, the limitations of the result must be recognized. Figure H-4 for Carneros Creek illustrates this well. The minimum flow providing maximum width for steelhead spawning (i.e., the optimum flow) is estimated at either 19 cfs or 29 cfs, depending on the transect. That's a large variation in estimate for what is supposed to be the same condition. While the passage transects were intentionally located differently than the spawning transects, the two spawning transects were intended to represent one validation site. Arriving at such widely divergent estimates of optimum flow for a given validation site should prompt caution in further application of this data.

6.2 Drainage Area is not an Adequate Predictor of Optimum Flow

Perhaps because of the expense involved in estimating the optimum flow for anadromous salmonids, the Scientific Basis next attempted to find a way to predict optimum flow throughout the North Coast region from a readily available parameter. The choice of parameter was drainage area. Figure E-4 (p E-11) summarizes recommended minimum instream flows.[14] The recommended flow for spawning was divided by the mean annual flow for plotting on the vertical axis. Drainage area is on the horizontal axis. Note that both axes are logarithmic. Drainage areas range from 3.48 sq. mi. to 6,248 sq. mi. The median is 74 sq. mi. This is far larger than the drainage areas associated with most pending applications for storage in the Policy area.

This plot shows a general trend of greater recommended flow to mean annual flow for smaller drainage areas. But this plot clearly shows that drainage area is insufficient to estimate recommended flow. At any given drainage area, the corresponding recommended flows range widely. For instance, at 70 - 80 sq. mi., the recommended flow ranges from 0.4 or 40 percent of mean annual flow to 5.0 or 500 percent of mean annual flow. It is also instructive to view this same data with linear axes as shown in Figure 6-1 (attached). No manner of statistical analysis is going to make drainage area a good predictor of recommended flow, as shown in Figure E-4.

6.3 Statistical Analysis is Flawed

6.3.1 Data were Discarded because they Disagreed with Hypothesis

Despite the wide range of recommended flows associated with a given drainage area, the Scientific Basis proceeded to perform statistical analyses to derive a relationship between

[14] Several of these data points were incorrectly located.

recommended flow for spawning and drainage area. First, the decision was made to discard some of the data compiled in Figure E-4. The justification for this is not entirely clear but part of the reasoning is provided on page E-14. That is, some of the recommended flows were (a) derived in a manner different than that used for the validation sites and (b) did not follow the expected trend associated with drainage area. In statistical analysis, it is incorrect to discard data for the reason that it does not fit the hypothesis.

6.3.2 Data Discrepancies were Included in Regression

The optimum flows estimated for the validation site transects was combined with recommended flows from Swift, 1976 (one of the studies compiled in Figure E-4) resulting in the data points shown in Figure E-8. Table 6-1 (attached) summarizes the data shown on Figure E-8 and used to derive MBF3.[15] However, some of the validation site data points shown on Figure E-8 and used in the regression don't belong there and some that do belong there are missing. These data discrepancies are detailed in the notes on Table 6-1. Note 2 indicates an apparent extraneous data point included for Dry Creek tributary validation site. All indications (Table G-1, Figure H-2) are that there was only one transect at this location, however, Figure E-8 and the statistical analysis included this second optimum flow. Note 3 indicates that from Figure H-3, the optimum flow for Dunn Creek Transect 1 should be about 26 cfs rather than 18.1 used in the regression analysis. Note 4 indicates that whereas Carneros Creek had two transects, the optimum flow estimated for Transect 1 was omitted from the regression and Figure E-8. Note 5 indicates another inexplicable discrepancy for Carneros Creek between Appendix H and the regression analysis. A request to State Water Board staff on April 9, 2008 for explanation of these apparent discrepancies has not been answered as of April 30, 2008.

6.3.3 Data Points from Validation Sites with no Habitat Included in Regression

The Scientific Basis demonstrated a lack of habitat for anadromous salmonids in watersheds of less than about 2.75 square miles. There simply is not enough naturally occurring (aka unimpaired) flow in small watersheds to create spawning opportunities for steelhead. Taken to an extreme, water would have to be pumped miles uphill in a 24- or 30-inch pipe in order to create the requisite 0.8-foot depth, 2-foot width estimated necessary for habitat. It doesn't make sense to calculate an optimum flow for spawning at sites where there is insufficient natural flow for spawning. The data points for Dry Creek, Dunn Creek, and arguably Carneros Creek should not have been included as data points in the MBF3 regression.

6.3.4 Data Underlying the Regression are Unreliable

As can be seen in Appendix H and in Table 6-1, the estimated optimum flow for a given validation site varies dramatically between transects. With that much variation, i.e. error in estimate, it is not clear that any additional analysis should be based on those data. At

[15] This data was provided to Wagner & Bonsignore Engineers on the spreadsheet Qopt-Qaa.xls and corresponds to the Second Errata of March 15, 2008.

the least, there should be consideration of using the average of the two estimates, or the lower estimate only.

6.3.5 Exponent on Mean Annual Flow was not Tested

In regression analysis, explanatory (aka independent) variables are used to mathematically explain a response (aka dependent) variable. In this case, mean annual flow (Q_{mean}) was incorporated into the response variable. It should have been included as another explanatory variable. The way it was modeled had the effect of forcing the exponent on Q_{mean} to be 1. There is no basis on which to make the presumption that the exponent on Q_{mean} is 1. If Q_{mean} had been modeled as an explanatory variable, the statistical model would have been able to estimate the exponent on Q_{mean}. If correct modeling of the data shows that the exponent on Qmean is significantly different from 1, then the regression result in Appendix E is invalid.

6.3.6 Estimates of Mean Annual Flow are Biased

Mean annual flow is an important variable. Unfortunately, the data sets used to estimate Q_{mean} were very short time periods: one validation site had only 2 years of data, two validation sites had only 3 years of data, two validation sites had only 4 years of data and two validation sites had only 5 years of data. Review of precipitation records reveals these short time frames were not representative of long-term average hydrology; some were wetter, some were drier. Because the Q_{mean} are biased due to the short data record, the model estimation is unreliable.

6.4 Envelope Curve was Intended to Exceed Optimum Flow

After all the foregoing analysis, the authors of the Scientific Basis then shifted the regression curve upward (maintaining the same slope of the line). Figure D-5 (p D-39) illustrates this step. The intent was to draw a line that exceeded 95 percent of all site specific estimates. As stated on page 6-6 of the Scientific Basis, "*Because a regionally protective Policy inherently results in over-protecting some streams (e.g., see Figure D-5 in Appendix D), application of the MBF3 alternative criterion would likely result in many cases where additional study could indicate that lower bypass flows might still be protective*." In other words, the MBF3 criterion was intended to <u>exceed</u> the optimum flow needed for anadromous salmonids.

6.5 Extrapolation of Derived Relationship was Outside of Range of Applicability

The analysis of bypass flow requirements, such as it was, was based on watersheds and stream sizes far larger than almost all pending applications for onstream reservoirs. The smallest watershed, for which an instream flow was recommended, as compiled in Figure E-4, was 3.5 sq mi. The smallest watershed among the validation sites for which habitat was clearly established was 4.9 sq. mi.

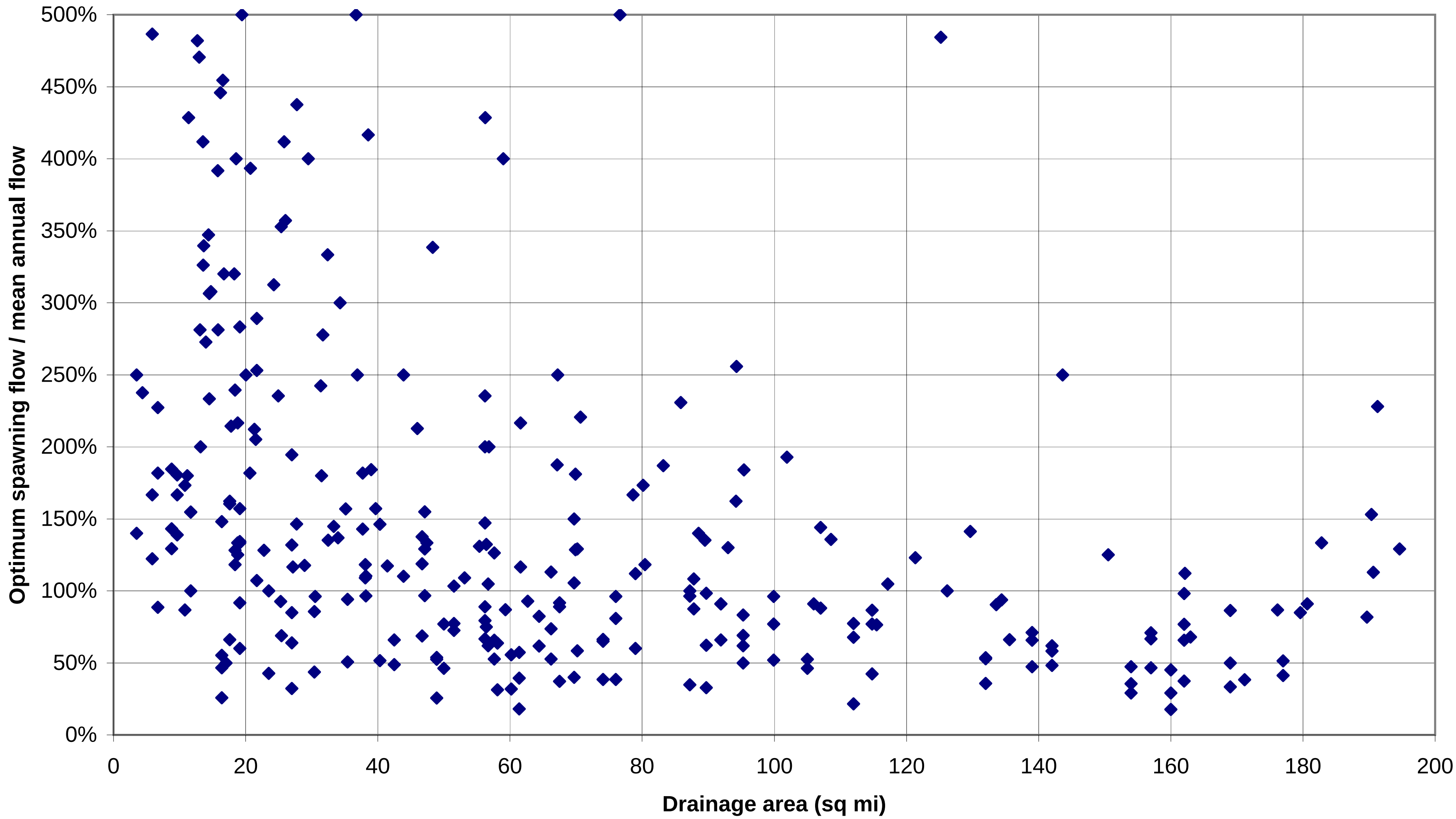
As Figure D-5 illustrates, if there is no "*stream size*," there can be no "*protective flow level*." At some small stream size, there can be no habitat. Figure D-5 recognizes this by showing that, at some small stream size; the "*protective flow level*" bends sharply to zero.

TABLE 6-1
Validation site data used in MBF3 regression analysis

Validation Site	Drainage Area	Mean Annual Flow, Qm	Minimum flow for maximum steelhead habitat		Minimum flow for maximum steelhead habitat	
	(sq mi)	(cfs)	Transect 1 (cfs)	Transect 2 (cfs)	Transect 1 (as % of Qm)	Transect 2 (as % of Qm)
EF Russian trib	0.25	0.13	no habitat (1)	no Tr. 2	no habitat	no Tr. 2
Dry Cr trib	1.19	2.2	19.11	21.24 (2)	869%	965%
Dunn Cr	1.88	2.5	18.1 (3)	21.24	724%	850%
Carneros Cr	2.75	3.8	missing (4)	19.77 (5)	missing	520%
Huichica Cr	4.92	7.4	15.16	no Tr. 2	205%	no Tr. 2
Olema Cr	6.47	13	95.25	55.26	733%	425%
Pine Gulch Cr	7.83	12	no habitat (6)	18.31	no habitat	153%
Warm Springs Cr	12.2	35	29.18	23.1	83%	66%
Santa Rosa Cr	12.5	19	45.38	17.09	239%	90%
Albion R	14.4	20	34.41	66.47	172%	332%
Salmon Cr	15.7	25	25.84	24.19	103%	97%
Franz Cr	15.7	24	71.85	19.13	299%	80%
Lagunitas Cr	34.3	72	116.83	38.49	162%	53%

Notes
(1) - From App H and SWRCB Public Workshop, no spawning habitat.
(2) - No such Transect 2.
(3) - Fom App H, should be about 26 cfs.
(4) - From App H, should be about 19 cfs
(5) - From App H, should be about 29 cfs.
(6) - From App H, no spawning habitat.

FIGURE 6-1
Recapitulation of Scientific Basis Figure E-4 using linear axes
(showing drainage areas less than 200 sq mi and Qopt / Qm less than 500%)



7.0 CHANNEL MAINTENANCE FLOW REQUIREMENT NOT SUPPORTED

Channel maintenance flows may be justified in areas of anadromy to maintain channel width suitable for spawning and to maintain gravels without fine sediment suitable for redd construction. Flow recommendations to accomplish these objectives can conflict. High flows to eliminate encroaching vegetation will also scour out beneficial gravels. Moderate flows suitable for removing fines at one location will remove gravels at another location in the channel where velocities are greater. Because of the inherent conflict in prescribing a beneficial flow for channel maintenance, the Scientific Basis defaulted to the concept that natural flows are best and any deviation could be harmful, and thus must be disallowed. Appendix D of the Scientific Basis puts forth a simplistic view of sediment transport in streams and the Draft Policy builds upon this simplified conceptual model. However, this simplification is inadequate to the task.

7.1 Flushing Flow Recommendations are Complicated, Site-Specific and a Compromise Among Objectives

The Scientific Basis for the Draft Policy basically rests on the idea that whatever flows occur naturally are, without question, somehow optimal for achieving suitable channel width and substrate. However, when the burden of analysis is not simply to say, "leave it essentially untouched" but rather to affirmatively propose beneficial flushing flows below an impoundment, the complexity is revealed.

Rieser, Ramey and Wesche (1989), in "Flushing Flows" state "*No standard method or approach has been developed for* [determination of a flushing flow recommendation] *and it is unlikely one will ever be developed. There are simply too many variables and interactive parameters to allow the formulation of a single method applicable for all stream systems for all purposes*."

Ligon, Dietrich and Trush (1995), in "Downstream Ecological Effects of Dams" state "… *Derivation of a flow regime is essential, but we believe that it is unlikely that a general method can be found that is applicable to all or even most streams, because the necessary flow regime depends critically on the geomorphic conditions and processes of the river* …". They also caution that "*Fluvial geomorphology is not at the point where one can conceptually take apart a river and understand how all of its morphological and process variables interrelate and then put it all back together in a predictive model*."

Wilcock, Kondolf, Matthews and Barta (1996), in "Specification of sediment maintenance flows for a large gravel-bed river" state, "… *a discharge cannot both minimize gravel transport and maximize sand transport* …" and "*[s]pecification of a flushing flow necessarily represents a compromise among gravel loss, sand removal, and water volume*."

Flow rates that remove fine sediment from gravels will wash out gravels at another location in the stream. Bankfull flows that eliminate encroaching vegetation also deposit sands and gravels in new locations. The simplistic view that more flow is better and less flow is worse is not true.

7.2 Channel Width not a Simple Function of Flow

Knighton (1998), points out that in Williams and Wolman's (1984) comprehensive study titled "Downstream Effects of Dams on Alluvial Rivers" they found there was an increase in channel width below dams in 46 percent of the cases they studied. Williams and Wolman conjectured that could be the result of less sediment in the flow below the dam resulting in greater capacity to entrain sediment from the bed and banks.

Even if channel width is decreased due to upstream impoundment of streamflow, that narrowed channel may result in increased depth of flow and thus greater passage and spawning opportunities (as noted on page 7-5 of the Scientific Basis).

The Navarro Watershed Restoration Plan (1998) prepared by Entrix, Inc. and others found that streams are undergoing a slow process of narrowing as they recover from historical logging practices.

7.3 Simplistic Approach used in Scientific Basis is Unsupported

In Appendix D of the Scientific Basis, the authors assert that stream width, depth and grain size can be determined as a simple function of discharge. However, the study upon which this claim is based, Parker, et al (2003), is inapplicable to onstream reservoirs. The article clarifies that "*[i]t is assumed that diversion is accomplished by, e.g., a low sill, such that sediment supply to the reach immediately downstream of diversion is unaffected by water diversion. The case for which diversion is accomplished by, e.g., a high dam, for which some of the water and all of the sediment are prevented from reaching the reach immediately downstream, is not analyzed here* [emphasis added]." This draws into question the applicability of these equations for evaluation of onstream reservoirs.

Note also that the streams studied in Parker et al (2003) averaged 18.3 meters, or 60 feet, in width. This is a far larger stream than those streams where most water right applications are pending. At least 90 percent of pending applications for onstream reservoirs are located on watersheds of less than 1 square mile. Studies of fluvial geomorphology have not been conducted in watersheds of that size. There is no reason to believe that the dynamic relationships of sediment transport studied in alluvial rivers would be found to behave similarly at a much smaller scale where the proposed projects are located.

7.4 Channel Forming Flow Concept is not Universally Applicable

The Draft Policy calls for use of the 1.5-year recurrence interval of peak annual flow for a measure of channel-forming flow. However, there is no single "channel-forming flow." Sediment is transported at all rates for which the velocity exceeds the threshold for entrainment of particles. Higher flow rates have a greater capacity to transport sediment and a capacity to move larger particles. Therefore, they may be particularly influential in adjusting the channel form. However, larger flows occur less frequently than smaller flows. Wolman and Miller (1960) introduced the idea that a medium magnitude flow rate moves the most sediment over the long-term. This has been termed the effective flow rate. Wolman and Miller (1960) also noted that the effective flow rate roughly corresponds to the bankfull flow.

Many other papers have extended this concept, identified some of its limitations and argued whether the bankfull flow rate can be reliably estimated by the 1.5-year recurrence interval (Biedenharn et al., 2000). Nash (1994) concludes "*it is misleading to speak of a universally or even widely applicable recurrence interval for effective discharge*." Knighton (1998) points out that "*it is bed load which is the most relevant from the standpoint of channel form adjustment, and* [because greater velocities are required to move bed load] *its effectiveness peak is displaced towards less frequent discharges*." In summary: a) the channel form is not shaped by a single flow rate, b) the flow rate that moves the most sediment in the long-term (the effective flow rate) is not necessarily responsible for the channel form, c) the effective flow rate does not necessarily correspond to the bankfull flow rate, and d) the bank full flow rate has a recurrence interval that varies far beyond the central tendency of 1.5 to 2 years.

Further, the rough equivalence that has been discussed between effective discharge, bankfull flow, and the 1.5-year recurrence flow has not been established or even examined for ephemeral streams with steep slopes draining small watersheds, such as are subject to the Draft Policy. Trush (1991) distinguishes between "alluvial channels" and "boulder-bedrock" channels and notes "*boulder-bedrock stream channels have a morphology substantially different than alluvial channels. Relatively little research has been focused on the description and dynamics of boulder-bedrock channel morphology*."

7.5 Estimation of 1.5-Year Recurrence Interval Flow is Inapplicable to Impaired Time Series

The Draft Policy directs that the 1.5-year recurrence interval annual peak flow be estimated for unimpaired conditions and for impaired conditions and directs that the methodology described in Bulletin 17B, Guidelines for Determining Flood Flow Frequency, USGS, 1982 can be used. However, Bulletin 17B cautions that "*[t]he procedures do not cover watersheds where flood flows are appreciably altered by reservoir regulation*…." This is understandable since the method of Bulletin 17B is predicated on the assumption that the time series of annual peak flows can fairly be represented as a log-Pearson Type III distribution. This has been shown to be a reasonable assumption for unimpaired streamflow in many different regions. However, impairment can affect any portion of the flow distribution disproportionally, rendering it no longer conformable to a log-Person Type III distribution. It is not reasonable to assume the impaired time series can be represented by the log-Pearson Type III distribution and the Bulletin 17B procedure should not be applied to impaired conditions.

7.6 Gravel Recruitment is not Necessarily a Limiting Factor

Regarding gravel recruitment, the Scientific Basis recognizes that *"[s]wales and similar drainage depressions … would by definition not be expected to be important for bedload supply downstream because there is no defined stream channel* [emphasis added]." The Scientific Basis recognizes that the smallest watersheds are not expected to be important for supply of gravel. The document then goes further to argue that because gravels *can* move from Type III streams to Type II streams, that they are therefore *needed* to maintain gravel transport. That would be true only if the presence of streambed gravels were limited by the supply of gravel as contrasted to capacity of the stream to transport gravels. The presence or absence of gravels is often determined by flow velocities rather than by gravel supply.

7.7 Evaluation of Fill-and-Spill Operation was not Conducted

Appendix J of the Scientific Basis includes some discussion of diversion to storage without a diversion rate limit, sometimes referred to as fill-and-spill operation. It notes that "*diversion could result in a flat-lining of the hydrograph, whereby essentially the only flow allowed downstream would be the* [bypass]. *Predicting the physical effects of flat-lining of the peak hydrograph is difficult and generally not possible without doing a site-specific analysis of flows, sediment transport, and channel stability* (page J-5)." It continued to say that "*studies have not been conducted to determine the allowable frequency or duration of such flat-lining events before adverse effects at a regional scale*." Indeed, the Scientific Basis did not analyze the possible impacts of fill-and-spill operation. While it may be elementary to say that hydrographs based on the 5 percent of 1.5-year flow rate restriction (MCD2) more closely resemble the unimpaired hydrograph than hydrographs based on fill-and-spill operation, that is not the same as identifying impacts attributable to fill-and-spill operation. That analysis was not done.

Streamflows in the Policy area are naturally sporadic and flashy. Changing the occurrence of flow peaks due to fill-and-spill operation does not necessarily translate into reduced channel width or a reduction in suitable gravel substrate.

7.8 Threshold of Significance was not Established

Even setting aside the above described problems and adopting the assumed simple relationship (shown in Figure D-4) where a change in flow translates directly into a change in desired channel morphological characteristics, there remains the failure of the Scientific Basis to identify a threshold of significance. The Scientific Basis admits "… *there is no readily discernable flow reduction limit suggested for identifying a protective channel and riparian maintenance flow*" (page 2-7). "*[T]he level of change in channel morphological response that would adversely affect salmonid habitat and production potential could not be determined with certainty*" (page xxv). Indeed, there was no attempt in the Scientific Basis to evaluate the level of morphological response that would represent the threshold between protectiveness and non-protectiveness. While the

Scientific Basis was willing to state that a 5 percent reduction would be protective, there was no opinion ventured that 6 percent would be non-protective.

Even if the arbitrary 5 percent impact was assumed to be the proper threshold for protectiveness (and the simplified relationships between flow and morphological characteristics shown in Figure D-4 were assumed to be applicable), it is still not clear the Policy made the proper conclusion for regional criteria. Note that, according to Figure D-4, a 5 percent reduction in flow is linked to a 2 percent reduction in channel morphological characteristics. If the intent is to limit physical impacts to 5 percent, then the simplistic model would call for a 12 percent limit on flow reduction, since that translates to a 5 percent reduction in stream morphological characteristics. Still, there is no reason to conclude that a 12 percent limit would be necessary or that a higher limit would result in loss of spawning habitat. As the Scientific Basis admits, because of the many factors affecting suitable stream morphology, it was not possible to identify a percentage change in flow that represents a threshold between protectiveness and non-protectiveness.

8.0 FAILURES OF EVALUATION

The Scientific Basis failed in evaluation in several respects. It failed to evaluate the recommended Policy, the specific design elements included in the Policy, the results of the habitat analysis, the benefit to fisheries from application of the Policy, and the impact to established water uses due to application of the Policy.

8.1 Draft Policy was not Represented as a Flow Alternative Scenario

The Scientific Basis formulated and analyzed five Flow Alternative Scenarios, summarized in Table 4-2 (p 4-9). Each Flow Alternative is comprised of three "design elements" (aka regional criteria). The design elements are Diversion Season (DS), Minimum Bypass Flow (MBF), and Maximum Cumulative Diversion (MCD). For example, Flow Alternative 5 consists of DS1, MBF1, and MCD3, which corresponds to the 2002 DFS-NMFS Draft Guidelines. None of the other Flow Alternatives correspond to the regional criteria recommended in the Draft Policy, which consists of DS3, MBF3, and MCD2. A huge amount of work was expended in the Scientific Basis but the Draft Policy was not evaluated as one of the five scenarios studied.

8.2 Design Elements were not Evaluated Properly

The effectiveness and impact of specific design elements were not evaluated because they were not isolated. The Flow Alternative Scenarios were developed in such as way that comparison between any two scenarios involved change in more than one design element. Thus any impacts observed could not be attributed to a specific design element. The Scientific Basis was unable to identify or evaluate the effects of the regional criteria under investigation.

A commonly applied and recommended procedure for evaluating the reliability and results of a simulation model is sensitivity analysis. When specification of a model parameter(s) is uncertain or is crucial in some way, it is important that a sensitivity analysis be performed. In this type of analysis, the parameter in question is varied slightly while holding all other parameters fixed. Observation of the change in model result then enables an assessment of model behavior and the sensitivity of the model to that parameter. Because this was not done in the Scientific Basis, an opportunity to test the model reliability was foregone and the opportunity to evaluate the design elements, which became the regional criteria, was foregone. For example, it may be that shifting the MBF or the MCD requirement could have little effect on habitat but a large effect on water available for diversion. Or the opposite may be true, but the analysis was not performed to answer that.

8.3 Appendix I was not Evaluated

Appendix I is the culmination of the habitat analysis, which was a central feature of the Scientific Basis. However, the Scientific Basis failed to include an adequate evaluation of the result of the habitat analysis. Appendix I included no discussion of the results contained therein. Section 4 of the main body of the document includes charts depicting change in the average number of days per year and percent change in the average number of days per year. This overlooked the importance of consecutive days for evaluation of opportunity. It also overlooked an evaluation of whether unimpaired conditions exhibited insufficient days for habitat or far more days than sufficient for habitat. A complete evaluation would assess whether spawning opportunities are a limiting factor for the species at a given location. The evaluation of the results of the habitat analysis is wholly inadequate. It is curious that the Scientific Basis did not attempt to plainly explain and discuss the modeled differences in passage and spawning and whether those differences would significantly affect salmonids. Of course, none of the Flow Alternatives modeled and presented in Appendix I actually represented the Draft Policy.

8.4 Benefit to Fishery Due to Specific Projects was not Analyzed

The Scientific Basis and Substitute Environmental Document analyses were conducted based on the assumption that the full amount of water available for diversion within the regional diversion constraint criteria would be diverted at the respective validation site(s). No actual existing or proposed project was evaluated. And because the watersheds of the validation sites selected are far larger than almost all pending projects, the impacts modeled correspond to far larger diversions than any actual project. For example, modeled diversions at the Franz Creek validation site averaged 1,200 AF/year under Flow Alternative Scenario 5.

The Scientific Basis did not evaluate changes in hydrology important to anadromous salmonids associated with any specific project. Further, the Scientific Basis did not perform any type of trade-off analysis that compared the benefits and impacts to fisheries and irrigation associated with different diversion restrictions. In a sequence of analysis, the first question would be: to what extent did a diversion to storage affect hydrology important for salmonid viability? This question was not adequately answered with the presentation in Appendix I. The second question would be: how does the impact to fisheries compare to the impact to irrigation in order to avoid that impact to fisheries? This is frequently called a trade-off analysis. Any diversion is going to change the hydrograph from natural conditions. The question becomes: is there a significant effect on salmonids? Because of uncertainty in the sciences involved and because there are competing societal values at stake, the measure of significance for fishery protection requires simultaneous consideration of diversions foregone attributable to the Draft Policy.

8.5 Hydrographic Analyses

Wagner & Bonsignore Engineers conducted hydrographic analyses to evaluate how the regional criteria of the Draft Policy improved hydrological conditions for salmonids and impacted diversion by irrigation projects. Attached are hydrographs of five projects which have applications pending before the State Water Board. These five examples are clients of Wagner & Bonsignore Engineers for which daily operational studies were prepared and submitted to the State Water Board in 2007 to support findings of water availability and to assist in evaluating possible environmental impacts.

The hydrographs attached were developed for the purpose of demonstrating possible flow impacts associated with the project diversions. Two diversion scenarios were compared. In the first scenario, no diversion constraints were applied other than unimpaired water availability and project physical capacity constraints. In the second scenario, diversions were constrained by the minimum bypass (MBF3) and maximum diversion (MCD2) constraints included in the Draft Policy. The overall purpose of this analysis was to compare and contrast changes in streamflow and changes in project yield associated with the Draft Policy as compared to no diversion constraints.

Table 8-1 (attached) summarizes a few particulars about the five projects evaluated.[16] Exhibits 8-1 through 8-5 (attached) provide location maps of each project. The limit of anadromy has been estimated based on identification of barriers and the proposed default rule of 12 percent slope over 330 feet included in the Policy (page 13). This estimate of the limit of anadromy does not factor in whether there is sufficient sustained flow to support salmonid passage and spawning. The Scientific Basis habitat analysis of 13 validation sites found anywhere from 7 cfs to 59 cfs of flow required to provide the 0.8-foot depth necessary for salmonid spawning. Ten to 20 cfs may be a more representative estimate of minimum flow needed, given hydraulic parameters, to provide spawning habitat. Any flow less than approximately 10 cfs over several days probably does not represent salmonid habitat.

All of the hydrographs show estimated streamflow under unimpaired and impaired conditions. The unimpaired flow was estimated based on a nearby USGS streamgage record and proration of this data to the location of interest based on drainage area and mean annual precipitation. The impaired flow was estimated using a daily simulation of reservoir filling based on the assumption the reservoirs start empty each fall and fill during their applied-for season until reaching their applied-for volume. Any other existing water rights of record in the watershed were also modeled.

8.5.1 Project #15

Project #15 has two points of diversion (POD): a 49 AF off-stream reservoir filled by diversions at POD #2, and downstream of POD #2, a 30 AF onstream reservoir at POD #1. The project is located on an unnamed stream (known locally as Carpenter Creek) that is tributary to Big Sulphur Creek, thence the Russian River (see Exhibit 8-1). Carpenter Creek in the vicinity of the project is a wide scoured channel with little riparian vegetation. The project is located approximately one mile upstream of the limit of anadromy. The limit of anadromy was estimated based on the proposed default rule of 12 percent.

Figure 8-1 (attached) shows modeled impairment during a normal hydrological year immediately below POD #1 assuming no constraints on diversion. It can be seen that the

[16] The project numbers are arbitrary identifiers.

hydrograph is "zeroed out" for a few days in December as the reservoir at POD #1 fills. The impaired flow (red line) diverges from the unimpaired flow (blue line) in January because POD #2, located upstream, is diverting at a maximum rate of 0.5 cfs to off-stream storage. The average annual project yield under this scenario would be 79 AF.

Figure 8-2 (attached) shows the modeled impairment at the same location during the same year, but this time subject to the Draft Policy diversion constraints. Also shown in Figure 8-2 is the bypass requirement and maximum diversion rate associated with the Draft Policy. Only that part of the hydrograph above the red line and below the orange line is available for diversion under the Policy.[17] The average annual project yield under the Policy would be 36 AF, i.e., less than half the yield without diversion constraint.

The exceedance curves shown in Figures 8-3 and 8-4 (attached) aggregate the unimpaired and impaired flows during the winter diversion season for all 15 years modeled for Project #15. Figure 8-3 shows the no diversion constraint scenario and Figure 8-4 shows the Policy scenario. The difference between the blue line and the thin red line reflects the change in streamflow due to the project.

Note in Figure 8-4 that the Policy minimum bypass requirement is met in unimpaired conditions only 11 percent of the time or about 12 days per year on average. That is, the project would be able to divert only 12 days per year, on average. That doesn't mean that streamflows would be suitable for salmonids 12 days per year; high flow rates create high velocities that are unsuitable for spawning.

As noted above, the limit of anadromy is located about one mile downstream of Project #15. Figures 8-5 through 8-8 (attached) provide information at the limit of anadromy. These hydrographs and exceedance curves show the impact of the project is minimal. One has to look closely at Figure 8-7 to see that at lower flow rates the red line (impaired flow) is below the blue line (unimpaired flow), whereas, in Figure 8-8 at lower flow rates, the red line and blue line are coincident. This amount of change is less than the order of accuracy in estimating impacts.

These hydrographs show the project, when diverting without constraint, creates minimal effect on streamflows. However, the Draft Policy would restrict allowable diversions and result in the project yield being cut to less than half.

8.5.2 Project #5

Project #5 consists of diversion (at a rate up to 2 cfs) to off-stream storage in a 30 AF reservoir. It is located on Donnelly Creek, which is tributary to Anderson Creek, thence the Navarro River (see Exhibit 8-2). In the vicinity of the project, Donnelly Creek is relatively flat with riparian vegetation and tree cover. The POD is in a reach open to

[17] The draft Policy appears to include the possibility to ignore the MCD2 rate restriction provided that another metric does not change by more than 5 percent. This is discussed further in another section of this report. In summary, analysis conducted to date shows that the MCD2 rate restriction must be honored in order to meet the alternative restriction.

anadromy. Streamflows immediately below the POD attributable to the project without diversion constraints are shown for a typical normal year and dry year in Figures 8-9 and 8-10 (attached), respectively. Only a small portion of the hydrograph in the early part of the season is affected. Note the different vertical scale on these two graphs. The average annual yield under the no diversion constraint scenario would be 30 AF.

Figures 8-11 and 8-12 (attached) show streamflows immediately below the POD under the proposed Policy scenario. Also shown is the minimum bypass flow (MBF3) required at this location under the Policy. The average annual yield of this Project under the Policy would be cut approximately in half, to 16 AF.

8.5.3 Project #6

Project #6 consists of storage in a 10 AF onstream reservoir and spring-time direct diversions for frost protection and irrigation. It is located upstream of a manmade barrier to anadromy on Witherell Creek, which is tributary to Anderson Creek, thence the Navarro River (see Exhibit 8-3). Witherell Creek has riparian vegetation both upstream and downstream of the project. Modeled streamflows at the limit of anadromy under the no diversion constraint scenario are shown in Figures 8-13 and 8-14 (attached) for a typical normal and dry year, respectively. Note the different vertical scale. The average annual project yield under this scenario would be 24 AF.

Figures 8-15 and 8-16 (attached) show diversions in a normal and dry year under the Draft Policy. The Policy minimum bypass is also shown. The impairment reflected early in the season in Figures 8-15 and 8-16 is due to other permitted rights upstream of Project #6. Project #6 is able to divert some water during the peak flow of January of the normal year. The average annual yield of this project under the Draft Policy would be cut to 9 AF, approximately one-third of the no constraint scenario.

8.5.4 Project #4

Project #4 is a 12 AF onstream reservoir with a contributory drainage area of only 13 acres. It is located on an unnamed stream tributary to Anderson Creek, thence the Navarro River (see Exhibit 8-4). The limit of anadromy is approximately one mile downstream. There is limited riparian vegetation downstream of the reservoir.

Figures 8-17 and 8-18 (attached) show the modeled impairment at the limit of anadromy in a typical normal and dry year, respectively. Note that there is a large, permitted existing reservoir between the project and the limit of anadromy. Thus, the hydrographs show a “present impaired” condition corresponding to operation of the permitted right. Project #4 diversions result in only a slight difference between the present impairment (green line) and future impairment (red line). The average annual yield of Project #4 under the no constraint scenario would be 10 AF. Under the Draft Policy, the project yield would be zero.

8.5.5 Project #12

Project #12 is located on two unnamed tributaries to Sulphur Creek, thence the Napa River (see Exhibit 8-5). It consists of enlargement of two existing, licensed onstream reservoirs, both of which are located above their respective limit of anadromy (estimated based on the 12 percent rule). Because they are both already licensed for a lesser volume, an existing impaired condition was also modeled.

Figures 8-19 and 8-20 (attached) show estimated flows immediately below POD #1 in typical normal and dry years under the no diversion constraint scenario (i.e., fill-and-spill operation with no bypass). Under unimpaired conditions, there is no flow at the POD during most of the year. There are a few storm events, when 1 or 2 cfs flows for a few days. With the licensed storage in effect (shown by the green line), water is captured and no flow passes POD #1 until mid-February of the normal year and not at all in the dry year. The red line shows that the applied-for enlargement of the storage right would result in no flow passing POD #1 throughout the normal year.

Viewed from the perspective of Figures 8-19 and 8-20, it may appear that operating the project without diversion constraints would have a large impact. However, it is important to place this in perspective. At the project location, there are only a couple cubic feet per second of flow for a few days in a normal year. It is far above the limit of anadromy. And, there are no other water rights above this limit of anadromy. Figures 21 and 22 (attached) show the estimated streamflow at the limit of anadromy below POD #1 with the project operating with no diversion constraints. These figures show that at the limit of anadromy the difference between unimpaired flow and impaired flow is slight.

Similar results were found in the modeling of flows at POD #2 and at the limit of anadromy downstream of POD #2. The average annual yield of this project without diversion constraint would be 37 AF at POD #1 and 16 AF at POD #2. However, under the Draft Policy the project yields would be cut to an annual average of 3 AF and 4 AF, respectively.

8.5.6 Conclusions from Hydrographic Analysis

The foregoing five case studies of actual projects reveal that at the limit of anadromy, where impacts to salmonids could be experienced, these projects even without diversion constraints do not cause significant changes to the hydrology. Therefore, diversion constraints (i.e., bypass flow and maximum diversion rate) are not needed on these projects to protect fishery values. Nevertheless, the Draft Policy would apply these diversion constraints resulting in significantly reduced diversion yield for these projects. There is insufficient impact to the hydrology at the limit of anadromy due to these projects to justify the Draft Policy restrictions. The Draft Policy restrictions on these projects (including both onstream and off stream diversions) would decimate project yields for no benefit to fisheries.

This highlights a fundamental flaw in the Draft Policy which is the requirement that point-of-interest (POI) analyses be conducted at points upstream of the limit of anadromy (Policy pg A1-12). The Draft Policy requires that a POI be located immediately below the point of diversion. At that location, the change in hydrology may appear significant. However, downstream at the limit of anadromy, where salmonids can be affected, the change in hydrology can be slight, as is the case with these five projects.

8.6 Impact to Irrigation Project Yields not Analyzed

The Scientific Basis failed to evaluate impacts to irrigation projects. Not only would the Draft Policy impose significant costs for constructing bypasses or moving reservoirs, the Draft Policy would also cause significant reduction in water yield to most irrigation projects. Wagner & Bonsignore Engineers evaluated 21 projects to estimate their average annual water yield under three different diversion scenarios. In the first scenario, the project diversions were constrained by a bypass requirement equal to the February median flow (FMF). In the second scenario, the project diversions were constrained by an FMF bypass and a seasonal volumetric limit equal to 10 percent of the seasonal unimpaired flow. This scenario corresponds to the 2002 DFG-NMFS Draft Guidelines. The third scenario corresponded to the Draft Policy regional criteria (aka design elements) for minimum bypass flow (MBF3) and maximum cumulative diversion rate (MCD2).

It should be pointed out that the 2002 Draft Guidelines were not formally adopted and the scientific applicability to small watersheds is questionable.

The 21 projects included in this evaluation of yield are all the projects for which Wagner & Bonsignore Engineers submitted a daily analysis of diversions to the State Water Board staff in 2007 for the purpose of establishing water availability for a pending water right application. Table 8-2 (attached) summarizes the result of yield analysis for the 21 projects. The project numbering is arbitrary. Figure 8-23 (attached) shows graphically the estimated average annual yield for the 21 projects under the three diversion constraint scenarios. Not shown are estimated yields corresponding to a no diversion constraint scenario, which was the topic of the previous section. Recall that for those projects, the no diversion constraint scenario resulted in slight or insignificant change in flows at the limit of anadromy.

The large difference between the FMF bypass and the MBF3 bypass can be observed in Table 8-2. This has a particularly strong effect on diversions in smaller drainage areas.

8.6.1 Alternative Application of 5 Percent of 1.5-Year Flow Rate Restriction (MCD2) Provides no Relief

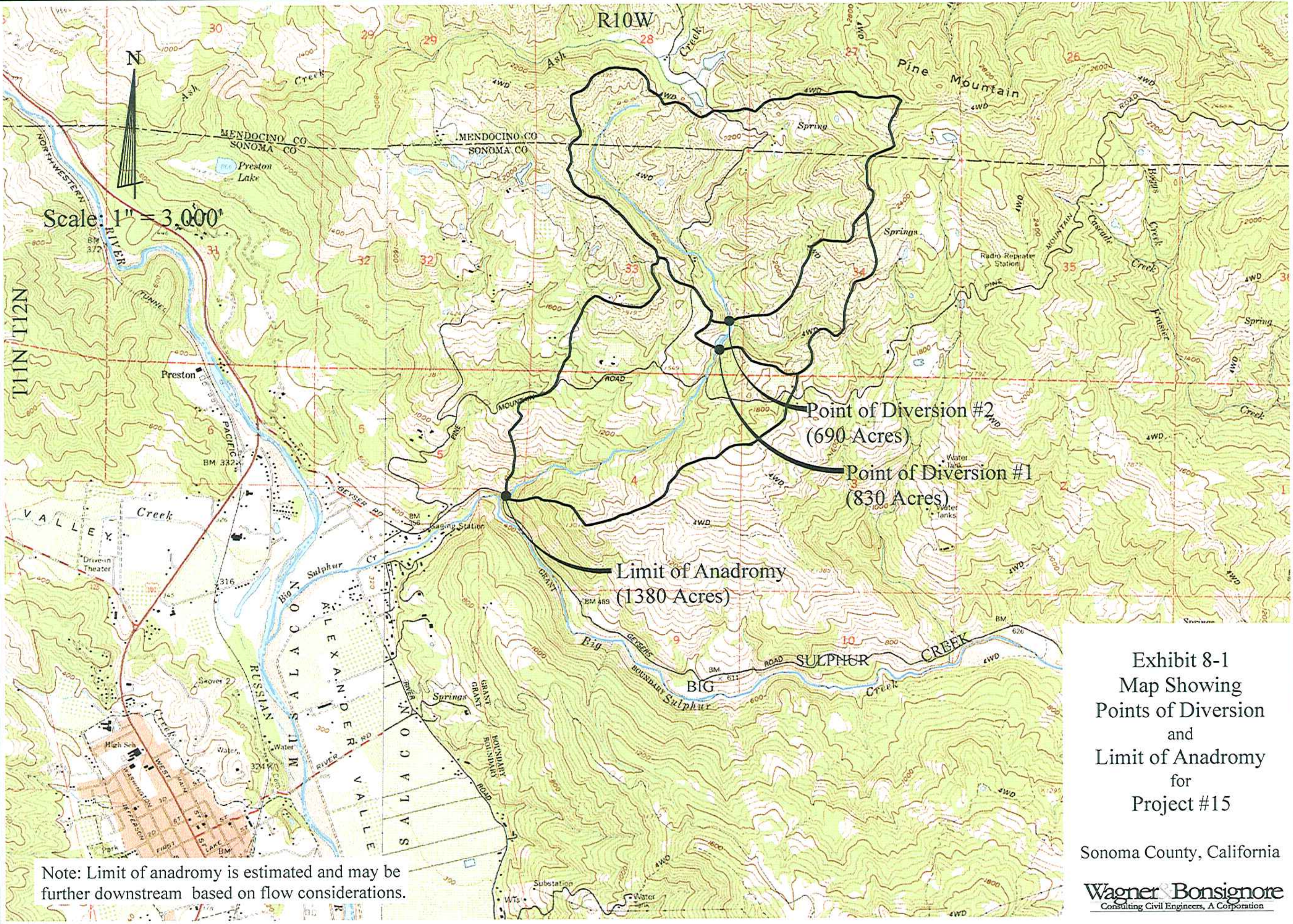
The Draft Policy is unclear about how the maximum cumulative diversion constraint (MCD2) should be applied to projects. First it states that the MCD2 constraint is an instantaneous rate constraint on diversion. Later it states that diversions need not be limited to that rate, instead the MCD2 constraint could be a test of comparison between unimpaired and impaired streamflow time series. Analysis of the latter constraint shows that it allows no more diversion than the first definition of MCD2.

As stated on page 5 of the Policy, "*The maximum cumulative diversion is the largest value that the sum of the rates of diversion of all diversions upstream of a specific location in the watershed can be in order to maintain adequate peak stream flows. The maximum cumulative diversion criterion is equal to five percent of the 1.5-year instantaneous peak flow.*" This definition is repeated in the Policy Appendix in paragraphs A.5.2.3 and A.5.9. Then in paragraphs A.5.10 and A.5.11, the document appears to lift the maximum cumulative diversion rate constraint and replace it with a test of difference in estimated 1.5-year flow rates corresponding to unimpaired and with-project conditions. It seems that 5 percent is the factor to multiply the estimated 1.5-year flow to arrive at a diversion rate constraint, unless your project is not suited for that, in which case, 5 percent is the allowable difference in two different estimates of 1.5-year flow rate (unimpaired vs. with-project). If this is correct, the Policy should state that somewhere before page A1-27.

The Policy Appendix provides, in detail, three different methods for estimating the 1.5-year recurrence interval of annual peak flow rate. This leaves open the possibility for ambiguity as to whether a project meets the 5 percent difference criterion. One of the methods ("*regional regression*") is not a function of flow and therefore will provide the same estimated 1.5-year flow rate under unimpaired and impaired conditions. This limits its usefulness.

The Policy Appendix directs that statistical analysis be conducted to estimate the 1.5-year flow rate corresponding to unimpaired and impaired flow conditions. This can be problematic since statistical techniques developed for unimpaired conditions may not be applicable to impaired conditions. While the Policy Appendix directs use of USGS Bulletin 17B "Guidelines for Determining Flood Flow Frequency" for estimating the 1.5-year flow rate, Bulletin 17B warns "*The procedures do not cover watersheds where flood flows are appreciably altered by reservoir regulation* …" (p. 2). It goes on to explain that while a natural time series can reasonably be assumed to conform to a log-Pearson Type III distribution, that assumption is violated where impairment is significant. Indeed, because the Bulletin 17B technique only looks at annual peak flows, all low and moderate flows could be eliminated without affecting the estimate of the 1.5-year flow. This would, however, violate the assumption on which the technique is based.

The maximum cumulative diversion rate (MCD2) was modeled as a rate of flow limiting the daily diversion at each respective point of diversion (POD). As noted above, the Policy Appendix appears to allow a project to divert more than the MCD2 rate, provided that the change in estimated 1.5-year flow rate does fall by more than 5 percent between the unimpaired and with-project conditions. This has the potential effect of allowing fill-and-spill operation for a reservoir (recognizing that the minimum bypass requirement is still effective). Analyses of diversion operations without the MCD2 as a diversion constraint nevertheless showed greater than 5 percent change in the estimated 1.5-year flow rate. Thus the apparent allowance to "ignore" the MCD2 diversion constraint fails upon testing for the change in 1.5-year rate.



Note: Limit of anadromy is estimated and may be further downstream based on flow considerations.

Exhibit 8-1
Map Showing
Points of Diversion
and
Limit of Anadromy
for
Project #15

Sonoma County, California

Wagner & Bonsignore
Consulting Civil Engineers, A Corporation

Base map per USGS 7.5 Minute Quad maps for Cloverdale and Asti.

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April 2008

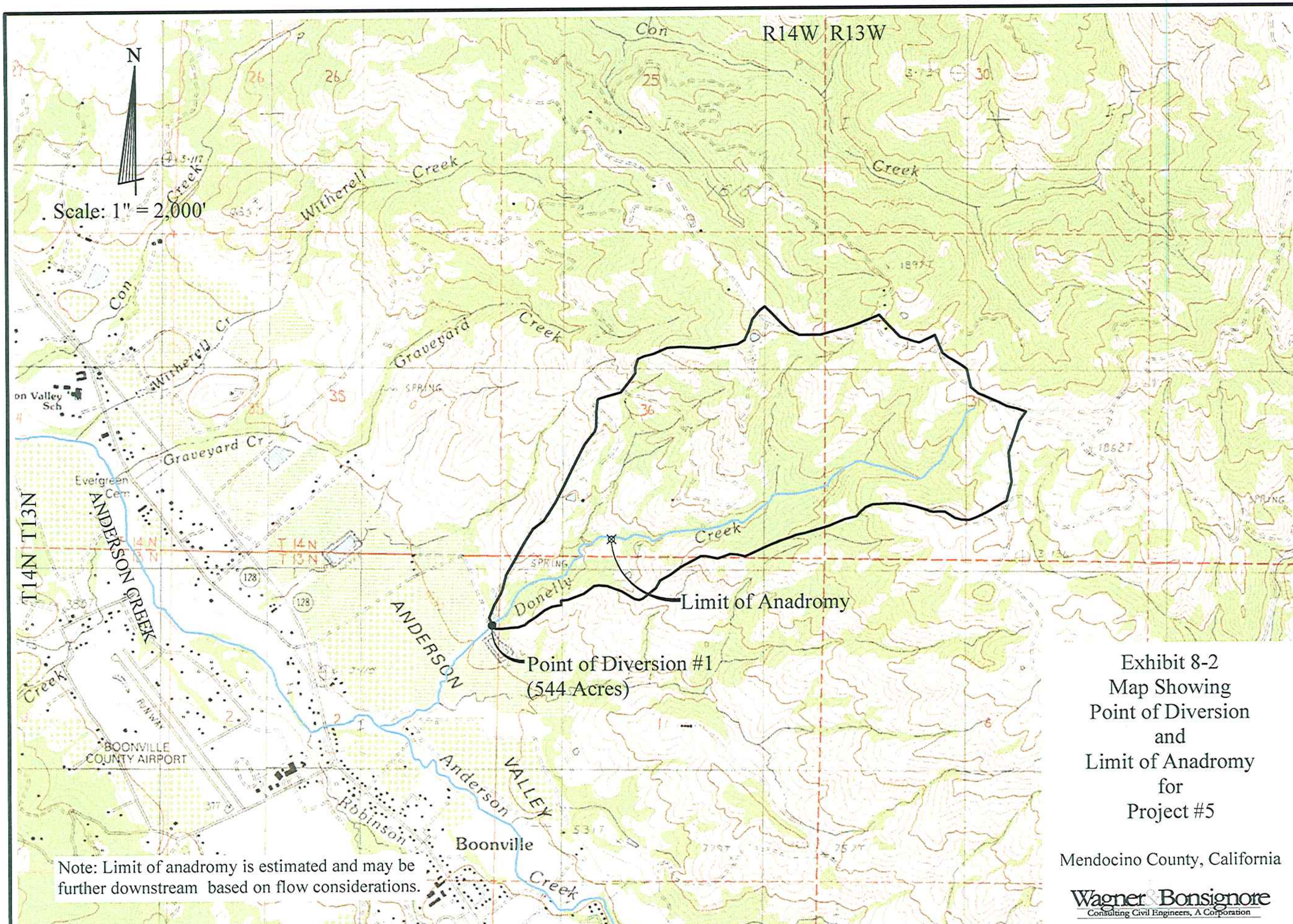

Exhibit 8-2
Map Showing
Point of Diversion
and
Limit of Anadromy
for
Project #5

Mendocino County, California

Wagner & Bonsignore
Consulting Civil Engineers, A Corporation

Base map per USGS 7.5 Minute Quad maps for Boonville and Philo.

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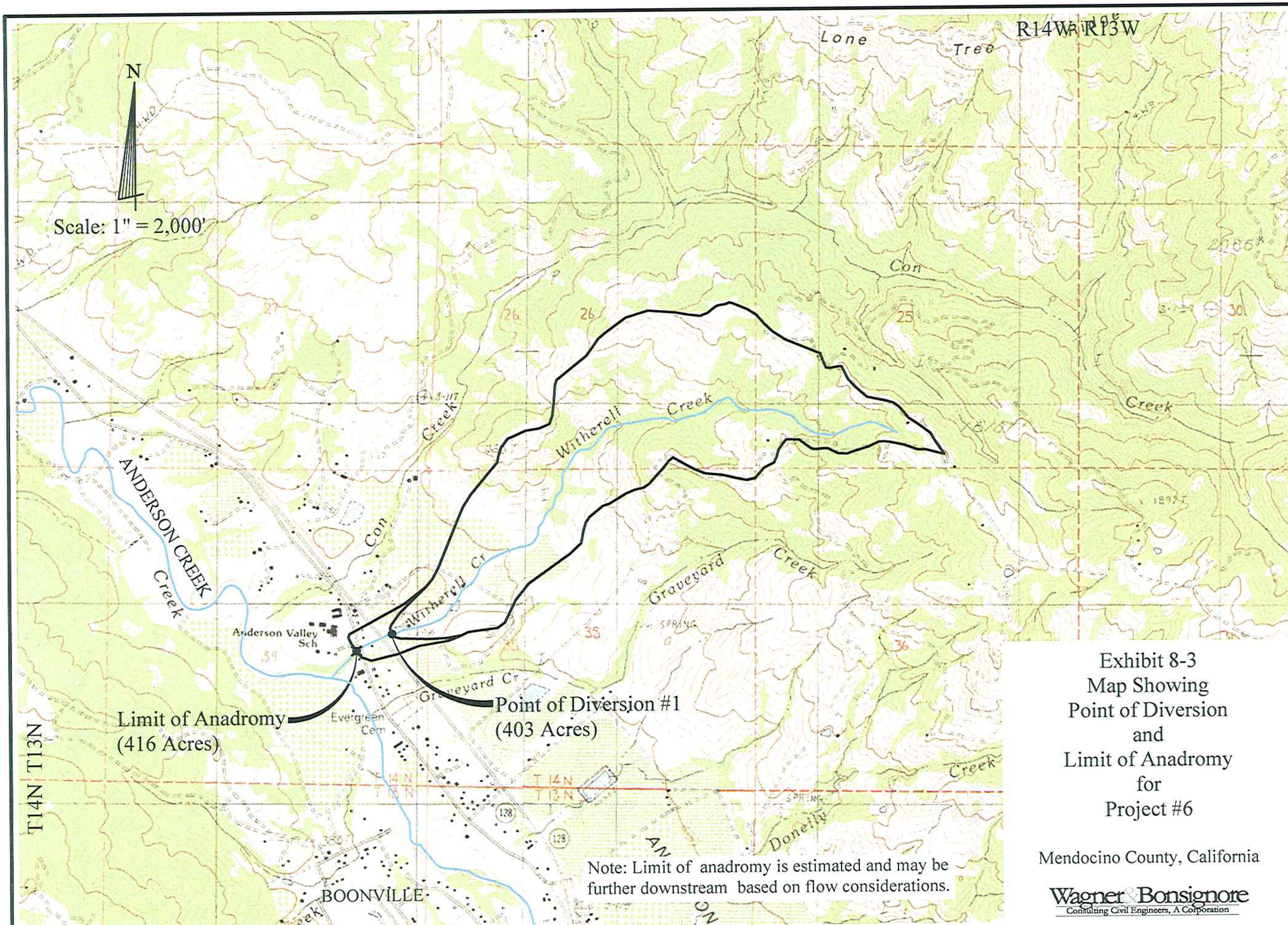

Exhibit 8-3
Map Showing
Point of Diversion
and
Limit of Anadromy
for
Project #6

Mendocino County, California

Wagner & Bonsignore
Consulting Civil Engineers, A Corporation

April 2008

Base map per USGS 7.5 Minute Quad maps for Boonville and Philo.

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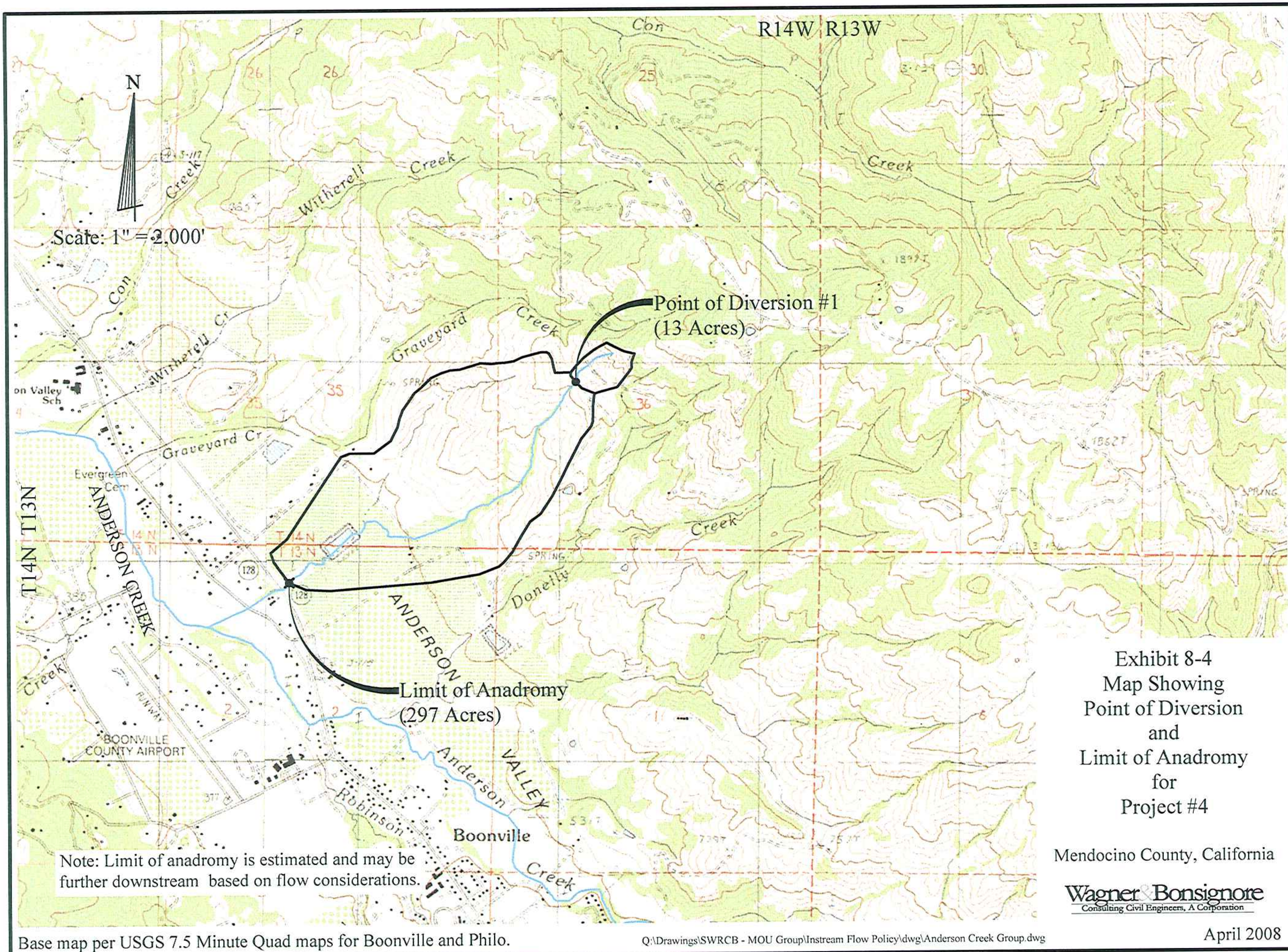

R14W R13W
N
Scale: 1" = 2,000'
Witherell Creek
Con Creek
Graveyard Creek
Graveyard Cr
Witherell Cr
Point of Diversion #1
(13 Acres)
Limit of Anadromy
(297 Acres)
T14N T13N
ANDERSON CREEK
ANDERSON VALLEY
Anderson Creek
Donelly
Evergreen Cem
BOONVILLE COUNTY AIRPORT
Robinson
Boonville
Exhibit 8-4
Map Showing
Point of Diversion
and
Limit of Anadromy
for
Project #4
Mendocino County, California
Wagner & Bonsignore
Consulting Civil Engineers, A Corporation
Note: Limit of anadromy is estimated and may be further downstream based on flow considerations.
Base map per USGS 7.5 Minute Quad maps for Boonville and Philo.
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April 2008

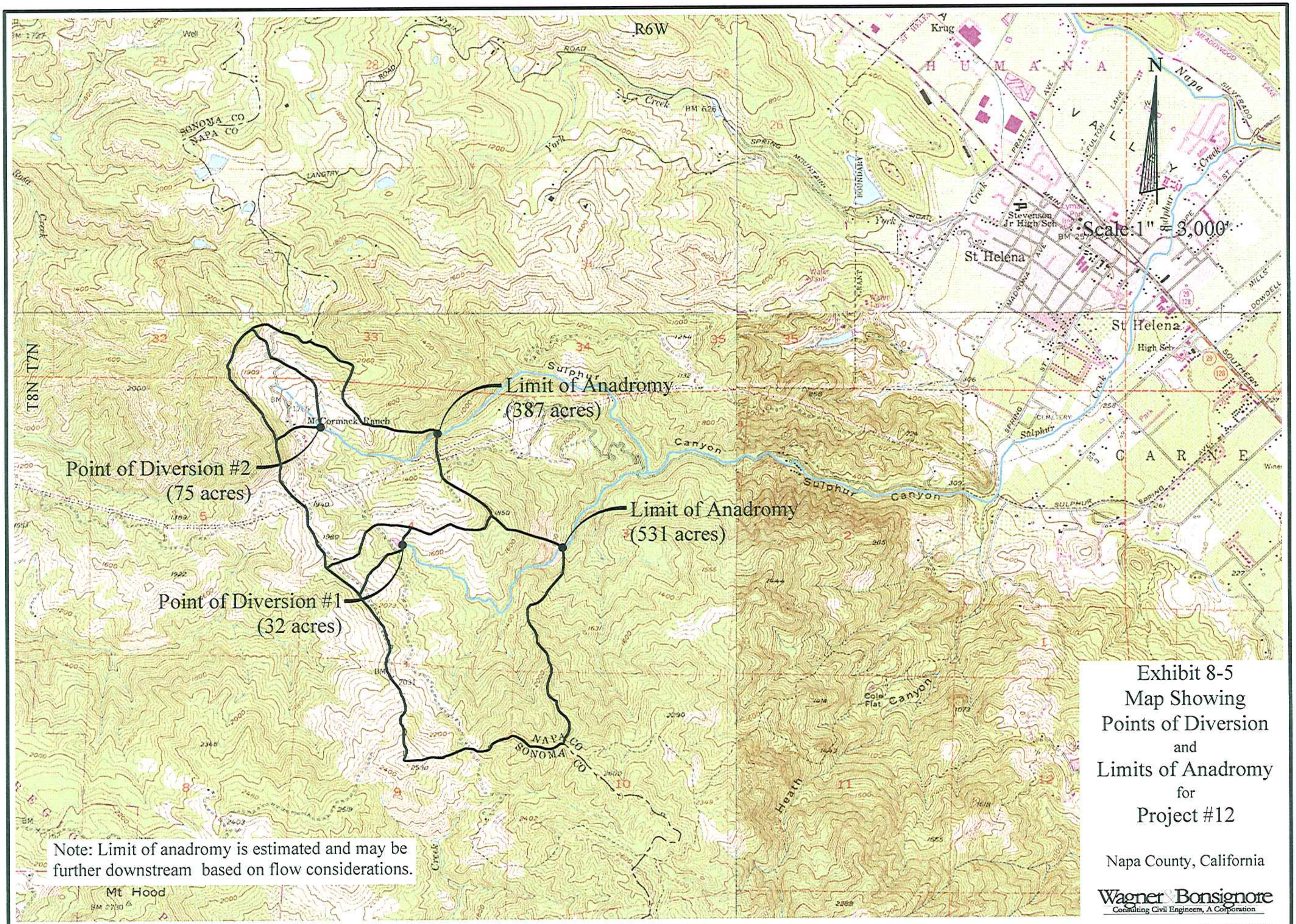

Exhibit 8-5
Map Showing
Points of Diversion
and
Limits of Anadromy
for
Project #12

Napa County, California

Wagner & Bonsignore
Consulting Civil Engineers, A Corporation

Base map per USGS 7.5 Minute Quad maps for Calistoga, St. Helena, Kenwood, and Rutherford.

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April 2008

TABLE 8-1
Projects Included in Hydrographic Analysis

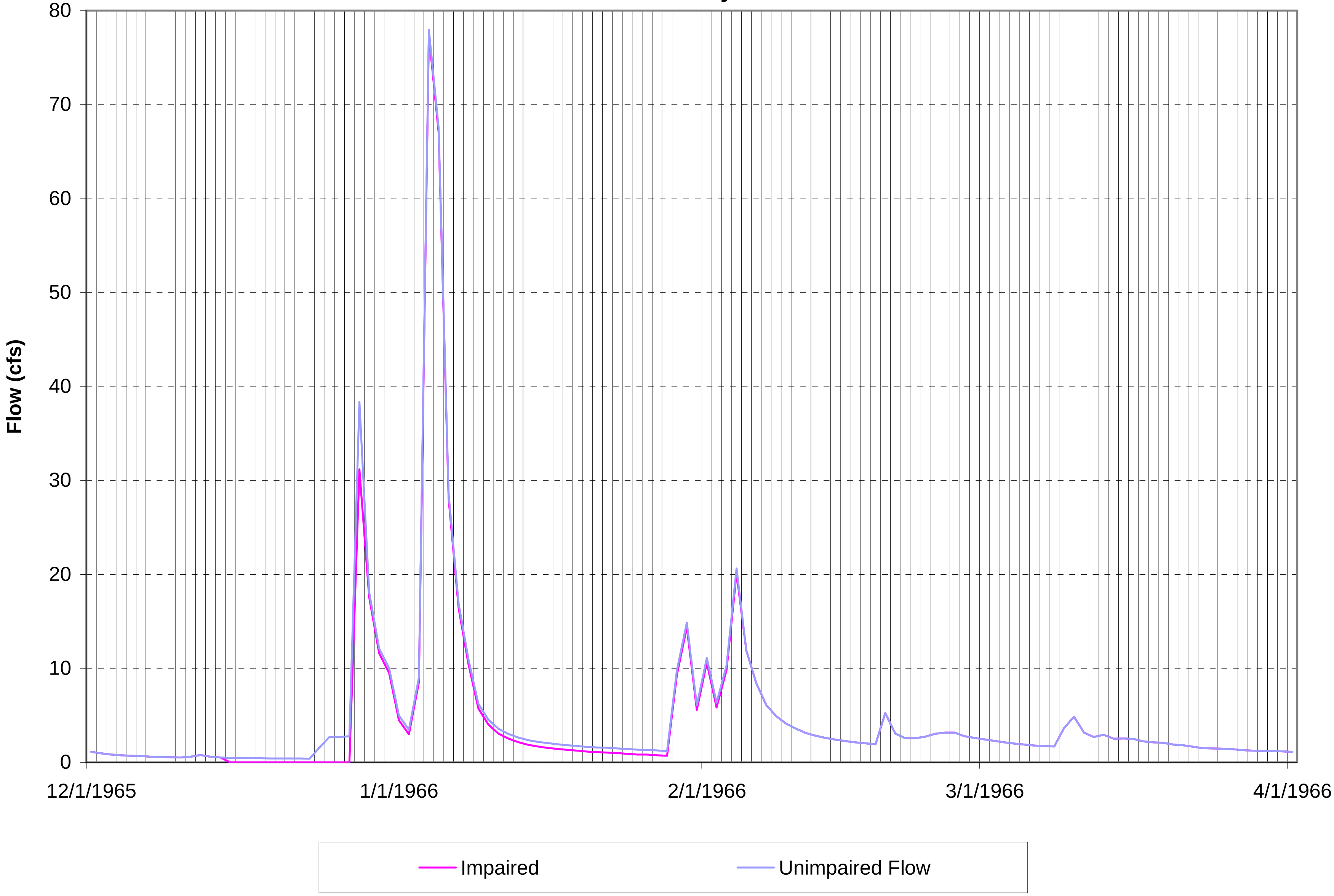
Project #	Storage Capacity (AF)	On-stream?	Drainage area above POD (acres)	Anadromy	Drainage area above POI (acres)	Yield without constraints (avg ann af)	Yield under Policy (avg ann af)
15	79	On	831	POD above limit of anadromy	1,380	79	36
5	30	Off	544	POD open to anadromy	544	30	16
6	10	On	404	POD above manmade barrier	419	24	9
4	12	On	13	POD above limit of anadromy	297	10	0
12 (POD#1)	55	On	75	POD above limit of anadromy	387	37	3
12 (POD#2)	16	On	32	POD above limit of anadromy	531	16	4

TABLE 8-2
Comparison of 2002 Draft Guidelines and 2007 Draft Policy

Proj #	Drainage	POD No.	POD Drainage Area (ac)	FMF (cfs)	MBF3 (cfs)	Yield under FMF (avg ann af)	Yield under Guidelines (avg ann af)	Yield under Policy (avg ann af)
1	Maacama Cr trib		156	0.46	1.76	63	20	21
2	Napa R trib	1	40	0.11	0.48	13	5	5
		2	5	0.01	0.15			
3	Napa R trib	1	250	0.46	3.86	37	37	30
		2	473	0.86	10.64			
4	Anderson Cr trib		13	--	0.40	10	10	0
5	Anderson Cr trib		544	1.57	12.77	44	44	26
			739	2.16	15.23			
6	Anderson Cr trib		404	1.14	10.55	19	19	9
			404	1.14	10.55			
7	Anderson Cr	1	13,542	42.27	75.92	53	53	42
	Anderson Cr trib	2	20	--	0.40			
	Anderson Cr	1	13,542	42.27	75.92			
8	Anderson Cr trib		3	--	0.08	4	4	0
9	Anderson Cr trib		4	--	0.04	6	6	1
10	Anderson Cr		15,014	46.47	79.52	48	48	47
11	Anderson Cr	1	13,434	41.91	75.56	41	41	40
	Anderson Cr trib	2	9	--	0.18			
12	Napa R trib	1	32	0.10	0.69	41	14	7
		2	75	0.22	1.84			
13	Dry Cr trib	1	114	0.27	5.31	20	14	5
		2	110	0.26	5.12			
14	Russian R trib	2	10	0.03	0.25	47	13	7
		3	85	0.25	2.24			
15	Big Sulphur Cr trib	1	831	2.88	13.97	60	60	36
		2	690	2.38	11.57			
16	Big Sulphur Cr trib	1	4	0.012	0.072	39	20	15
		2	136	0.50	2.89			
17	Russian R trib	1	133	0.37	3.98	218	43	14
		2	39	0.11	1.71			
		3	35	0.10	0.85			
		4	141	0.40	6.14			
		5	46	0.13	1.38			
18	Santa Rosa Cr trib	1	10	0.02	0.14	30	30	21
		2	103	0.26	1.50			
		3	194	0.50	2.82			
19	Dry Cr trib	1	30	--	1.17	45	9	11
		2	14	--	0.55			
		3	19	--	2.27			
20	Mark West Cr trib		280	0.73	6.20	106	27	4
21	Green Valley Cr trib		38	0.07	2.80	33	5	1

NOTES
Yield under Guidelines includes both FMF bypass and 10% seasonal volume limit as constraints.
Yield under Policy includes both MBF3 bypass and 5% of 1.5-yr MCD rate as constraints.
Projects 4, 8, 9 and 19 modeled with zero bypass for Yield under FMF and Yield under Guidelines.

FIGURE 8-1
Project #15: Modeled impairment at POD#1 with no diversion constraints
Normal water year



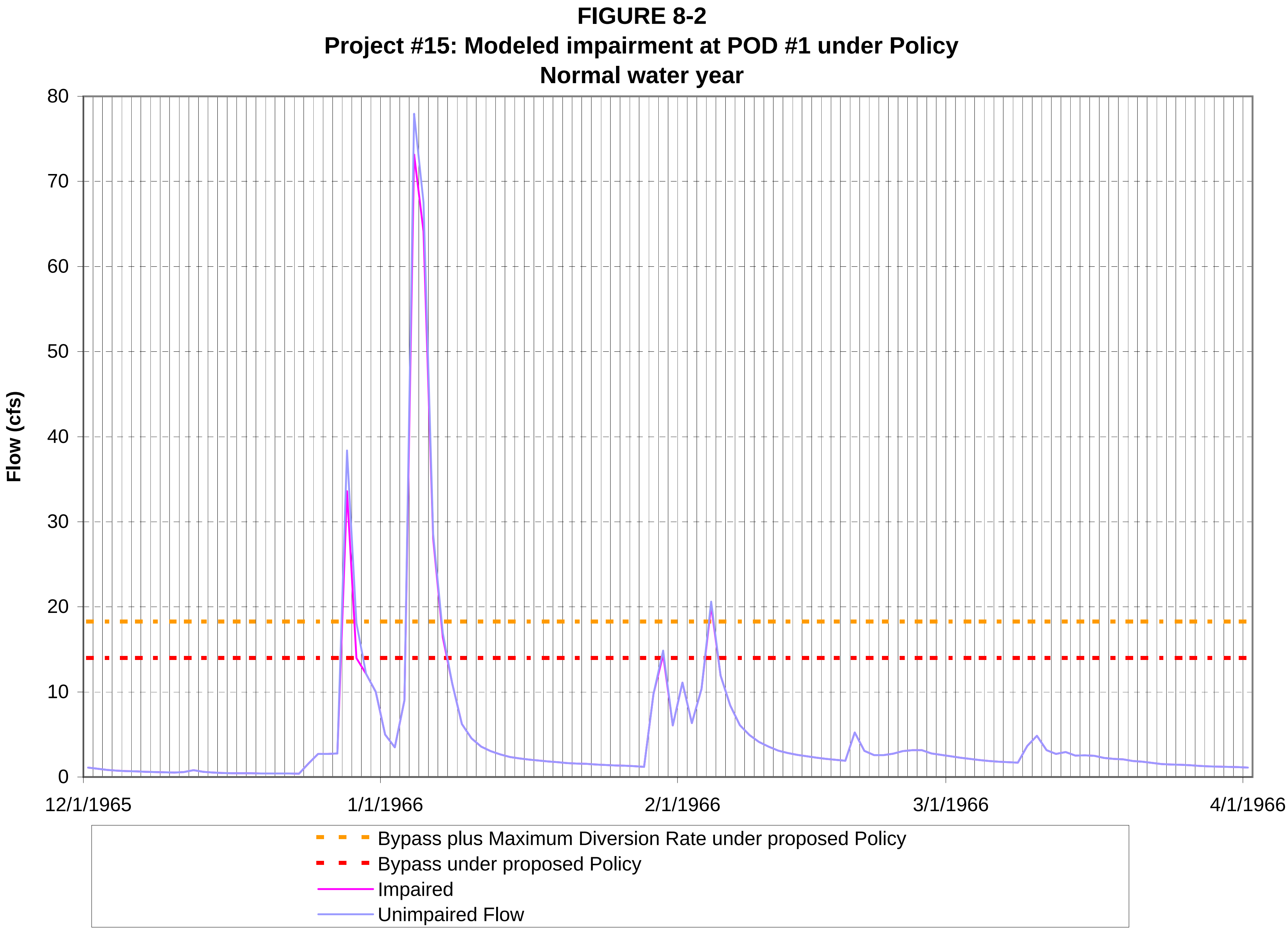


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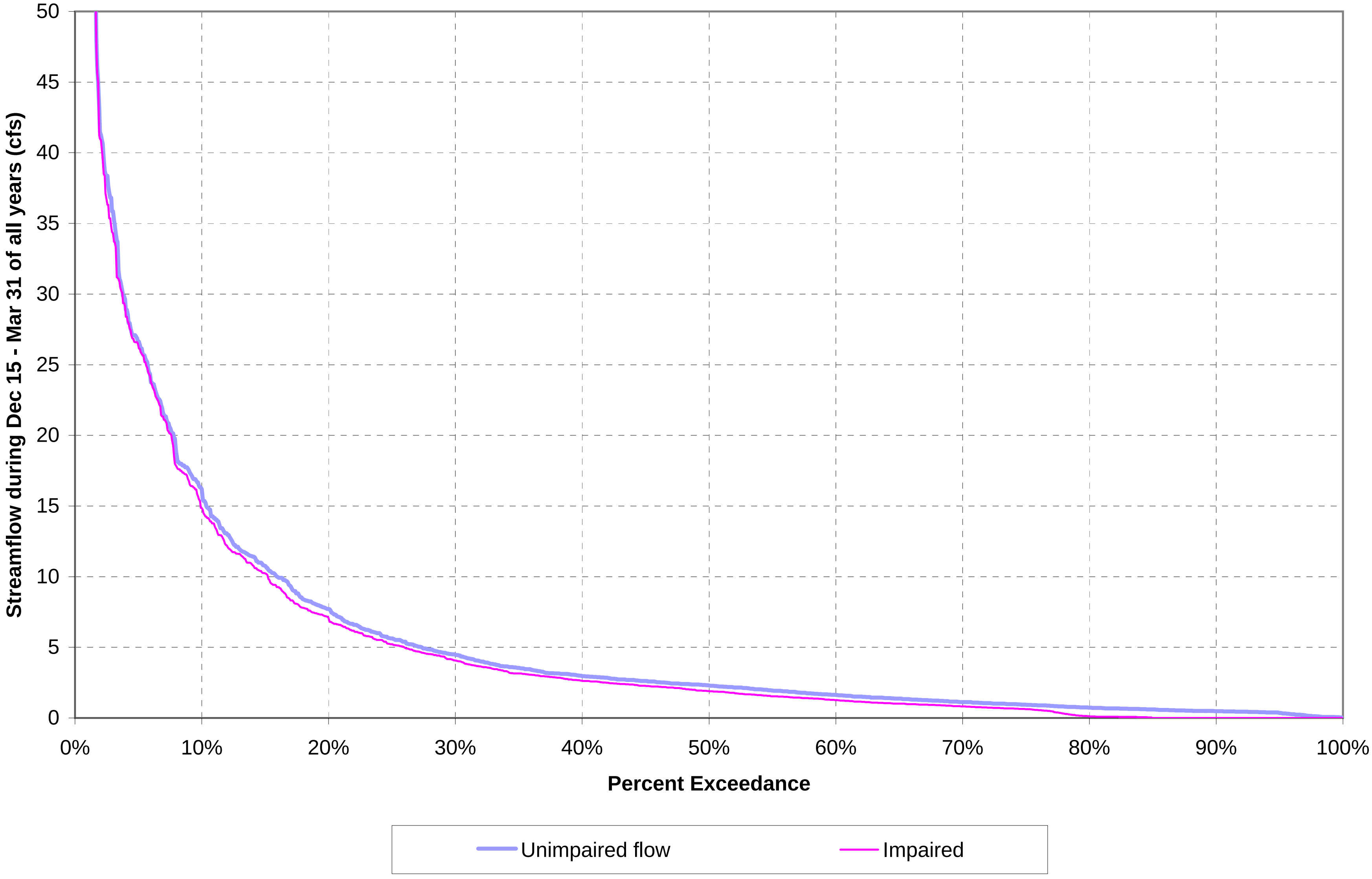
FIGURE 8-3
Project #15: Modeled impairment at POD#1 with no diversion constraints
All years



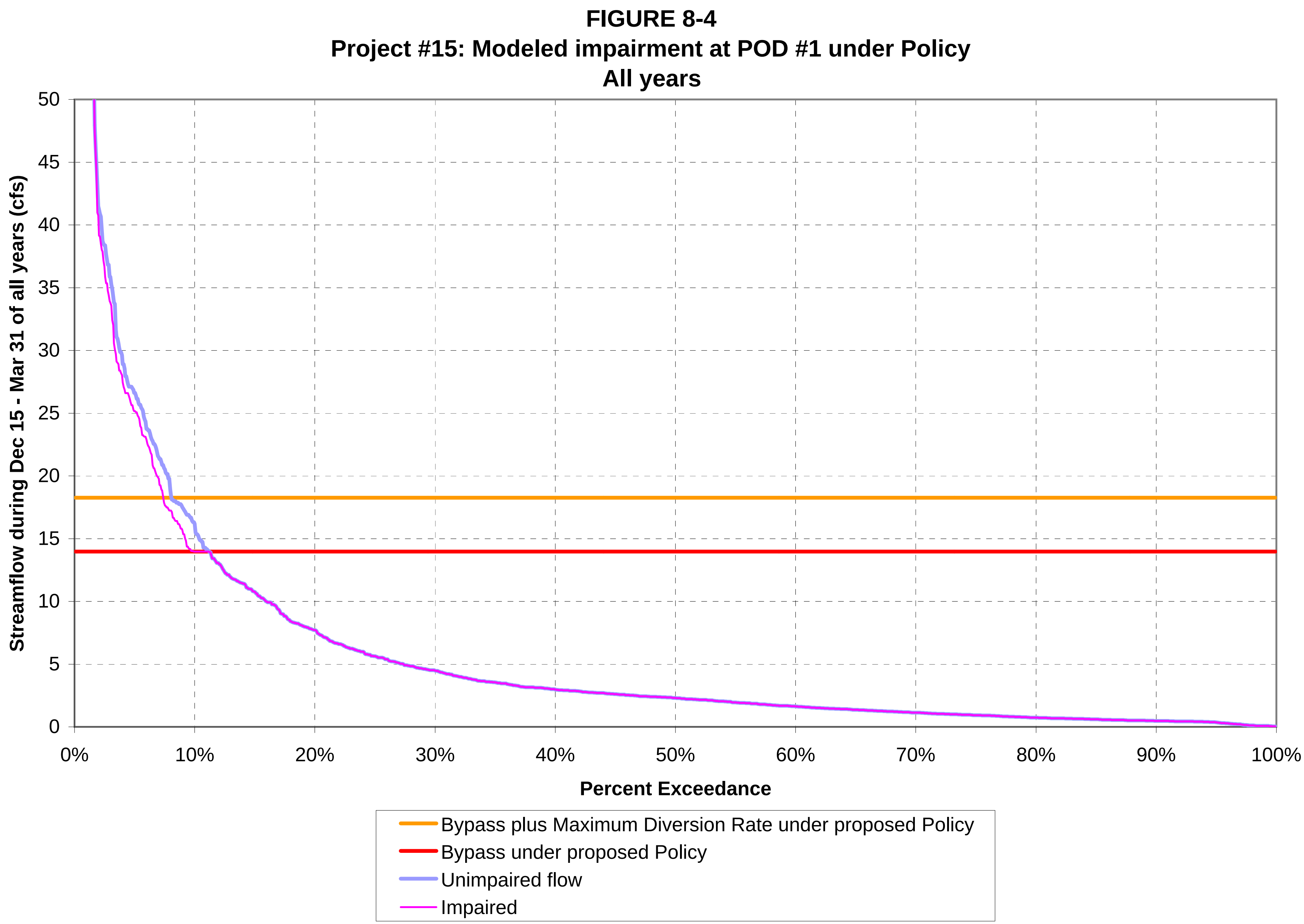
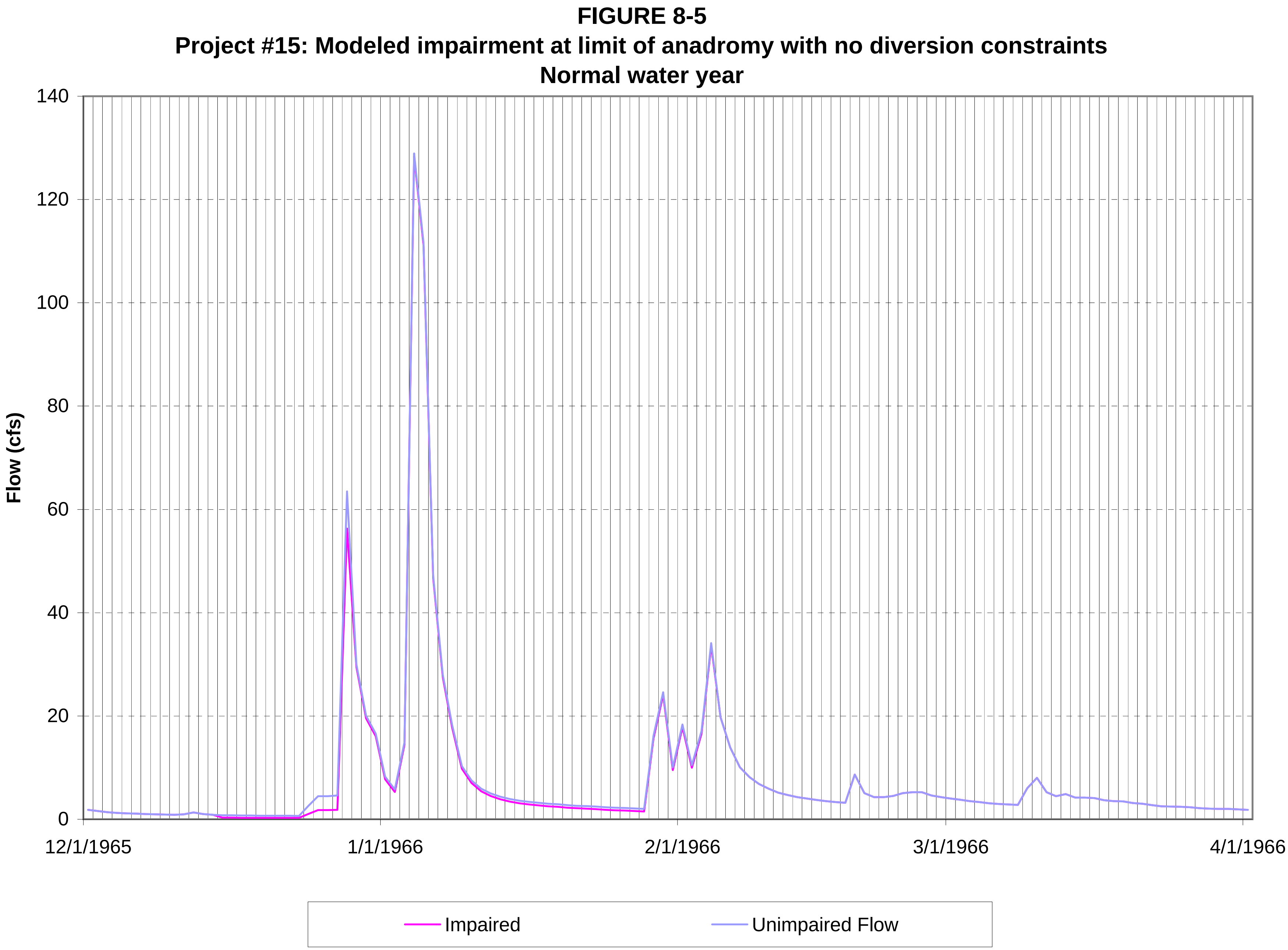


FIGURE 8-4
Project #15: Modeled impairment at POD #1 under Policy
All years
Streamflow during Dec 15 - Mar 31 of all years (cfs)
50
45
40
35
30
25
20
15
10
5
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Exceedance
Bypass plus Maximum Diversion Rate under proposed Policy
Bypass under proposed Policy
Unimpaired flow
Impaired

4/30/2008



Proj 15.xls, nocons poa 1966

FIGURE 8-6
Project #15: Modeled impairment at limit of anadromy under Policy
Normal water year

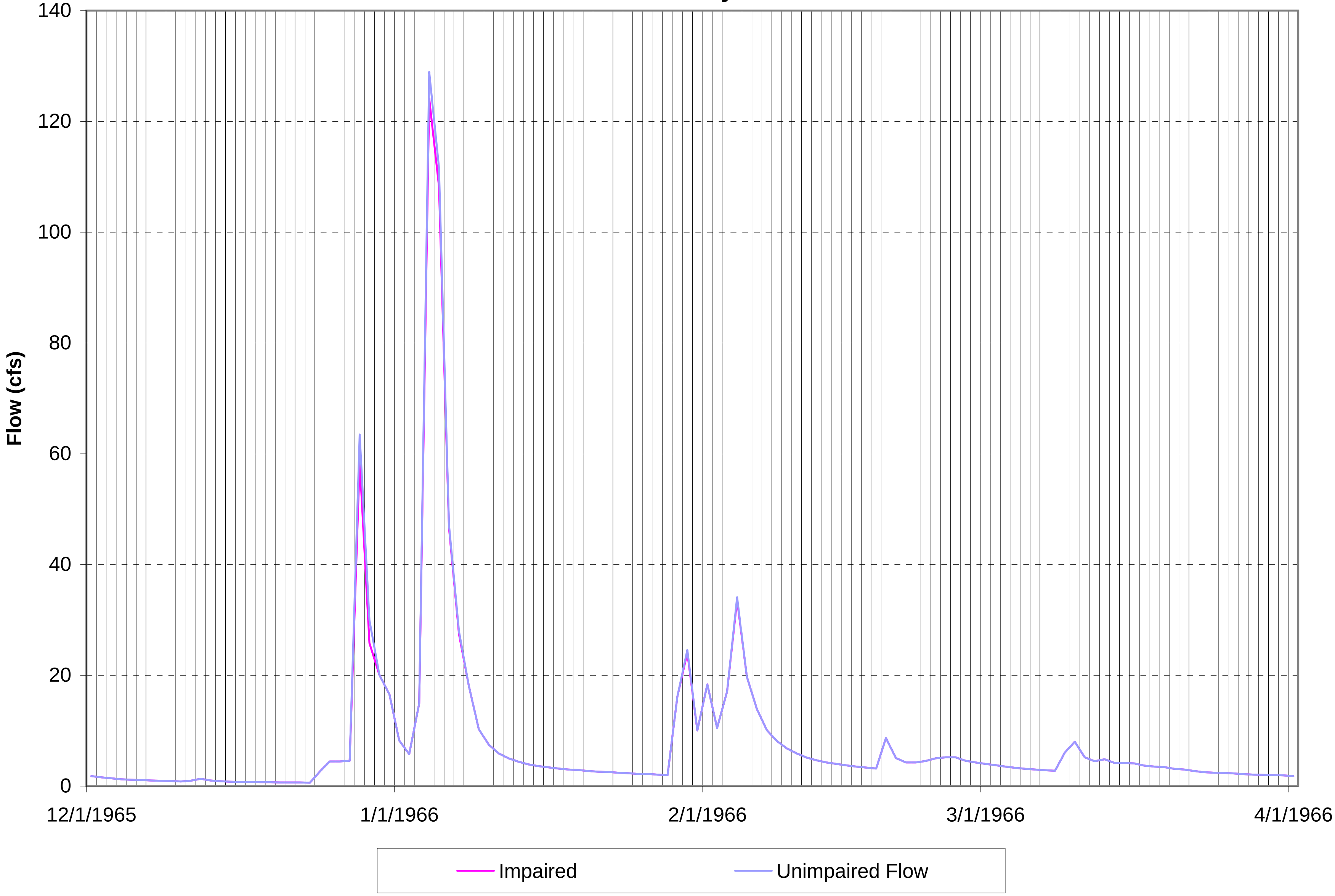


FIGURE 8-7
Project #15: Modeled impairment at limit of anadromy with no diversion constraints
All years

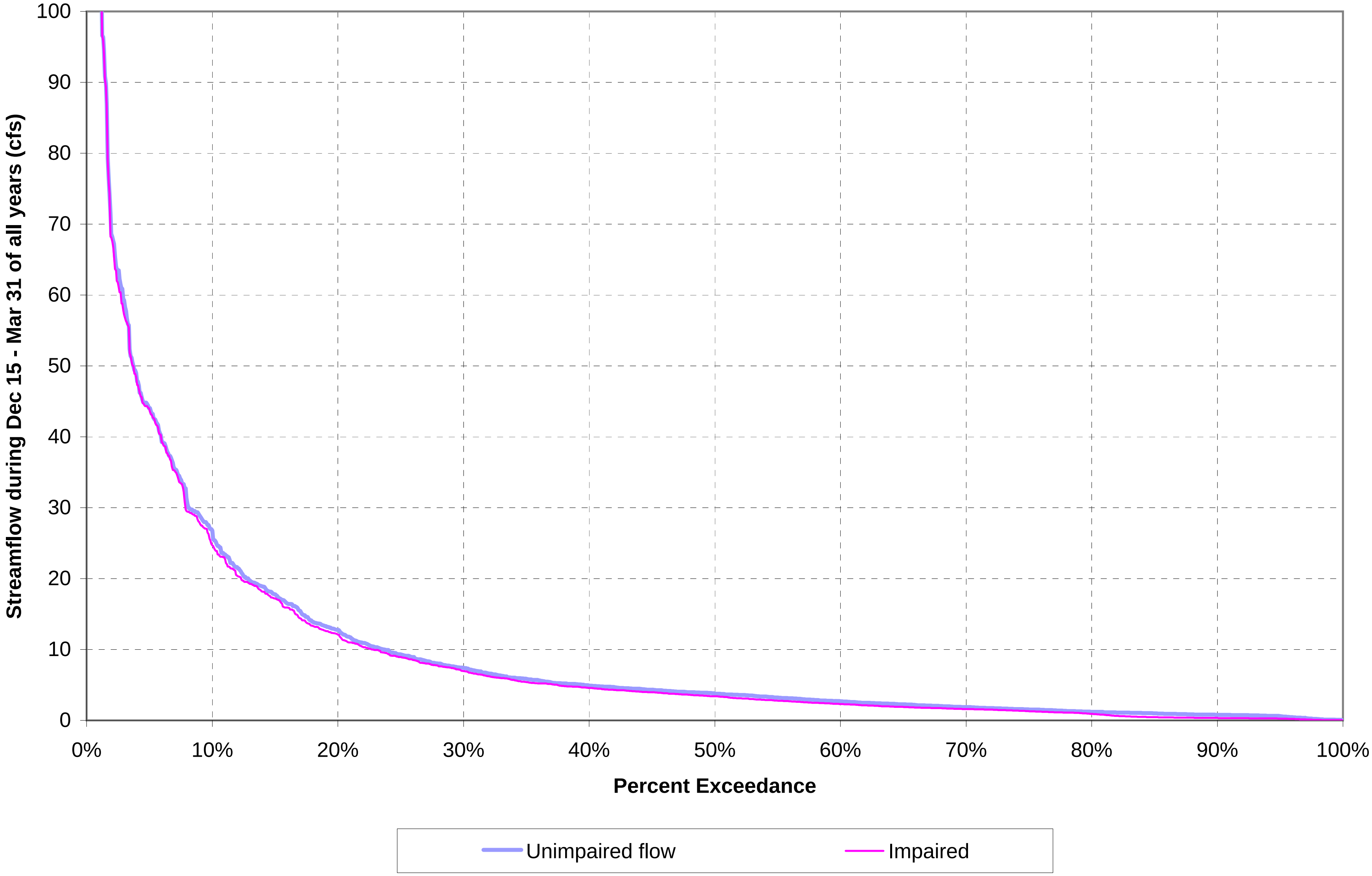


FIGURE 8-8
Project #15: Modeled impairment at limit of anadromy under Policy
All years

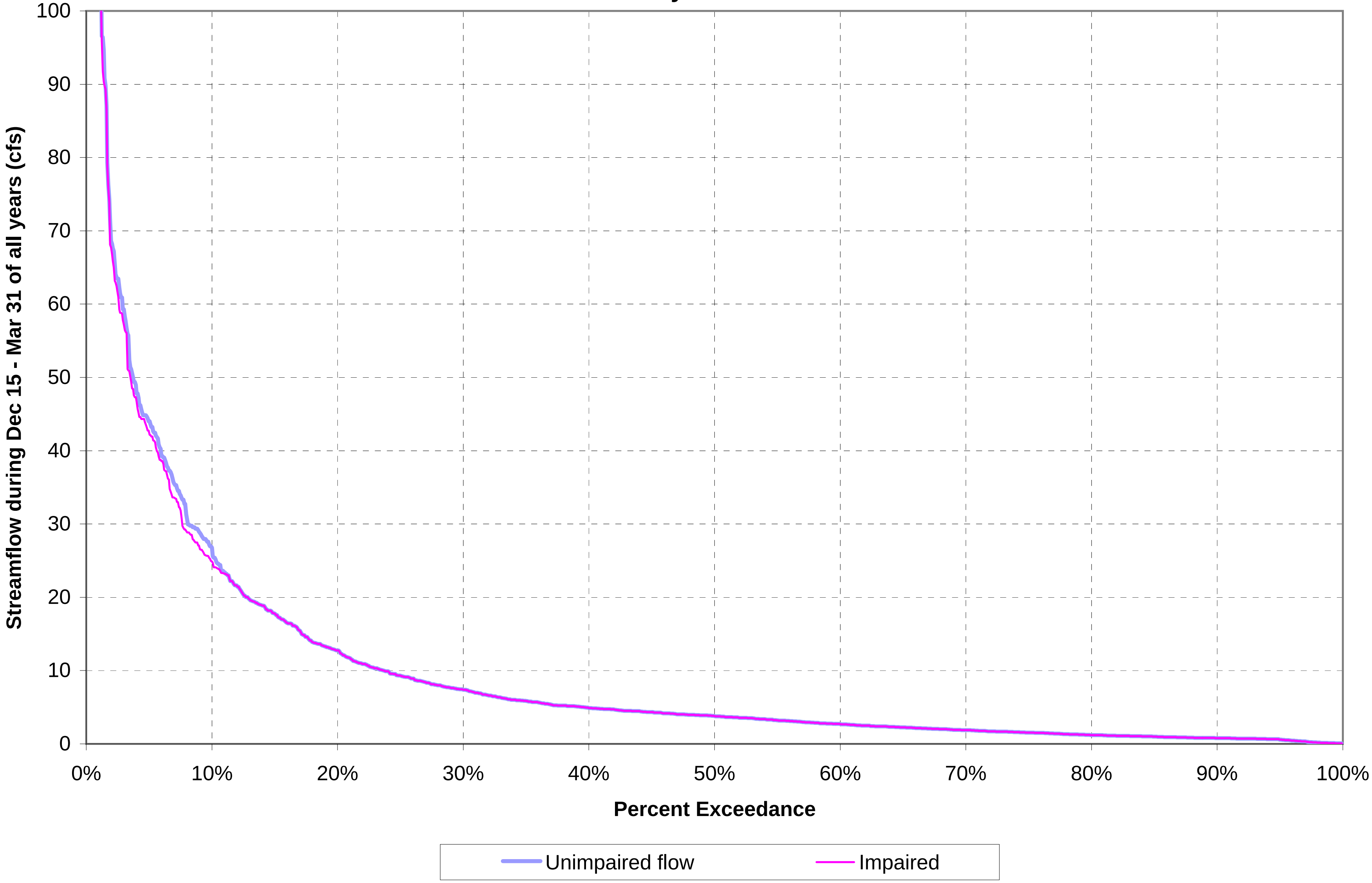
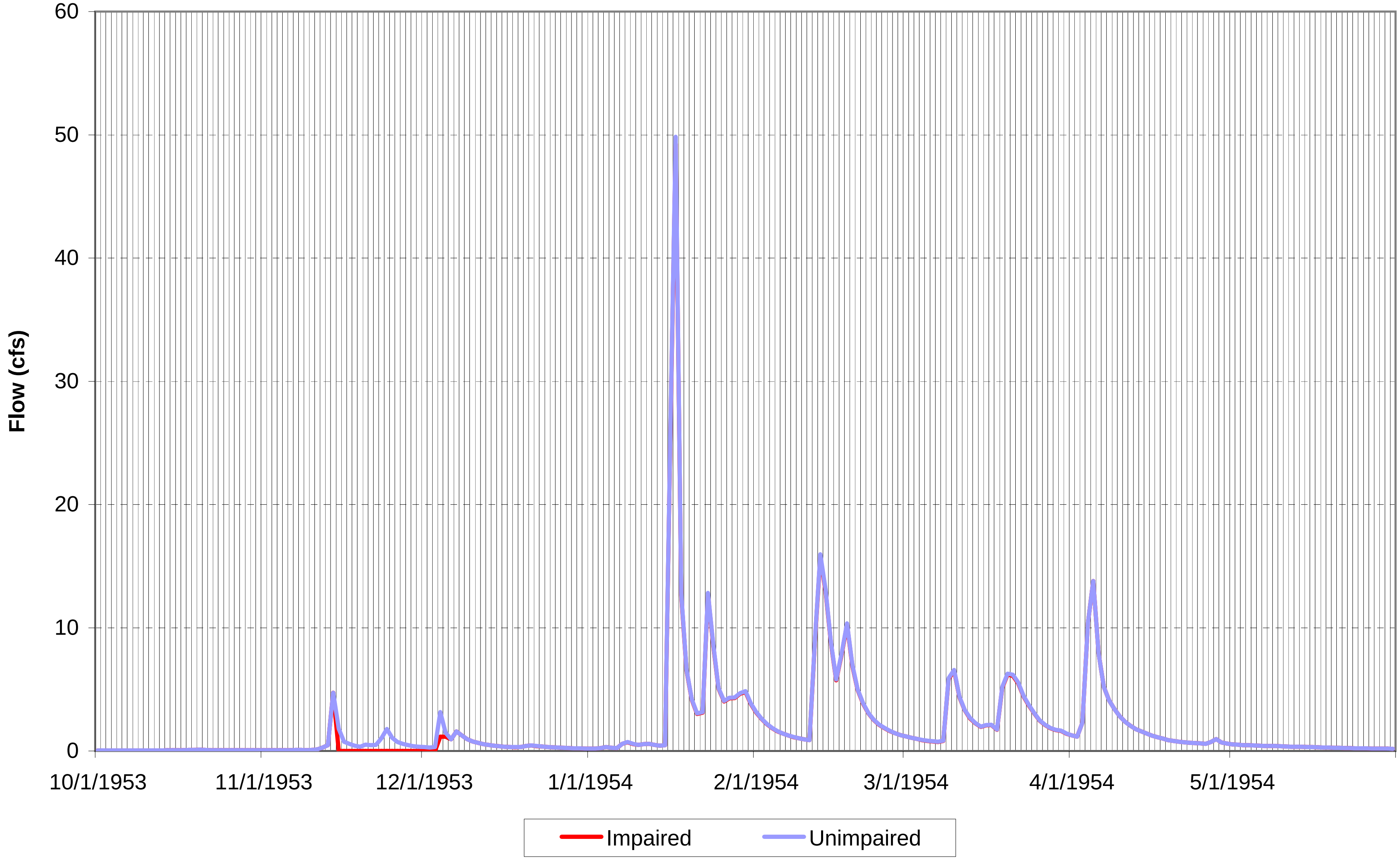


FIGURE 8-9
Project #5: Modeled impairment at POD with no diversion constraints
Normal water year (Project yield this year = 30 AF)



AndersonCreek no constraint.xls, 54poi#43

FIGURE 8-10
Project #5: Modeled impairment at POD with no diversion constraint
Dry water year (Project yield this year = 30 AF)

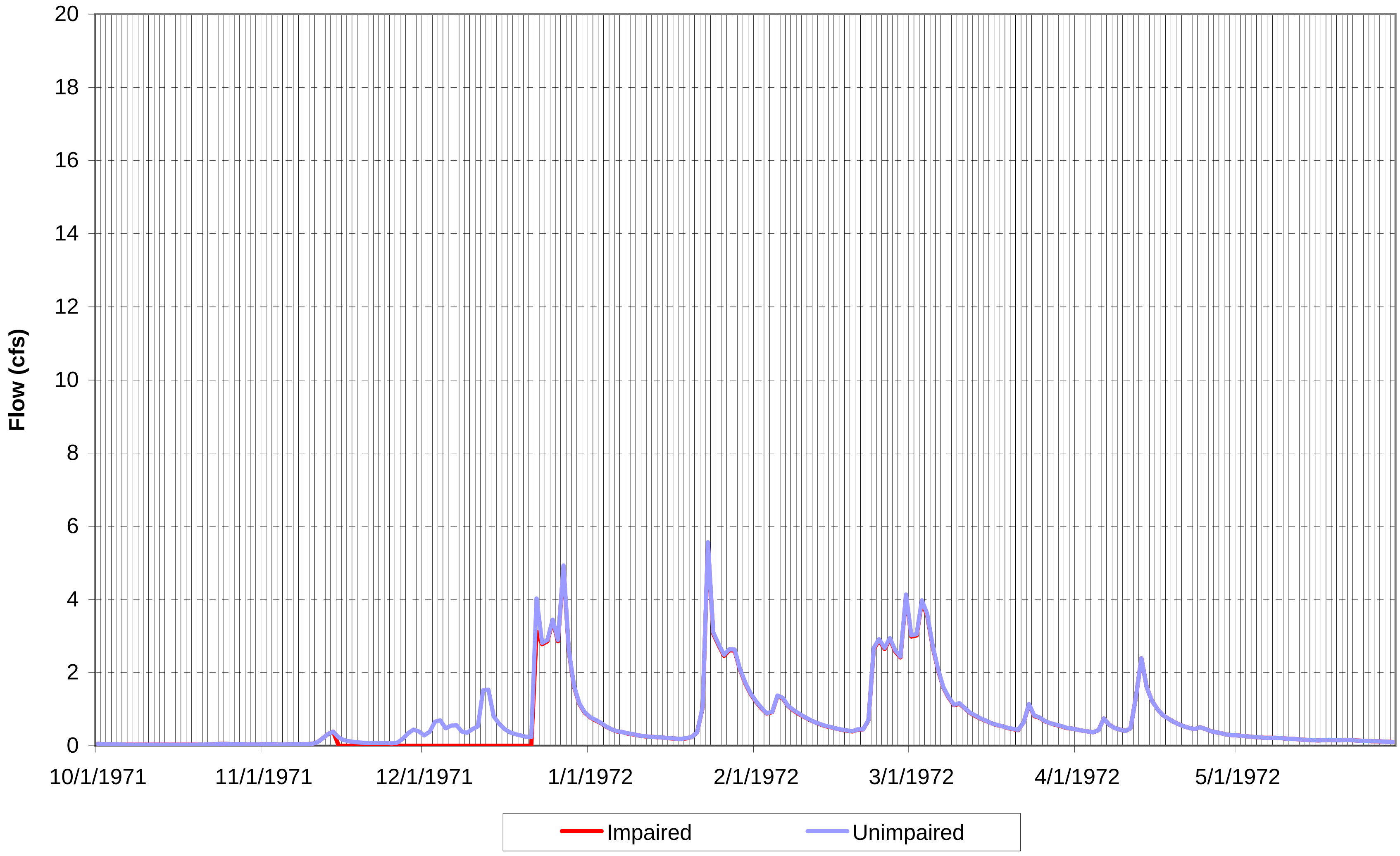


FIGURE 8-11
Project #5: Modeled impairment at POD under Policy
Normal water year (Project yield this year = 15 AF)

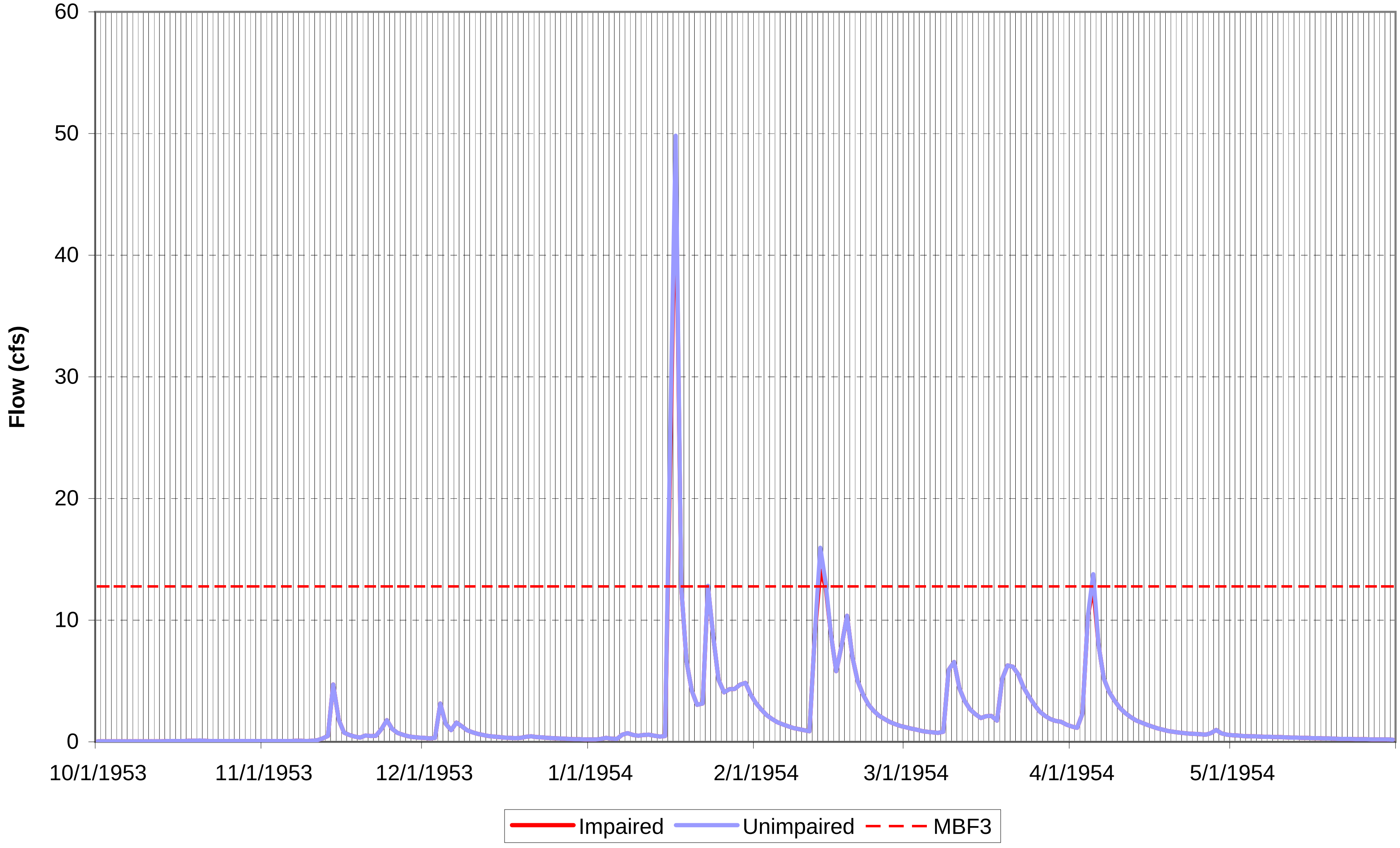


FIGURE 8-12
Project #5: Modeled impairment at POD under Policy
Dry water year (Project yield this year = 0 AF)

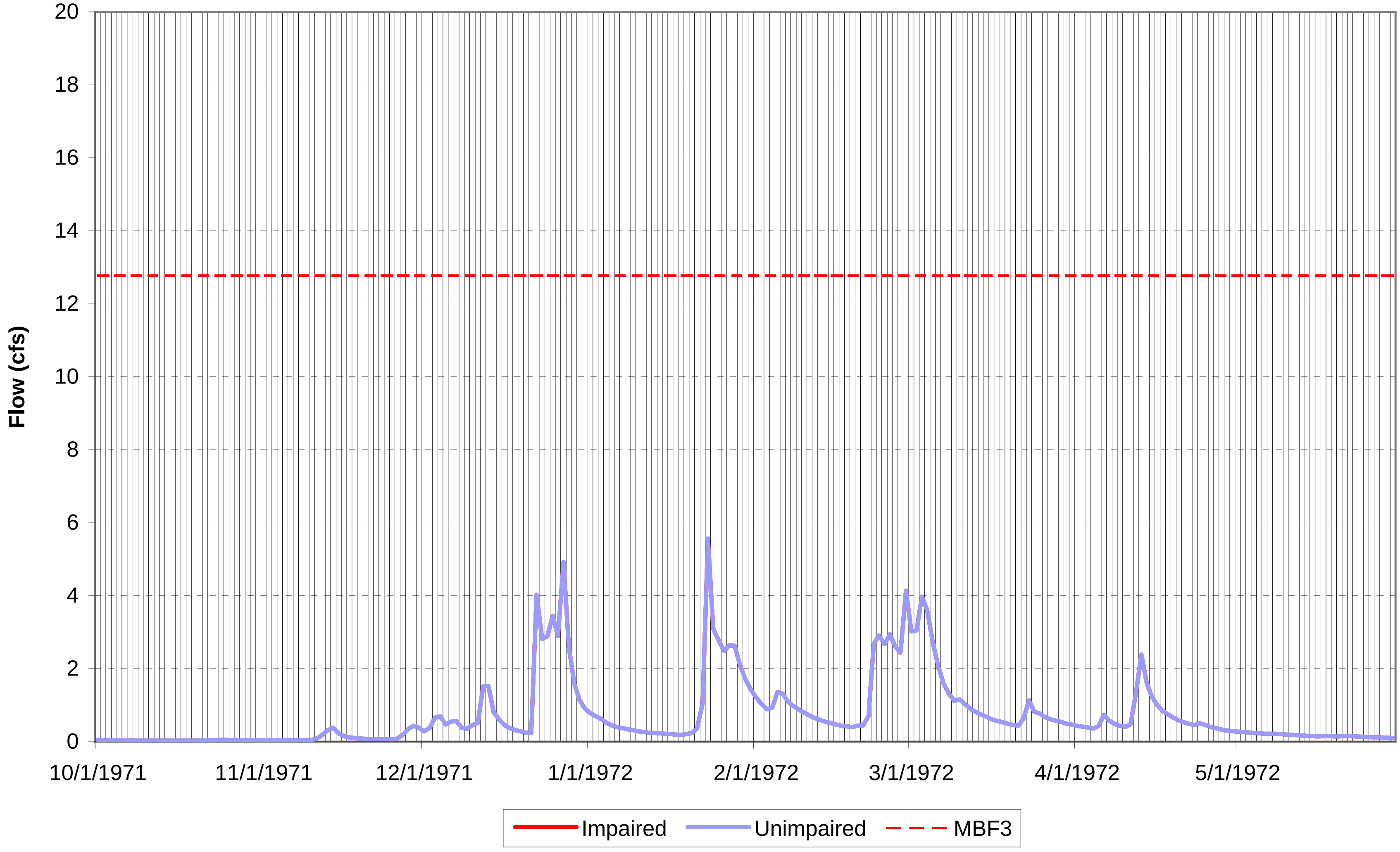


FIGURE 8-13
Project #6: Modeled impairment at limit of anadromy with no diversion constraints
Normal water year (Project yield this year = 24 AF)

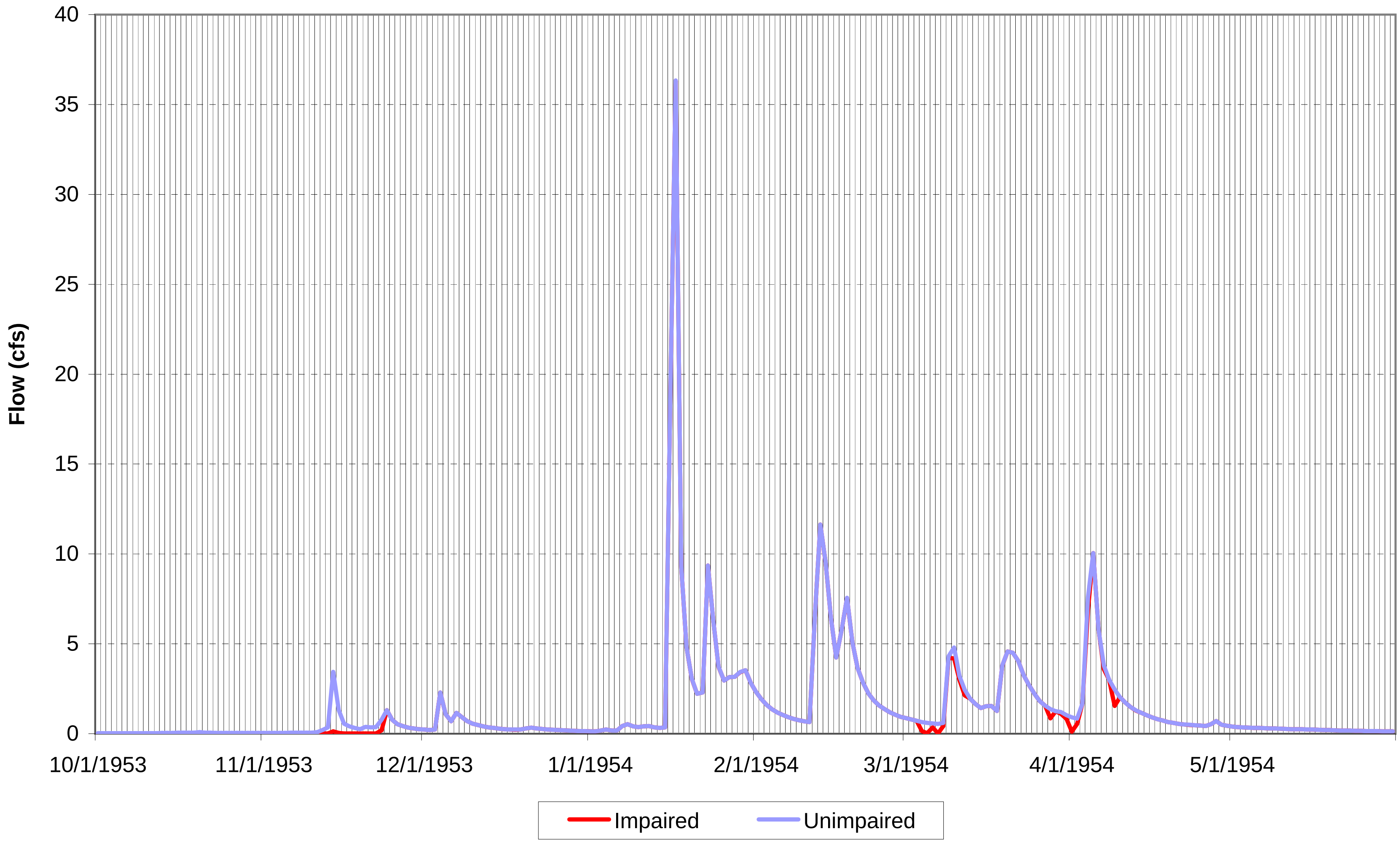


FIGURE 8-14
Project #6: Modeled impairment at limit of anadromy with no diversion constraints
Dry water year (Project yield this year = 24 AF)

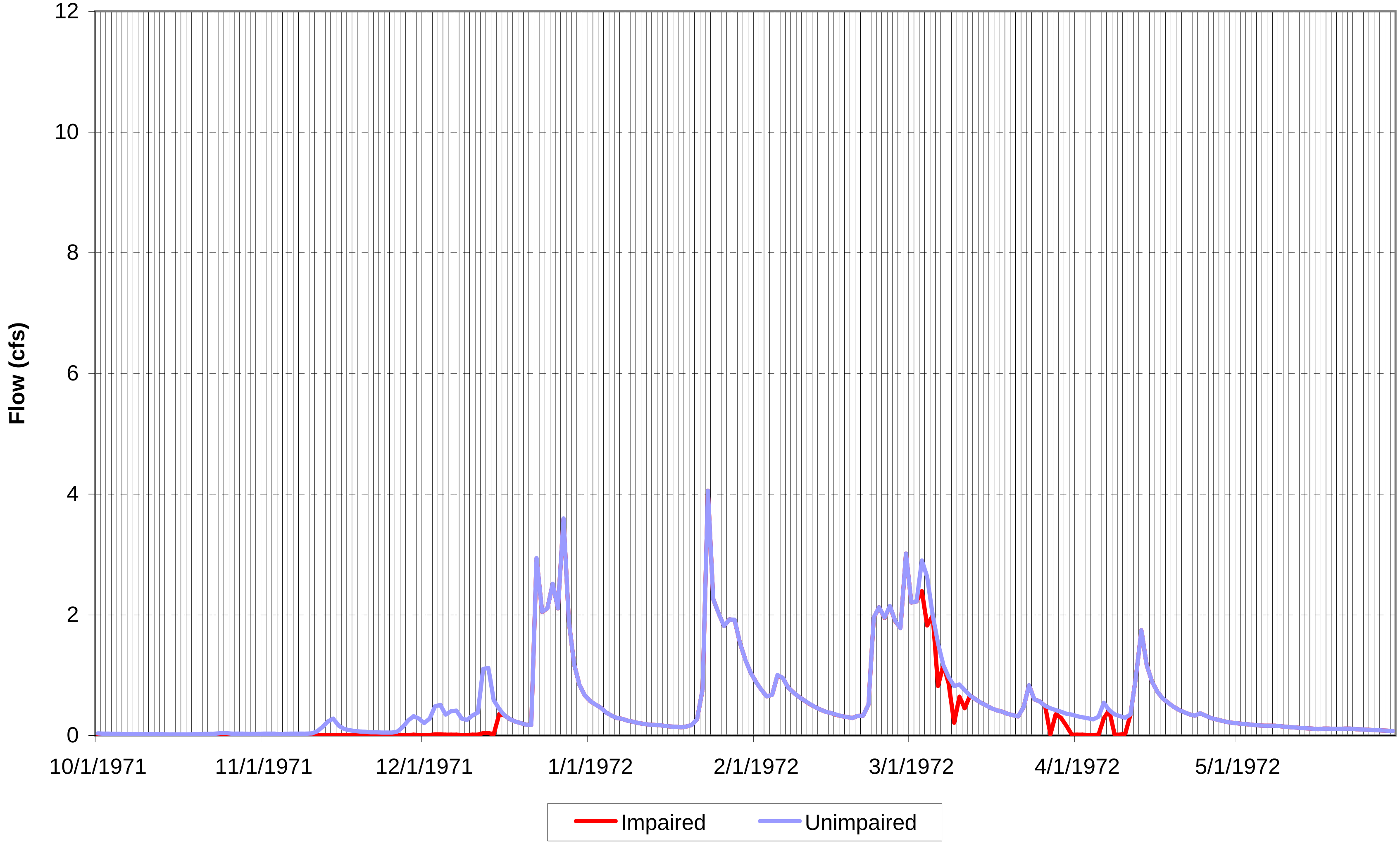


FIGURE 8-15
Project #6: Modeled impairment at limit of anadromy under Policy
Normal water year (Project yield this year = 7 AF)

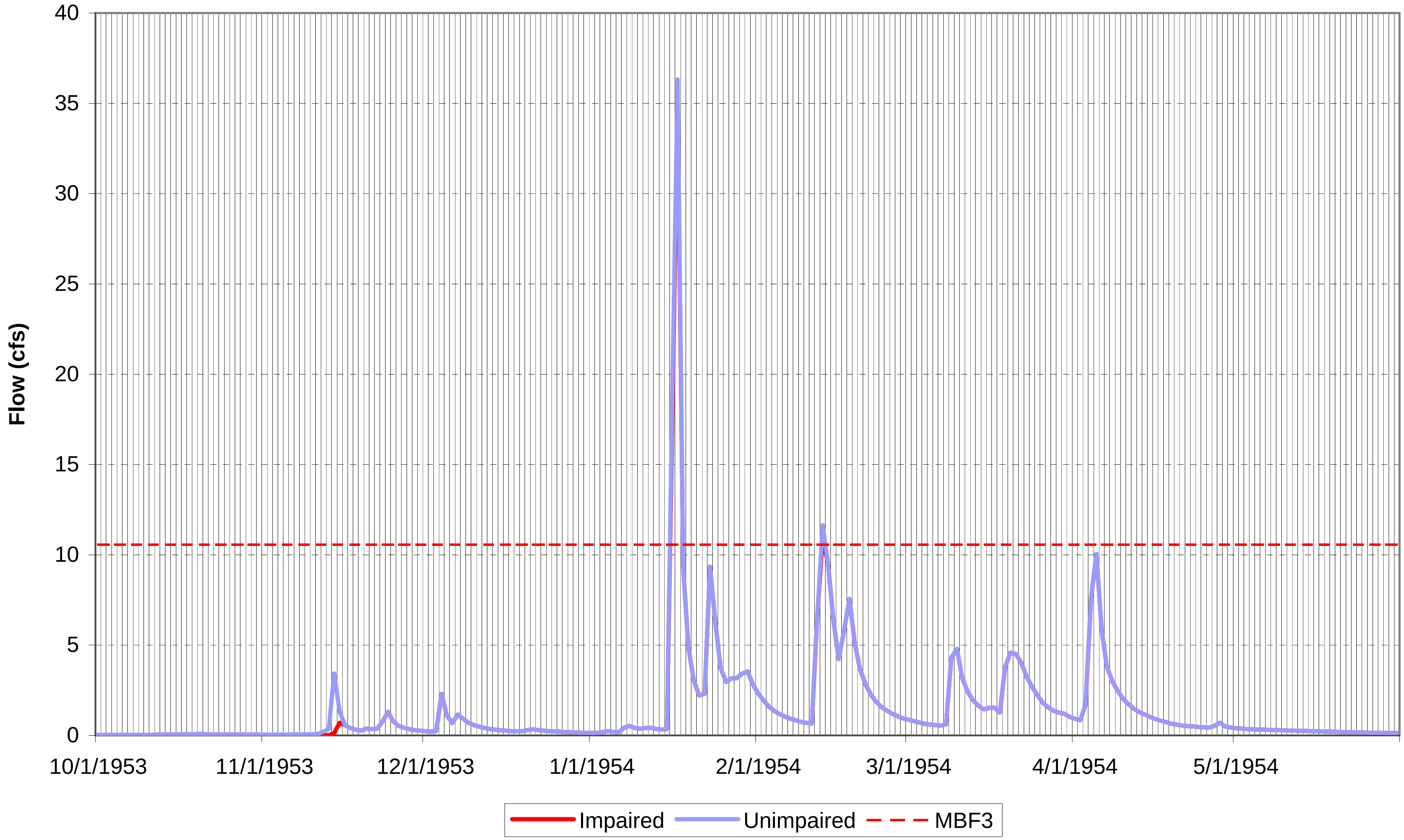


FIGURE 8-16
Project #6: Modeled impairment at limit of anadromy under Policy
Dry water year (Project yield this year = 0 AF)

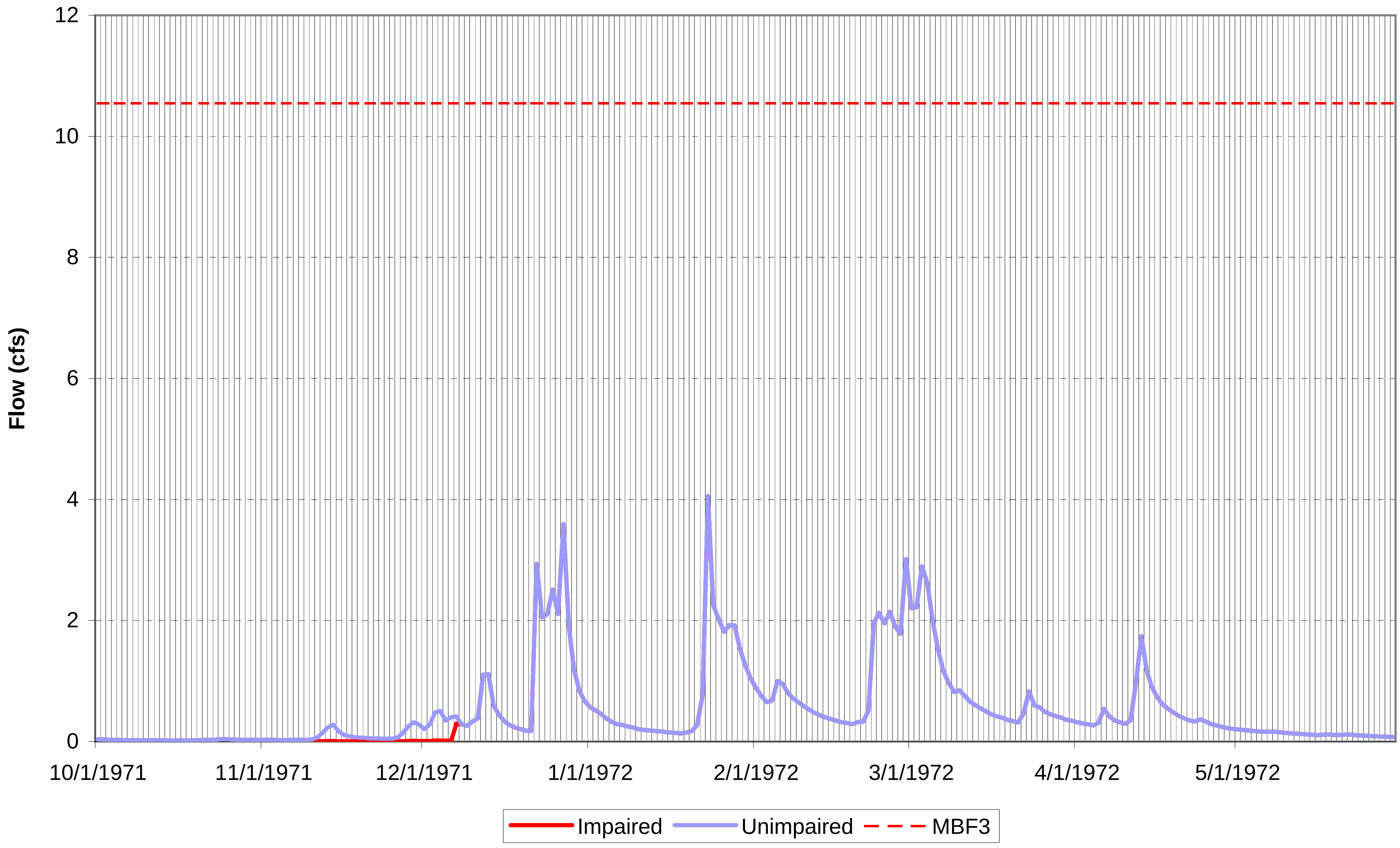


FIGURE 8-17
Project #4: Modeled impairment at limit of anadromy with no diversion constraints
Normal water year (Project yield this year = 12 AF)

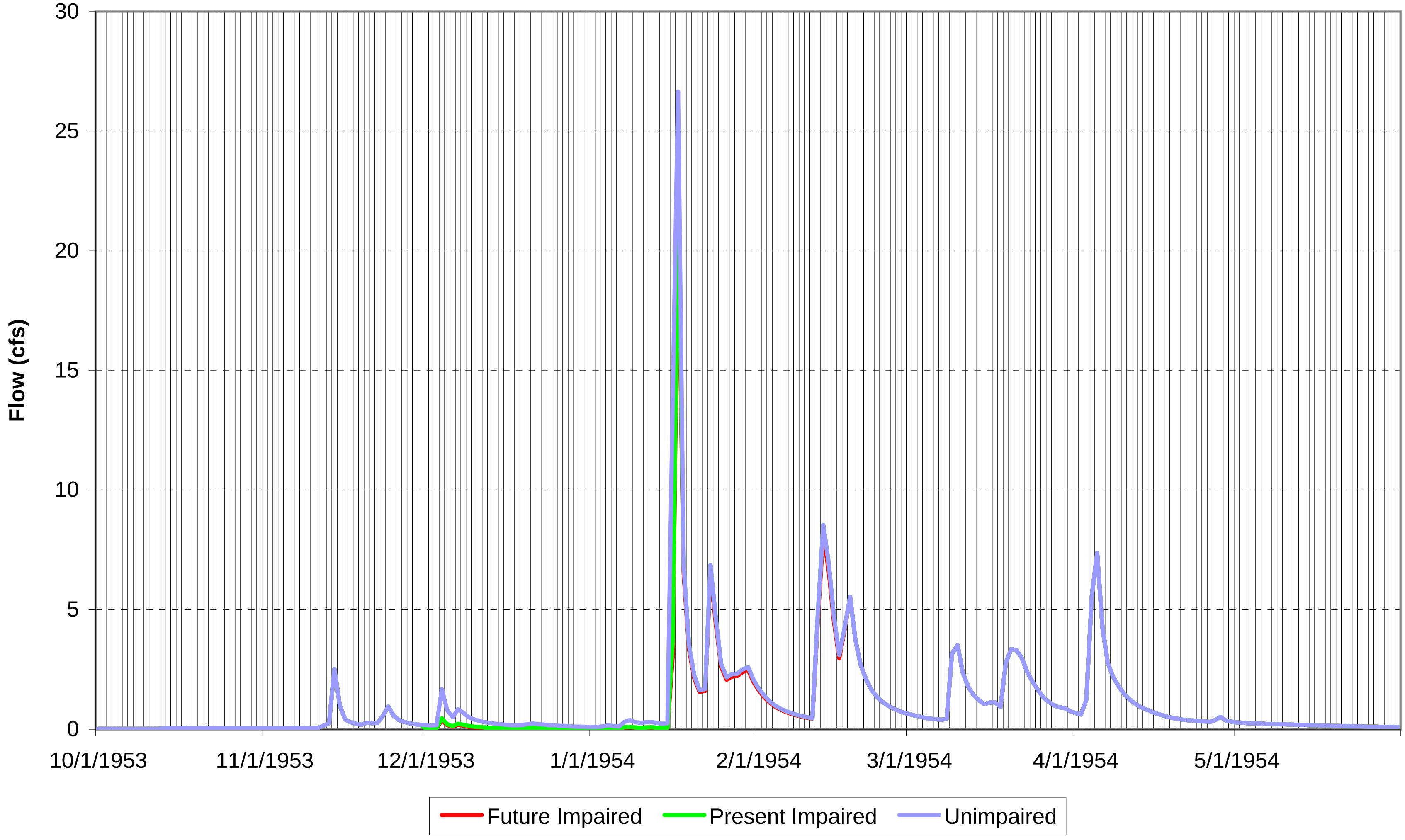


FIGURE 8-18
Project #4: Modeled impairment at limit of anadromy with no diversion constraints
Dry water year (Project yield this year = 7 AF)

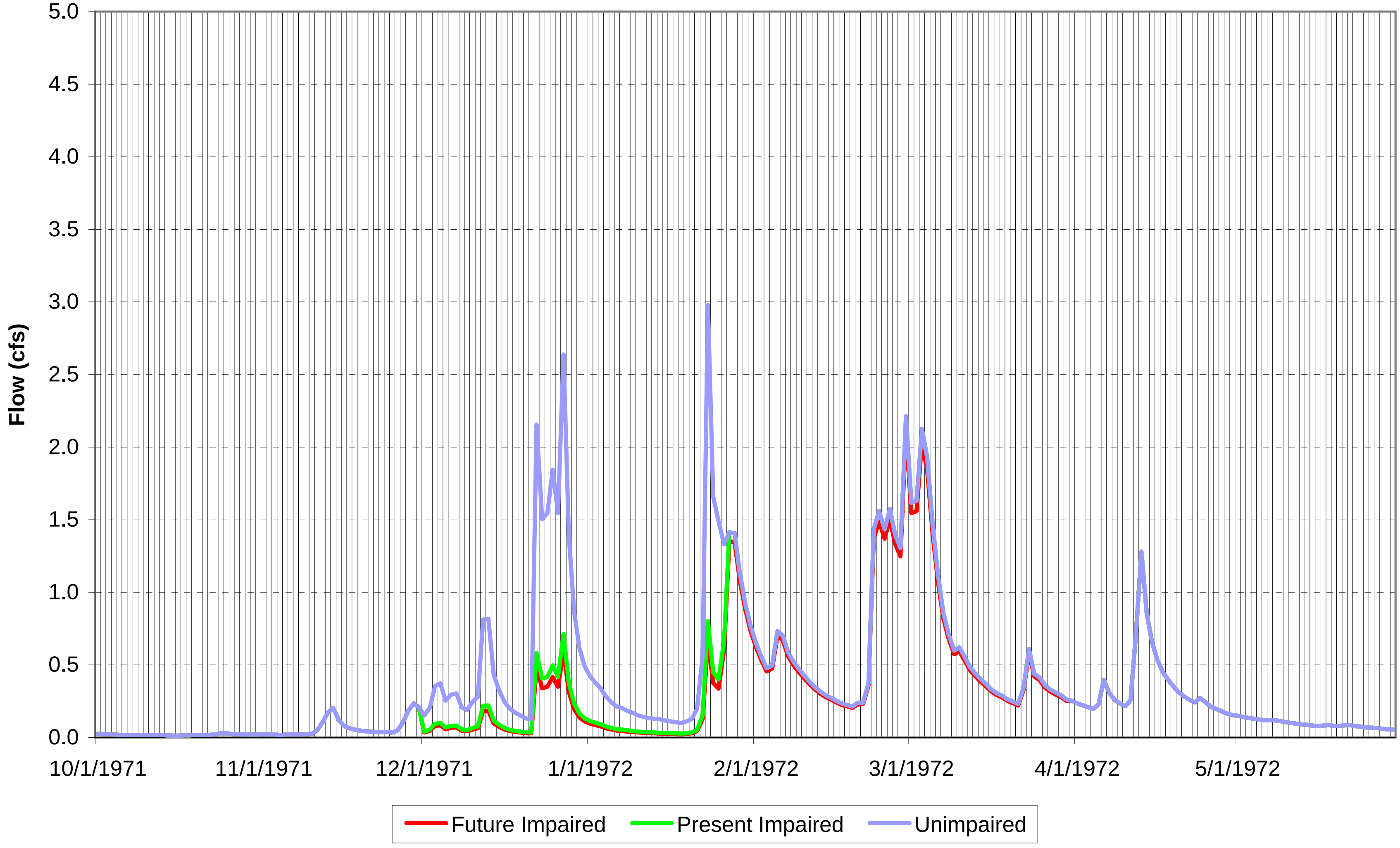


FIGURE 8-19
Project #12: Modeled impairment immediately below POD #1 with no diversion constraints
Normal water year

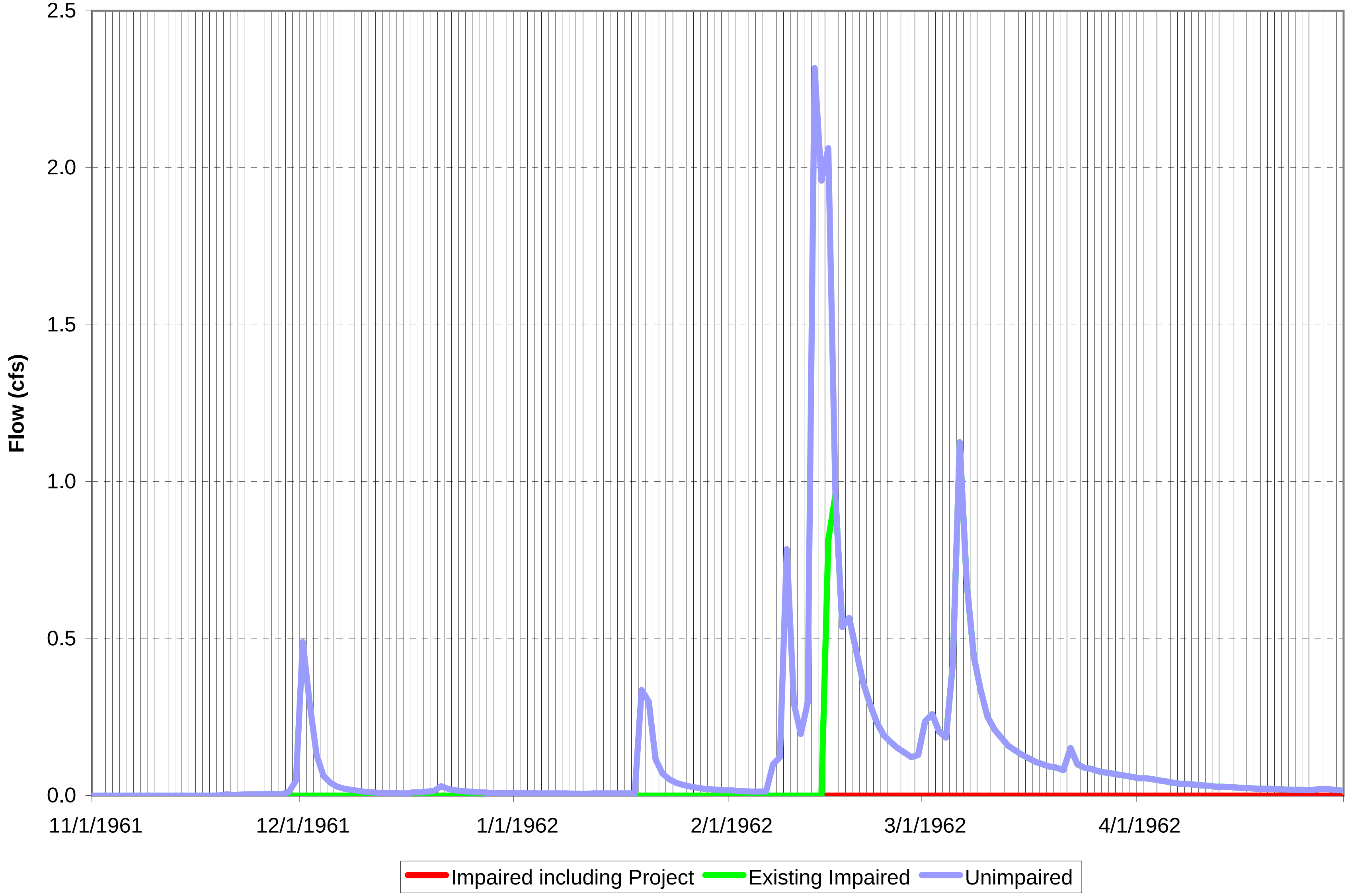


FIGURE 8-20
Project #12: Modeled impairment immediately below POD #1 with no diversion constraints
Dry water year

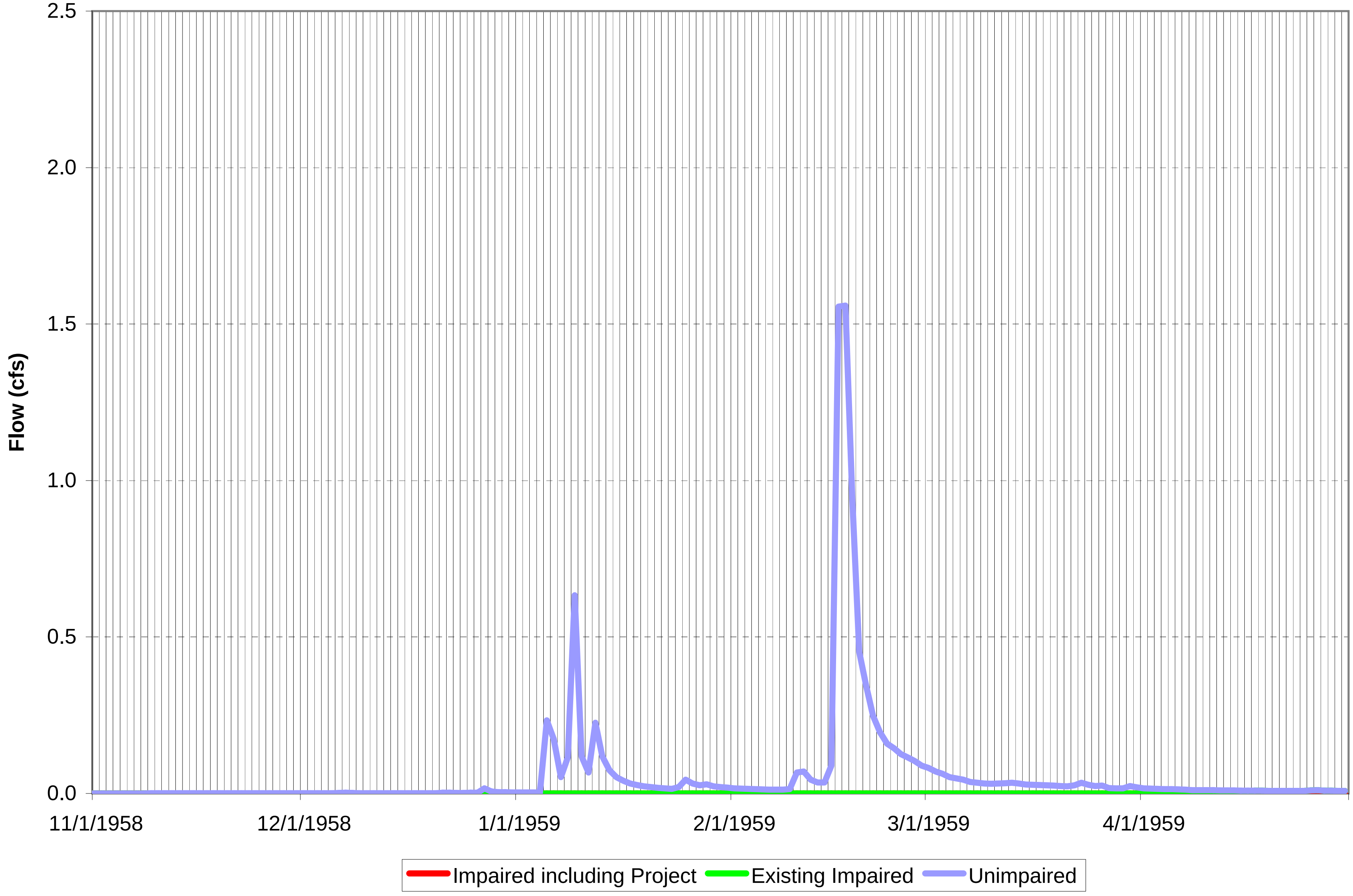


FIGURE 8-21
Proj #12: Modeled impairment at limit of anadromy below POD #1 with no diversion constraints
Normal water year

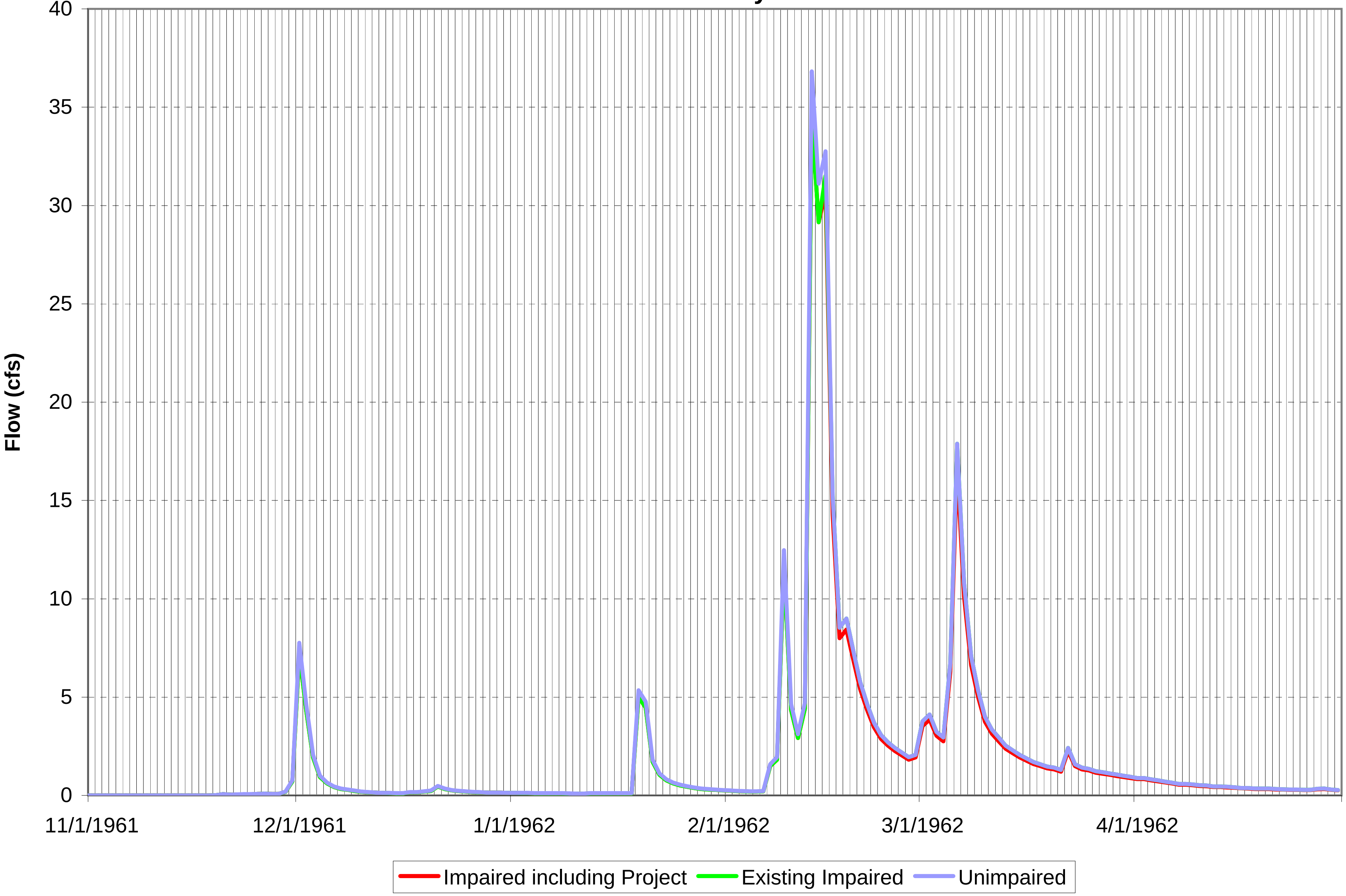
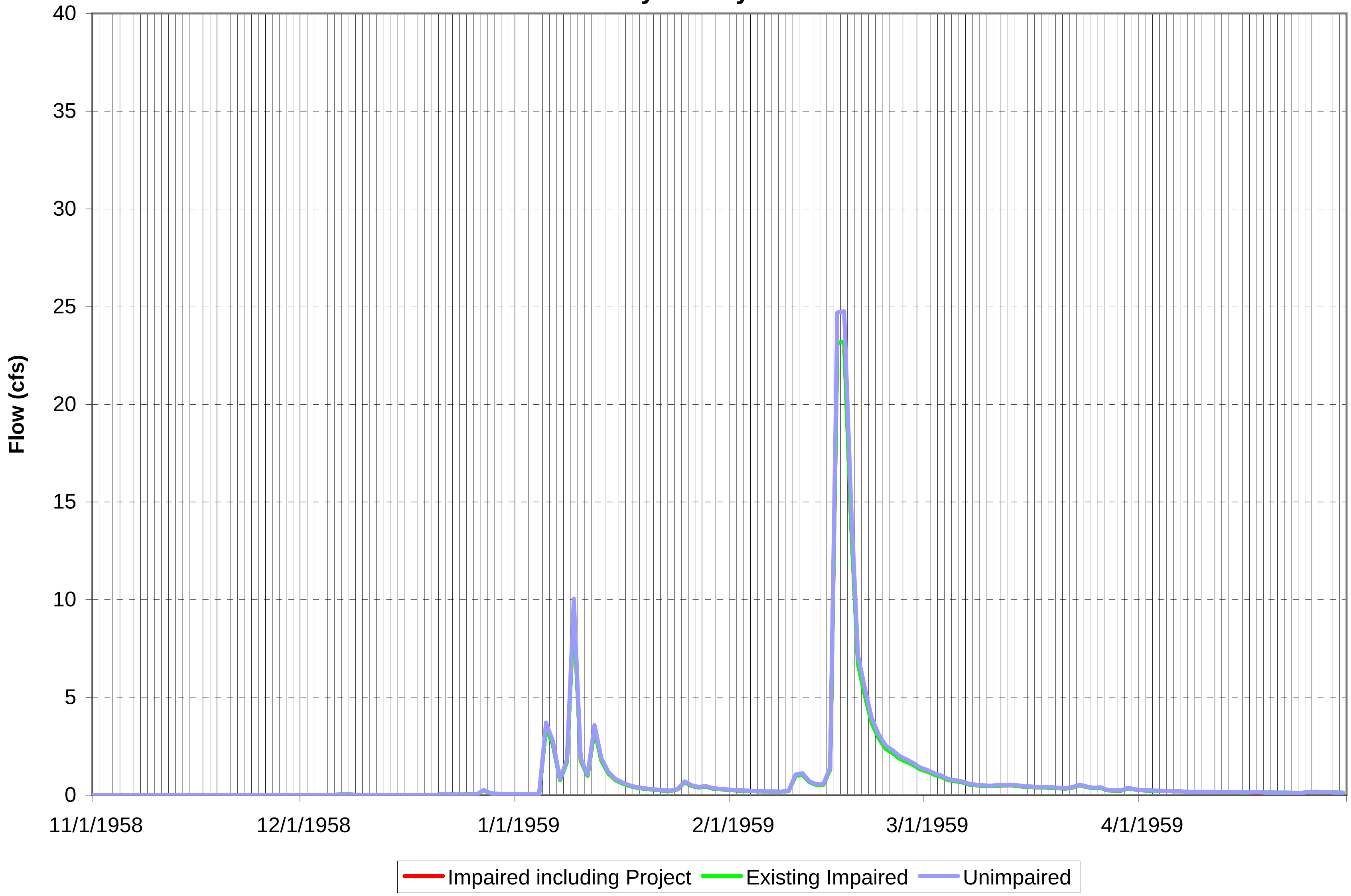
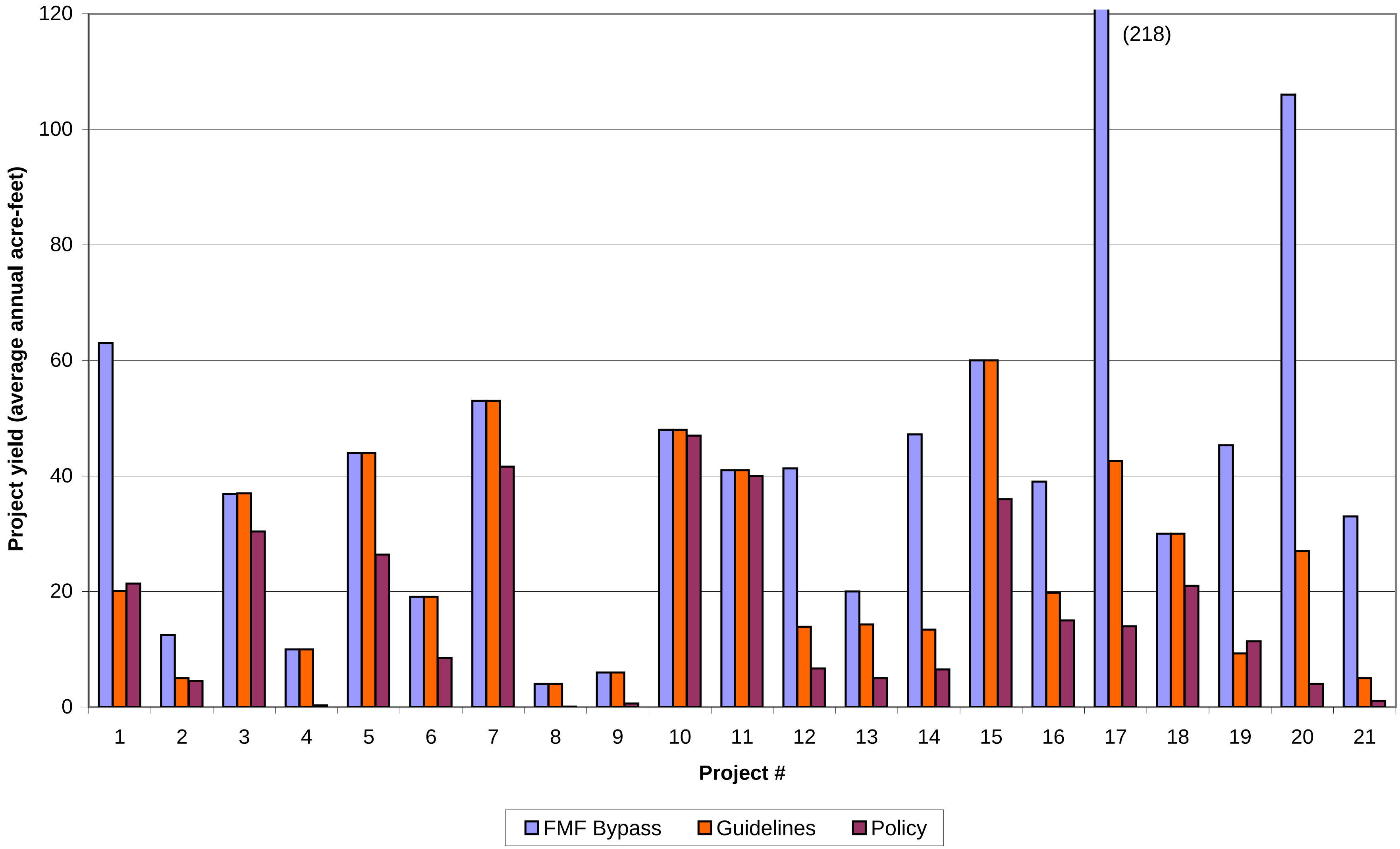


FIGURE 8-22
Proj #12: Modeled impairment at limit of anadromy below POD #1 with no diversion constraints
Dry water year



Proj 12.xls, poi3.5 1959 (2)

FIGURE 8-23
Average annual project yield estimated for 21 Wagner & Bonsignore clients under FMF bypass, Draft Guidelines, and Draft Policy



9.0 WRONG CONCLUSION WAS DRAWN FROM "WATER COST" ANALYSIS

The "Water Cost" analysis leads to a primary conclusion in the SED (p. 82) that "… *the proposed Policy alternative would allow a larger average volume of water to be diverted than if the CDFG-NMFS Guidelines criteria were applied*." It continues on that page to explain that this is important because "…*the proposed Policy may lead affected persons to take actions that could result in indirect environmental effects*" associated with obtaining an alternative supply of water and that "*[i]t follows then that the proposed Policy, by virtue of it being the least restrictive, would result in the least environmental effects among the regionally protective alternatives.*"

This conclusion is opposite of fact for smaller drainage areas, that is, those with less than about 2 square miles, as explained below. This is important because most pending applications are for projects with drainage areas far less than 2 square miles. The median drainage area of pending applications from Wagner & Bonsignore Engineers sampling is about 50 acres. Because most pending applications are on small watersheds, the Draft Policy would allow less diversion than the DFG-NMFS Draft Guidelines. According to the logic of the SED, it would then follow that the Draft Policy, by being more restrictive, would result in more indirect environmental effects than the Draft Guidelines. However, there is no basis to conclude that the Draft Guidelines are the appropriate standard for comparison.

9.1 Water Availability was Developed from Screening Criteria

The "Water Cost" analysis was not an economic analysis. Nor was it an estimate of water available for diversion while maintaining streamflows protective of anadromous salmonids. It was an estimate of water available for diversion as constrained by the three Design Elements: diversion season (DS1, DS2 or DS3), maximum cumulative diversion (MCD1, MCD2, MCD3, or MCD4), and minimum bypass flow (MBF1, MBF2, MBF3, or MBF4). These Elements were combined into 48 possible scenarios.

Both the Draft Guidelines and the Draft Policy make clear that the quantitative regional criteria are intended to be sufficiently conservative to be applicable in all situations to provide a threshold of diversions under which protectiveness of fisheries is assured without further study. Both the Draft Guidelines and the Draft Policy provide for site-specific analyses to evaluate whether diversions in excess of the regional threshold would impact fishery resources. Thus the CFII criteria in the Draft Guidelines and the regional criteria in the Draft Policy are screening criteria, rather than an assessment of how much water may be diverted without significant impact to fishery resources.

9.2 Water Availability to Smaller Watersheds was not Evaluated

The "Water Cost" analysis was applied to 11 of the 13 "validation sites" studied by R2 Resource Consultants and Stetson Engineers. These sites varied in drainage area from 0.25 to 15.7 sq mi. The analysis involved calculating on a daily basis, based on the gage record, the total amount of water that could be diverted at that location as constrained by the three Design Elements: diversion season, MBF and MCD. Results of the analysis for 3 of the 48 possible combinations were summarized in Figure 6-5 of the SED. This figure is misleading, though, because the results were averaged together. Figure 9-1 (attached) illustrates the numbers presented in Tables 6-12 and 6-14 of the SED without averaging the results. When larger values are averaged in with smaller values, the larger values have a dominating effect. The Draft Policy allows more water available for diversion relative to the Draft Guidelines for larger drainage areas, but less for smaller watersheds.

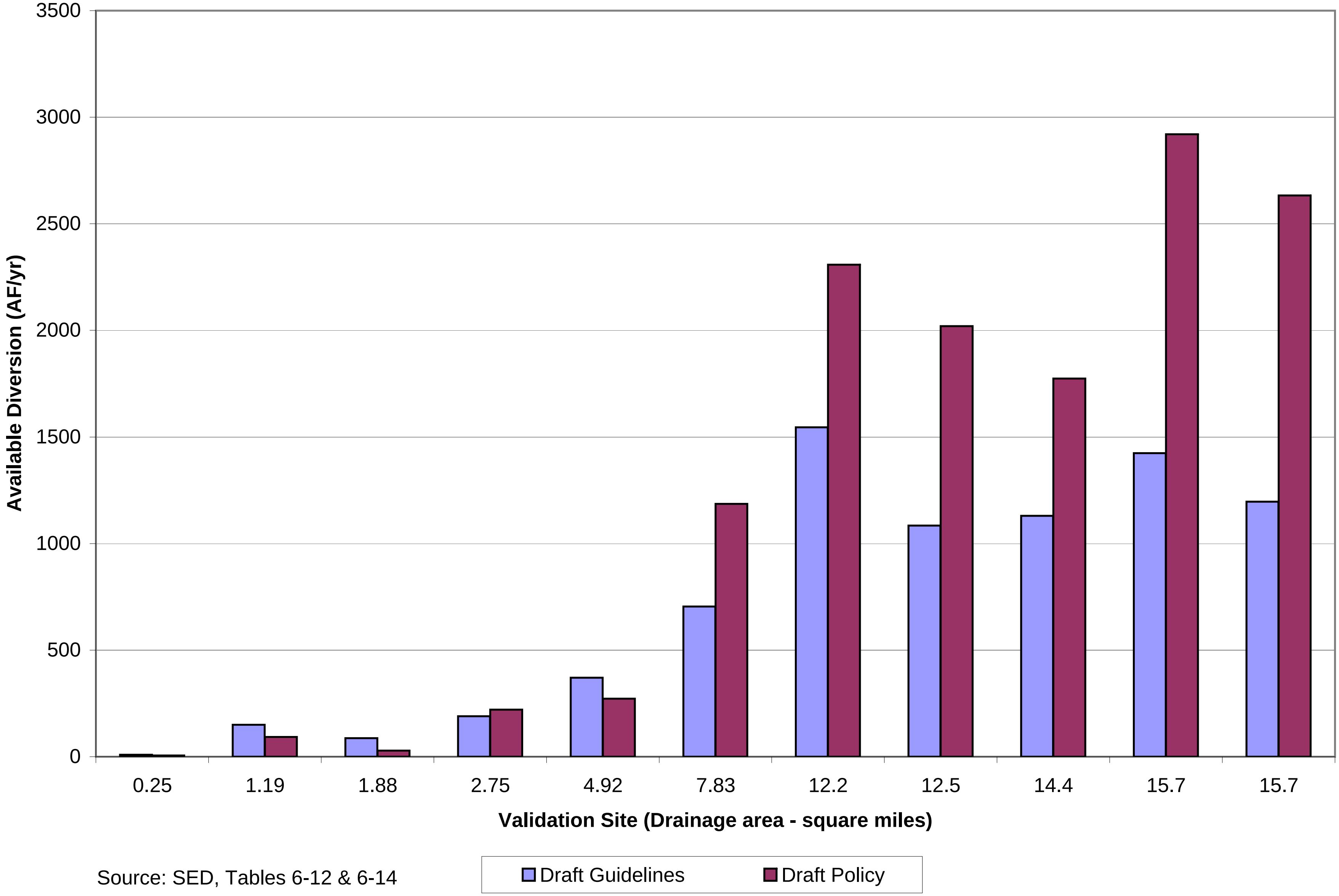
Figure 9-2 (attached) extends the analysis to drainage areas more representative of pending applications. Because of the way the minimum bypass flow was formulated, the Draft Policy is particularly restrictive in small drainage areas. Most pending applications for storage are not down near the base of the watershed where the validation sites were located, but rather are located higher in the watershed with much smaller drainage areas. Using Santa Rosa Creek, one of the validation sites as an example, an analysis was conducted to compare relative restrictiveness of the Draft Guidelines and the Draft Policy on small watersheds. Applying the same algorithm as used in the water cost analysis, but with smaller drainage areas, water availability within the regional criteria of the Draft Guidelines and Draft Policy were calculated and are summarized in Figure 9-2. As can be seen, as the drainage area decreases the Draft Policy becomes dramatically more restrictive of diversions as compared to the Draft Guidelines. A similar analysis and result was found for Salmon Creek, another of the validation sites.

9.3 Water Availability was Evaluated Using Biased Short-Term Records

In addition to performing the analysis on drainage areas that are non-representative of most water rights which will be regulated by the Draft Policy, other flaws were noted. Streamgage records of very short duration were utilized for the validation sites, as noted earlier. Because the short records were not representative of long-term average hydrology, the analysis is biased. Note that the Draft Policy (page A1-3) recommends use of gage records of at least 10 years length.

4/30/2008

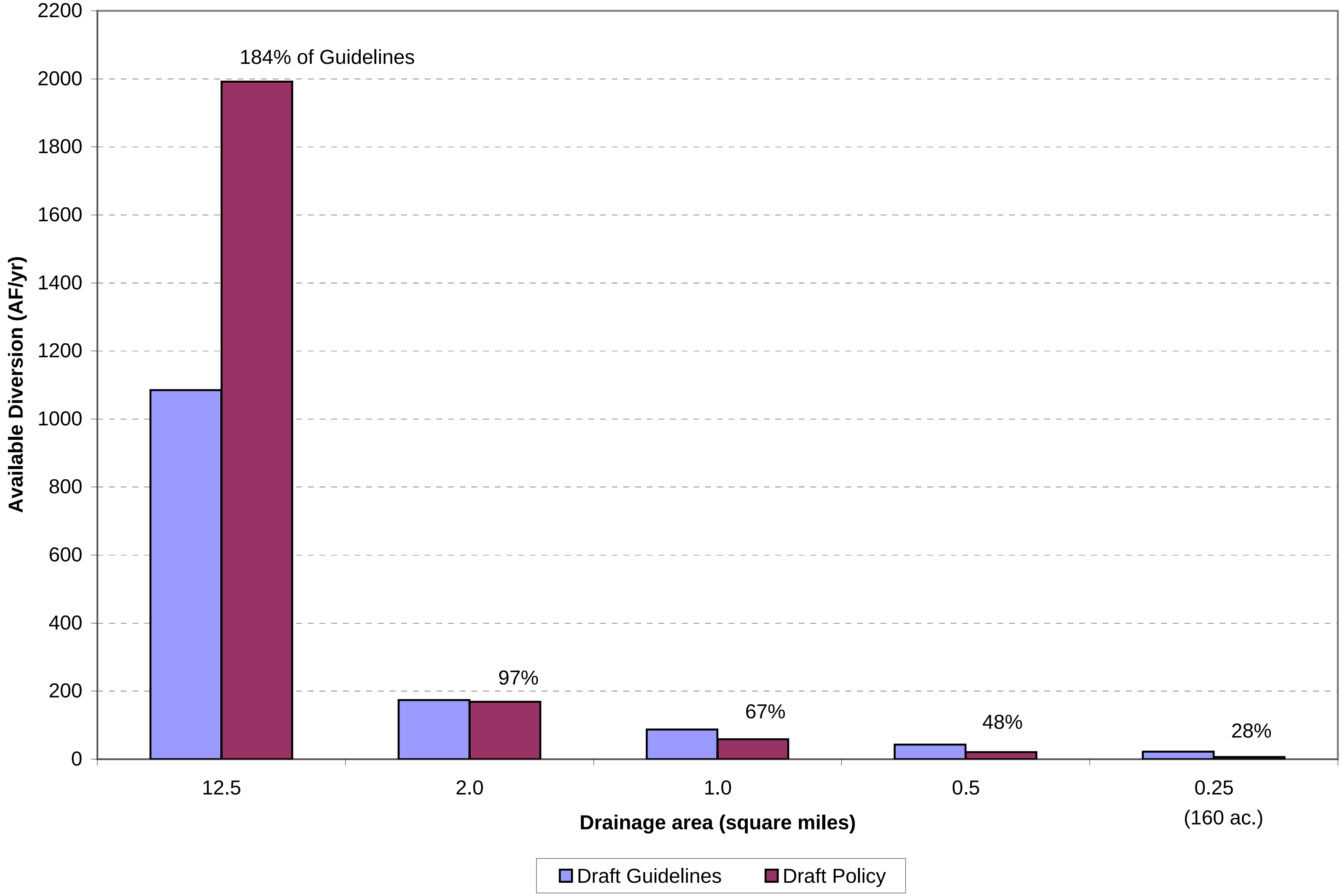
FIGURE 9-1
Water available for diversion per "Water Cost" analysis



Source: SED, Tables 6-12 & 6-14

SantaRosaCr.xls, Chart1

FIGURE 9-2
"Water Cost" available diversion in smaller drainage areas in Santa Rosa Creek watershed



10.0 DIRECT COSTS OF COMPLIANCE IS INADEQUATELY ESTIMATED

The report by Chambers Group, Inc., and Stetson Engineers Inc., entitled "Direct Cost Analysis for the Proposed Policy for Maintaining Instream Flows in Northern California Coastal Streams" dated December 2007 ("Direct Cost Analysis") is one of the documents comprising the State Water Board's Draft Instream Flow Policy. The Direct Cost Analysis purports to present *"an analysis of the potential direct costs to applicants to comply with the proposed Policy."* Appendix A to the Direct Cost Analysis presents hypothetical compliance "case studies" based on three existing authorized onstream dam projects selected from the State Water Board's eWRIMS database. In the conceptual designs and cost estimate tables referred to in Appendix A, the three case-study examples are categorized as a large dam on a Class I stream, a medium dam on a Class II stream, and a small dam on a Class III stream, respectively. For each project, three alternative methods for compliance are represented: passive bypass, dam removal and diversion to off-stream storage, and automated bypass (making for 9 alternatives in all).

10.1 Cost Estimates do not Enable Assessment of Draft Policy

The Executive Summary of the Direct Cost Analysis states:

> *"The potential costs to the applicants to comply with the Policy would vary from applicant to applicant depending upon many factors. It is impossible to predict how applicants would choose to comply with the Policy. This report provides estimates of a range of representative typical costs that applicants may incur to comply with the Policy."*

While the foregoing quote acknowledges some uncertainty and speculation associated with a general informative analysis of this type, certain parameters are so vastly in error that the suitability of the information presented for purposes of supporting and evaluating the effects of the Draft Policy is dubious. Further, as also acknowledged in the Executive Summary, an economic analysis is not included in the Direct Cost Analysis. We understand based on subsequent communications with State Water Board staff that an economic analysis of the Draft Policy was not "mandated" by the legislation authorizing the development of an instream flow policy. However, the absence of a mandate in AB2121, as codified in California Water Code Section 1259.4, does not relieve the State Water Board of its duty to conduct a thorough and comprehensive analysis, including an economic analysis. Absent an economic analysis, a complete picture of the cost and relative benefits associated with the Policy, i.e. the <u>intrinsic value of the Policy</u>, cannot be ascertained with any degree of certainty, and hence the State Water Board Members will not be equipped to render an informed decision as to the merits of the Draft Policy. The Draft Policy did not evaluate the economic impact associated with the potential loss of almost 4,000 acres of irrigable land.[18]

[18] Per Table 12 of the document "Potential Indirect Environmental Impacts of Modification or Removal of Existing Unauthorized Dams", by Stetson Engineers, Inc., December 2007, noting that the basis for the estimated extent of irrigable land is disclosed in any of the Draft Policy documents.

Despite the absence of a mandate in the legislation, the State Water Board staff should have recognized the importance of an economic analysis to the Board members and to the regulated community.

The Executive Summary of the Direct Cost Analysis also states that *"The estimated potential costs represent typical costs based on the professional judgment and experience of Stetson Engineers, Inc., R2 Resource Consultants, Inc., and Chambers Group, Inc."* However, "real world" data in support of the cost information presented is lacking in the subject document. The analysis would have benefited greatly from a discussion of actual projects the preparers have been involved with pertaining to construction of bypass facilities and dam removal within the Policy area, or in similar environs.

Also, it is unstated in the document whether site visits were made to the existing authorized projects that the conceptual designs and cost estimates are based upon, thus one is left to assume that site visits were not made. Certain shortcomings in the analysis discussed below likely could have been avoided had site visits been made.

10.2 Summary of Estimated Application and Implementation Costs is Convoluted and Confusing

Table 3-6 in the Direct Cost Analysis, which is a matrix of estimated item costs associated with various compliance alternatives for various alternative project types, is almost indecipherable, and the ranges in estimated costs for certain cost categories are so broad so as to be of little informative value to the regulated community. Examples: the estimated cost of passive bypass for an onstream storage dam on a Class III stream ranges from $25,000 to $150,000; the estimated cost of fish passage for an existing onstream storage dam on a Class I stream ranges from $10,000 to $250,000. In either case, there is no parameter disclosed that would lead a particular project owner to determine which cost would be applicable to his/her project, and hence the information presented is of little value.

Additionally, Table 3-6 lacks explanation for certain cost category items and their applicability to particular project types. It is unclear whether there is an interrelationship among the column headings/subheadings "Fish/Passage", "Fish/Screen", and "Bypass". If only one of these items apply to a dam on a Class I stream, then a high cost would be $250,000, whereas if all three apply, a high total cost would be $675,000. Again, the information as presented is of little value for decision-making purposes.

The "smorgasbord" presentation of potential item costs in Table 3-6 also omits an estimate of total costs that might be incurred for a particular type of project. It would appear, therefore, that project owners are left to rely on the conceptual designs and cost estimates provided in Appendix A of the Direct Cost Analysis to get an idea of what the cost of implementation might be for their particular project; in fact this appears to be the intent of Appendix A. However, as discussed below, the project cost estimates in Appendix A have several shortcomings that render them questionable for purposes of disclosing the actual cost that would be expected to be incurred for compliance with the Draft Policy.

10.3 Estimated Cost of Fish Passage Facilities for a Dam on a Class 1 Stream is Greatly Understated

Figure A-1 in Appendix A shows a bypass/passage channel around a "large dam" and reservoir, situated on a Class I stream. Fish would utilize the channel to pass upstream and downstream around the facility, and the channel would also facilitate required bypass flows. In Figure A-1, a proposed fish passage structure is identified upstream of the reservoir, which would be required for fish to overcome the MBF diversion weir. Figure A-1 also shows that the bypass/passage channel is on a 20 percent slope immediately above the "Outlet" as it passes near the dam. Based on supporting information appended to the Draft Policy, a 20 percent channel slope would preclude access by fish, absent a fish passage facility such as a fish ladder.[19] However, no passage facility is shown at that location on Figure A-1.

Table A-1 shows the estimated cost associated with the project shown on Figure A-1. The line-item estimated cost for one fish passage structure is $227,000, and the total project cost is estimated to be $473,000. However, including the cost of another fish ladder (at the Outlet), and allowing for the stated percentages for design, environmental permitting, construction management, unlisted items, and contingencies, would increase the estimated total project cost shown in Table A-1 from $473,000 to over $800,000. Accordingly, the potential estimated "typical" cost of a project involving the construction of a bypass/passage facility for a large dam on a Class 1 stream is greatly understated and therefore appropriate disclosure and analysis of the cost of this type of project has not been provided.

10.4 Estimated Cost of Removal of a Dam from a Class 1 Stream is not Adequately Supported

Figure A-2 in Appendix A shows the conceptual design for the case study involving the removal of an existing "large" earthen dam from a Class 1 stream. Estimated costs of major construction activities associated with the project are provided on Table A-2. The cost estimate assumes earthwork totaling 33,093 cubic yards, and site stabilization and revegetation covering 4.7 acres. The total estimated project cost associated with dam removal and site restoration portions of the project is indicated to be about $1.5 million, including allowances for design, environmental permitting, construction management, unlisted items, and contingencies. Apart from line item costs for earthwork and stabilization/revegetation (from which estimated unit costs can be deduced), neither the Direct Cost Analysis nor Appendix A include any information with regard to the basis for this estimate. No case histories for actual dam removal projects and associated costs are provided in these documents.

[19] R2 Resource Consultants, Inc., Technical Memorandum dated July 9, 2007 regarding GIS Analysis Criteria for Upstream Distribution Limit of Steelhead.

The "large dam" shown in Figure A-2, having an impoundment capability of 70 acre-feet and material volume of about 33,100 cubic yards per Table A-2, is actually not so large. Per the attached Table 10-1, the average material volume for DSOD-jurisdictional dams within the Policy area having reservoir surface areas of 10 acres and less is about 42,100 cubic yards. At a unit cost for earthwork of about $25/cubic yard, the added direct cost for the average project would be $225,000. Including the percentage allowance for design, etc., the additional cost would be about $337,000, and the total estimated dam removal cost in Table A-2 would increase from $1,489,000 to about $1.8 million.

Additionally, for about a decade, the City of St. Helena has been working on a project involving the removal of an earthen dam located on York Creek, which is a Class I stream tributary to the Napa River. As of August 2007 construction activities had not commenced, however, the City had already expended about <u>$800,000</u> on design and permitting. The total project cost is estimated to go as high as $5 million.[20] This is <u>over 3 times</u> the estimated cost of dam removal and restoration shown in Table A.2. While admittedly this is just one real-world project, it is one more than disclosed in the Direct Cost Analysis, and the estimated cost of the St. Helena project is vastly outside of the "*range of representative typical costs*" that the Direct Cost Analysis purports to disclose.

Based on the foregoing, the Direct Cost Analysis misinforms the public and the regulated community of the costs likely to be incurred for removal of a "large dam" from a Class I stream.

10.5 Stream Class is an Inappropriate Metric for Generalized Estimation of Dam Removal Costs

Figures A-2 , A-5, and A-8 of Appendix A of the Direct Cost Analysis show conceptual designs for the removal of large, medium, and small dams on Class I, Class II, and Class III streams, respectively. Cost estimates corresponding to each conceptual project are provided in Tables A-2, A-5, and A-8, respectively. However, the assumption that dam size (and removal cost) is related only to stream class is misleading. In estimating the cost of the removal of a dam from a Class I stream, a dam having an earthwork volume of about 33,000 cubic yards was assumed. In estimating the cost of removing of a dam from a Class II stream, a dam having an earthwork volume of about 10,500 cubic yards was assumed. However, no basis is provided in the Direct Cost Analysis to conclude that 33,000-cubic-yard dams only exist on Class I streams, while 10,500-cubic-yard dams only exist on Class II streams. The Direct Cost Analysis provides no information to indicate that the earthwork volumes and their relative differences are representative of existing projects on particular stream classes within the Policy area.

The estimates for all alternatives appear to use a unit cost basis for estimating earthwork and stabilization/restoration costs ($25/cubic yard for earthwork and about $27,000/acre for stabilization/restoration). Based on this approach, the estimated cost of removing a dam on Class II stream would be the same as the estimated cost for removing a dam on a Class I stream if the two dams were of similar size. Accordingly, instead of an estimated

[20] St. Helena Star newspaper article "No York Creek Construction This Year," August 30, 2007.

cost of $540,000 for removal of a dam on a Class II stream (Table A-5), the cost could be $1,489,000 (per Table A-2) if it is similar in size to the Table A-2 project. Or, the cost could be $5 million per the estimate for the City of St. Helena's dam removal project discussed in the preceding section.

According to Table 11 in the document entitled "Potential Indirect Environmental Impacts of Modification or Removal of Existing Unauthorized Dams" in Appendix E of the SED, of the estimated 1,569 existing unauthorized impoundment dams in the Policy area, 212 are situated on Class I streams, while 1,357 are on Class II and III streams. If the Direct Cost Analysis has underestimated the cost of removing 1,357 dams on Class II and Class III streams, the costs associated with removal of about 86 percent of the existing unauthorized dams has not been accurately estimated and disclosed in the Direct Cost Analysis. The State Water Board should conduct a more detailed and comprehensive evaluation of the affected facilities in order disclose to the public and to the regulated community more realistic costs associated with dam removal.

10.6 Costs for Mitigation of Terrestrial Impacts Caused by Construction of Bypass Facilities were not Considered

The three passive bypass alternatives (Figures A-1, A-4, and A-7) show varying types of natural vegetation along the bypass channel alignments. Figure A-1 for a large dam on Class 1 stream shows a treeless alignment over a distance of 1,540 feet long. Figure A-4 for a medium dam on a Class II stream shows treed and treeless reaches over a total bypass channel distance of 1,180 feet. Figure A-7 for a small dam on Class 3 stream shows what appears to be dense mature woodland over a bypass channel distance of 940 feet. The construction of a bypass channel capable of bypassing the 1.5-year peak flow is expected to be relatively substantial, and would result in the loss of a swath of natural vegetation along its entire reach.

Based on our experience with regulatory permitting for water projects, the Department of Fish and Game would consider the loss of dense mature woodland, as shown for the smallest project (Figure A-7) to be a significant terrestrial impact. Mitigation would likely require the planting of new native trees elsewhere on the project site at some multiple of the removed trees (likely at a ratio of 3-to-1 or greater), and professional services for ongoing survival monitoring would be required for a period of years. However, the cost estimate for the project shown on Table A-7 does not include an allowance for mitigation and monitoring of woodland impacts associated with bypass channel construction; such cost are not included in Table 3-6 either. In fact, none of the cost estimates for alternatives having passive bypass facilities include consideration of costs for mitigation of terrestrial impacts, and hence understate the cost of compliance for these types of projects.

10.7 Estimated Project Costs have not been Disclosed in Proper Perspective

10.7.1 Cost of Compliance for the Entire Policy Area

Based on an assumption that the estimated costs of compliance presented in Appendix A are accurate, the range in typical costs are as shown in the table below for various project sizes:

Dam Size/Stream Class	Range of Estimated Unit Cost		Number of Impoundment Dams[21]	Range of Estimated Total Cost	
	Low	**High**		**Low**	**High**
Large/Class I	$473,000	$3,032,000	212	$100 million	$642 million
Medium/Class II	$107,000	$1,178,000	679	$72.6 million	$800 million
Small/Class III	$118,000	$594,000	678	$80 million	$403 million
Total				**$253 million**	**$1.8 billion**

The above costs are staggering, and to the extent that they underestimate the actual costs of compliance as discussed in previous sections above, they represent a non-conservative estimate of the total cost to comply with the Policy. Further, the above quantification does not include removal of regulatory dams, of which there alleged to be 202 such dams in the Policy area per Table 11. Given that the neither the Draft Policy or the supporting documentation quantitatively identify benefits to instream resources, the notion put forth that the expenditure of nearly $2 billion (possibly more) by the regulated community, not to mention the cost incurred by governmental agencies in administering compliance with the Draft Policy, for undefined and perhaps minimal resource benefits, is highly irresponsible.

10.7.2 Cost and Yield Impacts for Individual Projects

Reference is made to Table 8-2 of these comments, which summarizes impacts to estimated yield for 21 projects within the Policy area. Table 8-2 shows estimated yield under three operational conditions: FMF bypass only, Draft Guidelines, and Draft Policy.

[21] Table 11 in the document entitled “Potential Indirect Environmental Impacts of Modification or Removal of Existing Unauthorized Dams” in Appendix E of the Substitute Environmental Document for the Draft Instream Flow Policy. Table 11 presents Class II and Class III dams as a group (1,357 total), therefore, the number of dams for each stream class have been assumed to be evenly divided.

10.7.2.1 Example – Small Dam on Class III Stream

Project #9 is a small (11 acre-feet) reservoir situated on an unnamed stream high in the watershed of Anderson Creek, Mendocino County; drainage area tributary to the reservoir is 4 acres. Accordingly, this facility estimated to be on a Class III stream. With reference to Table 8-2, the average annual yield under no bypass conditions is estimated to be 6 acre-feet. Compliance with the Draft Policy would reduce the yield to 1 acre-foot, and because this is a consumptive use project, would render the project infeasible for the intended use, and the reservoir would be relegated to use as an aesthetic pond or stockpond. Based on the range of project costs presented in Appendix A of the Direct Cost Analysis (and repeated in the above table) the cost of compliance for this project would range from $118,000 to $594,000.

10.7.2.2 Example – Multi-Reservoir Project, Class II Stream

Project #15 is situated on an unnamed stream (also known as Carpenter Creek and Carpenter Creel Creek) tributary to Big Sulphur Creek thence the Russian River in Sonoma County. The project consists of two reservoirs (totaling 79 acre-feet), one of which is an existing onstream reservoir of 30 acre-feet and the other of which is a proposed offstream reservoir of 49 acre-feet. The offstream reservoir would be filled by diversion to offstream storage from the subject unnamed stream. The proposed use of the water is irrigation of up to 122 acres. The affected stream is believed to be Class II. With reference to Table 8-2, the average annual yield under FMF bypass conditions is estimated to be 60 acre-feet. Compliance with the Draft Policy would reduce the yield by 40 percent to 36 acre-feet.

Based on the range of project costs presented in Appendix A of the Direct Cost Analysis (and repeated in the above table) the cost of compliance for a dam on a Class II stream would range from $107,000 to about $1.2 million. Because the subject project is for an agricultural consumptive use, the loss in yield alone would require that the extent of acreage to be developed be reduced, which could render the project infeasible. The cost of compliance for the reduced yield would likely kill the project altogether.

10.7.2.3 Summary

The aforementioned Table 8-2 of these comments presents yield analyses for 21 pending projects in the Policy area. The reduction in yield among the 21 projects ranges from 2 percent to 98 percent, and averages 62 percent on a project-by-project basis. The reduction in yield will greatly impact project viability and together with expenditures required for compliance with the Draft Policy will likely render most projects infeasible.

10.8 Conclusions

- Because an economic analysis was not prepared, a complete picture of the costs and relative benefits associated with the Policy cannot be ascertained with any degree of certainty, and hence the State Water Board Members will not be equipped to render an informed decision as to the merits of the Draft Policy.

- The Direct Cost Analysis does not present any basis for the estimated costs of compliance apart from "professional judgment and experience." The analysis would have greatly benefited from a discussion of actual projects the preparers have been involved with pertaining to construction of bypass facilities and dam removal within the Policy area, or in similar environs.

- The estimated cost data summarized in Table 3-6 is so broad so as to be of little value to individual project owners for purposes of evaluating what their costs will be for compliance with the Draft Policy.

- The estimated cost of a bypass/passage facility for a dam on Class I stream (Figure A-1, Table A-1) is understated because a necessary fish passage facility has not been included. With the inclusion of an additional fish passage facility the estimated cost of the project would be much greater. Accordingly, the stated objective of disclosing a "range of representative typical costs" is not fulfilled for this type of project.

- The estimated cost of removing a dam from a Class I stream (Figure A-2, Table A-2) is not adequately supported, and based on information for an actual dam-removal project being undertaken by the City of St. Helena appears to be greatly underestimated. Since the project shown in Figure A-2 is the most costly of the 9 conceptual projects estimated, the objective of disclosing a "range of representative typical costs" is not fulfilled.

- The Direct Cost Analysis distinguishes estimated costs of dam removal on the basis of stream class, rather than on the basis of dam size. This potentially results in an underestimate of dam removal costs, and hence the objective of disclosing a "range of representative typical costs" is not fulfilled.

- The cost for mitigation impacts to terrestrial resources associated with construction of bypass facilities is not included in the Direct Cost Analysis, therefore, the estimated costs of compliance for projects involving bypass facilities (Figures/Tables A-1, A-3, A-4, A-6, A-7, and A-9) is understated.

- The Direct Cost Analysis does not present the estimated cost of compliance in any useful context. Based on the estimated costs presented for various types of projects, the estimated cost to the regulated community of complying with the Draft Policy ranges from about $250 million to $1.8 billion (based on the shortcomings of the cost estimates discussed above, there is good reason to believe that this range of total cost is non-conservative). Given that the Draft Policy contains no information regarding specific benefits resulting from its implementation, the mandate placed on the regulated community for such expenditure is highly irresponsible.

- The loss in project yield coupled with large costs for compliance with the Draft Policy will significantly affect the viability of most projects subject to the Draft Policy, and will render many of them infeasible. The impacts of these occurrences on the regulated community and on the public interest are not disclosed in the Direct Cost Analysis or in any other Policy-related document. Such disclosure should be provided for public review and comment prior to the adoption of the Policy.

TABLE 10-1

Division of Safety of Dams Jurisdictional Onstream Reservoirs in Humboldt, Marin, Mendocino, Napa and Sonoma Counties [1]

(Surface Area 10 acres and Less)

County	Dam Name	DSOD No.	Dam Height[2] (ft)	Freeboard (ft)	Jurisdictional Height[3] (ft)	Storage Capacity (af)	Surface Area (ac)	Average Depth (ft)	Material Volume (cu yd)
Humboldt	Arcata	27-000	50	5.0	45.0	46	2	23.0	18,000
Marin	Dolcini	431-000	35	3.8	31.2	70	8	8.8	27,961
Marin	Hagmaier	9000-247	30	0.0	30.0	23	0	-	ND
Marin	Lower Turney	9000-261	15	0.0	15.0	50	0	-	ND
Marin	Vonsen	430-000	35	5.0	30.0	70	9	7.8	24,700
Marin	Walker Creek	434-000	25	10.0	15.0	66	6	11.0	29,600
Mendocino	Chinquapin	1089-003	49	10.0	39.0	45	4	11.3	11,430
Mendocino	Cornett	1385-000	31	3.8	27.2	65	6	10.8	ND
Mendocino	Hooper #2	7030-002	20	10.1	9.9	120	8	15.0	ND
Mendocino	Hooper #4	7030-004	33	8.4	24.6	18	2	9.0	ND
Mendocino	Lake Ada Rose	1038-000	50	5.0	45.0	138	7	19.7	69,400
Mendocino	Lolonis Vineyards	2380-000	67	6.0	61.0	209	10	20.9	65,000
Mendocino	McNab	384-000	40	6.5	33.5	96	7	13.7	46,500
Mendocino	Mendocino 3 Uppr	1089-002	49	1.0	48.0	85	5	17.0	ND
Mendocino	Mendocino Middle	1089-000	39	3.3	35.7	27	2	13.5	ND
Mendocino	Mill Pond	2381-000	33	5.2	27.8	72	9	8.0	ND
Mendocino	Perry Gulch	2382-000	37	4.0	33.0	33	2	16.5	18,672
Mendocino	Schwindt	2383-000	37	ND	-	23	ND	-	ND
Napa	Bassett Brown	7000-012	36	7.5	28.5	51	ND	-	ND
Napa	Burns	1419-000	39	4.0	35.0	62	5	12.4	23,500
Napa	Circle S	2417-000	28	5.3	22.7	131	9	14.6	20,300
Napa	Crystal	410-000	51	3.0	48.0	105	8	13.1	49,600
Napa	Davis	1416-000	42	5.3	36.7	140	9	15.6	42,000
Napa	Deer Creek	3414-000	40	5.5	34.5	83	5	16.6	93,000
Napa	Heitz	4415-000	87	6.2	80.8	272	10	27.2	215,000
Napa	Henne	413-004	49	4.0	45.0	109	9	12.1	65,000
Napa	Homestake Sed M-1	1391-002	73	7.0	66.0	392	10	39.2	94,405
Napa	Hudson Vineyards	4416-000	25	4.0	21.0	80	6	13.3	ND
Napa	Jamieson Vineyards	4418-000	34	4.0	30.0	46	4	11.5	17,300
Napa	La Herradura	415-000	73	5.6	67.4	110	5	22.0	38,000
Napa	Lake Camille	1-005	30	1.3	28.7	47	3	15.7	22,000
Napa	Lake La verne	1414-000	50	10.0	40.0	54	4	13.5	24,800
Napa	Lake Marie	1-006	60	24.0	36.0	170	8	21.3	75,000
Napa	Linda Vista	2412-000	39	4.7	34.3	52	4	13.0	14,000
Napa	Long Val W #2	3414-004	35	4.0	31.0	177	10	17.7	54,200
Napa	Morgan	3417-000	30	3.0	27.0	108	7	15.4	68,575
Napa	Old Waterworks	3415-000	42	ND	-	28	1	28.0	1,500
Napa	Orville	413-006	28	4.0	24.0	89	6	14.8	15,000
Napa	Scotts Canyon	417-000	41	5.0	36.0	58	3	19.3	26,300
Napa	Upper Twin lake	3414-006	19	6.2	12.8	63	6	10.5	14,000

TABLE 10-1
Division of Safety of Dams Jurisdictional Onstream Reservoirs in Humboldt, Marin, Mendocino, Napa and Sonoma Counties [1]
(Surface Area 10 acres and Less)

County	Dam Name	DSOD No.	Dam Height[2] (ft)	Freeboard (ft)	Jurisdictional Height[3] (ft)	Storage Capacity (af)	Surface Area (ac)	Average Depth (ft)	Material Volume (cu yd)
Napa	Veterans Home	1-014	47	3.5	43.5	39	2	19.5	ND
Sonoma	Azalea	2420-000	44	5.0	39.0	85	8	10.6	7,750
Sonoma	Bosch No 2	2429-000	55	4.5	50.5	37	2	18.5	22,000
Sonoma	Buena Vista Winery	4422-000	40	3.8	36.2	120	10	12.0	39,000
Sonoma	Cook No 2	1428-003	35	4.0	31.0	82	6	13.7	24,000
Sonoma	Dennis #2	1428-004	60	5.0	55.0	148	9	16.4	125,000
Sonoma	Donovan	1422-000	40	4.0	36.0	70	4	17.5	19,700
Sonoma	Dutcher Creek	1428-002	43	5.0	38.0	186	9	20.7	150,000
Sonoma	Foote No 3	428-002	28	9.2	18.8	77	6	12.8	40,000
Sonoma	Foote No 4	428-003	47	8.7	38.3	117	7	16.7	34,500
Sonoma	Foothill Reg Park	1002-008	51	4.0	47.0	109	5	21.8	33,500
Sonoma	Foss Creek No Area	20-002	19	4.0	15.0	85	10	8.5	14,840
Sonoma	Hillside Ranch	4420-000	60	8.0	52.0	210	10	21.0	47,688
Sonoma	John C Warnecke	5423-000	32	4.5	27.5	30	2	15.0	9,500
Sonoma	Lagunita	1427-000	49	4.3	44.7	133	8	16.6	30,000
Sonoma	Lawler	1014-000	40	5.5	34.5	227	10	22.7	32,530
Sonoma	Lowe	2427-000	30	4.0	26.0	95	10	9.5	31,754
Sonoma	Murray	421-003	55	5.0	50.0	117	6	19.5	40,000
Sonoma	Richardson	2428-000	40	4.0	36.0	96	7	13.7	7,000
Sonoma	Salinger	1420-000	46	5.0	41.0	58	4	14.5	15,000
Sonoma	Sleepy Hollow 2	426-000	39	5.7	33.3	104	5	20.8	56,154
5-County Average			**41**		**36**	**97**		**16.0**	**42,136**

Notes:

[1] Source: http://cdec.water.ca.gov/cgi-progs/damSearch

[2] "Dam Height" is the vertical dimension measured from the lowest outside limit of the dam to the dam crest

[3] “Jurisdictional Height” is the vertical distance from the lowest outside limit of the dam to the maxmum water storage elevation, i.e. it is the Dam Height minus the Freeboard.

11.0 STREAM CLASS DEFINITION DIFFERS FROM CALIFORNIA CODE OF REGULATION

The Draft Policy specifies criteria for Stream Class that differs from the California Code of Regulation (CCR), California Forest Practice Rules. While the two classification systems are similar, even down to the use of roman numerals, the Draft Policy definition for Class I is more inclusive. The CCR definition for Class I states "*Fish always or seasonally present onsite, includes habitat to sustain fish migration and spawning*." The Draft Policy for Class I streams states "… *the presence of seasonal presence of fish, either currently or historically, or by the presence of habitat to sustain fish*" [emphasis added]. The inclusion of the word "or" could make streams above natural barriers, such as waterfalls, a Class I stream, though salmonids have never been in that reach.

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