# APPENDIX D

# WATER DRAFTING GUIDELINES

D-1 NMFS Water Drafting Specifications

D-2 DFG Guidelines for Temporary Water Drafting: Preliminary Draft

# D-1 NMFS - WATER DRAFTING

## WATER-DRAFTING SPECIFICATIONS

National Marine Fish Service
Southwest Region

August 2001

AWater-drafting@ is a short-duration, small-pump operation that withdraws water from streams or impoundments to fill conventional tank trucks or trailers. Usually, this water is used to control road dust, or for wildfire management.[1] Short term water drafting is also used to temporarily de-water a construction site, or to temporarily divert water around a construction site.

The specifications below are given primarily for the protection of juvenile anadromous salmonids, in waters where they are known to exist; but they also may be applied to protect a host of other aquatic organisms as well. The issue of sufficient in-stream flow for life support of the aquatic ecosystem should be addressed by a local Fish & Game biologist. Temporal and cumulative effects should be considered on a watershed scale. While we give some guidelines in that area, the actual impact of water drafting on stream ecology should be assessed and monitored at the local level by qualified personnel.

The main focus of this guidance is the construction, operation, and maintenance of a fish screen module(s) that must be installed at the in-stream end of the drafting hose to protect small salmon and steelhead fry from being entrained in the hose, or impinged on the surface of the screen. The specifications are based on the critical Aapproach velocity@ at the screen surface[2], and a recognition that many temporary screens will not be outfitted with automatic cleaning devices to remove debris buildup. Since it is difficult to measure water velocities in the field, only the construction, pumping capacities, and operations are specified. Variances from these specifications may be considered, but only on a case-by-case basis.

## Operating Guidelines

[1] In case of emergency wildfire, where human life is in danger, the operator may disregard the screening requirement if a suitable screen is not immediately accessible.

[2] Approach velocity is the horizontal velocity vector component, typically measured at a distance of 3 inches from the screen face.

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1. Operations are restricted to one hour after sunrise to one hour before sunset.[3]
2. Pumping rate shall not exceed 350 gallons per minute.
3. The pumping rate shall not exceed ten percent of the stream flow.[4]
4. Seek streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools.
5. Pumping shall be terminated when the tank is full. The effect of single pumping operations, or multiple pumping operations at the same location, shall not result in obvious draw-down of either upstream or downstream pools.
6. Each pumping operation shall use a fish screen. The screen face should be oriented parallel to flow for best screening performance. The screen shall be designed and used such that it can be submerged with at least one-screen-height-clearance above and below the screen.
7. Operators shall keep a log on the truck containing the following information: *Operator=s Name, Date, Time, Pump Rate, Filling Time, Screen Cleaned (Y or N), Screen Condition, Comments*. These guidelines should be included as instructions in a logbook with serially numbered pages. This assures each truck operator easy access to this information.

## Screen Construction Criteria

1. Surface Area

The total (unobstructed) surface area of the screen shall be at least 2.5 square feet, based on the upper limit of pumping of 350 gpm[5]. Larger surface areas are recommended where debris buildup is anticipated, and where stream depth is adequate to keep the screen submerged at approximately mid-depth.

2. Screen Mesh

Screen Mesh must be in good repair and present a sealed, positive barrier- effectively preventing entry of the Adesign fish@ into the intake. The design fish in this case is a immature (20-30mm) salmon or steelhead fry.

The screen mesh size shall be:
Round openings - maximum 3/32 inch diameter (.09 inch)
Square openings - maximum 3/32 inch diagonal (.09 inch)
Slotted openings - maximum 1/16 inch width (.07 inch)

3. Screen Design

[3] Restricting operations to daylight-only prevents the use of lights that will attract fish to the drafting pool

[4] Restricting drafting to ten percent of the stream flow provides adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Ten percent of flow may be estimated by pump operators.

[5] If larger pumping volumes are needed, or if the pumping application is continuous, refer to http://swr.nmfs.noaa.gov/habitat.htm and review addendum for small pump intakes.

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Water drafting screens may be off-the-shelf products, but they are often custom-made devices appropriate to the scale and duration of pumping operation. To keep the screen supported and correctly positioned in the water column, adjustable support legs are advised. Screen geometry can be configured either as rectangular or cylindrical, i.e.- as a shallow Abox-shape@ or tubular. The intake structure shall be designed to promote uniform velocity distribution at all external mesh surfaces. This can be accomplished with a simple internal baffle device that distributes the flow evenly across the entire surface of the screen. In order to accomplish this, the designer needs to understand the hydraulic characteristics of these devices. There is a tendency for most of the intake water to enter the screen near the hose end, so a typical internal baffle would consist of a pipe (or a manifolded set of pipes) which have variable porosity holes at predetermined spacing. We recommend starting near the hose end with approximately 5-10% average open area, and gradually increasing the porosity toward the length of the screen. At a point where screen length exceeds three times the diameter of the suction hose, the baffling effect tends to diminish rapidly. At this point the baffle porosity may approach 100%. A successful baffle system will functionally distribute flow to all areas of the screen. A poorly designed screen may result in high-velocity Ahot spots,@ which could lead to fish impingement on the screen face. Hydraulic testing of prototype screen designs is recommended where the application is on-going and extensive.

4. Screen Structure
The screen frame must be strong enough to withstand the hydraulic forces it will experience. However, structural frames, braces, and other elements that block the flow, change flow direction, or otherwise decrease the screen surface area should be minimized.

5. Screen Cleaning
The screen shall be cleaned as often as necessary to prevent approach velocity from exceeding 0.33 feet per second. Operators should withdraw the screen and clean it after each use, or as necessary to keep screen face free of debris. Pumping should stop for screen cleaning when approximately fifteen percent or more of the screen area is occluded by debris. A suitable brush shall be on board the truck for this cleaning operation.

If the operator notes (a) impingement of any juvenile fish on the screen face or (b) entrainment of any fish through the screen mesh, he/she should stop operations and notify the Department of Fish & Game and/or NMFS hydraulic engineering staff :

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# D-2 DFG - WATER DRAFTING: Preliminary Draft

**DRAFT**

STATE OF CALIFORNIA
Resources Agency
Department of Fish and Game

Guidelines for Temporary Water Drafting from Watersheds
Supporting Anadromous Salmonids;
Special Application for Timber Harvest Activities

by

Richard Macedo

Timberland Resources Program
Central Coast Region

November 16, 2001

**Preliminary Draft - Subject to Revision**

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The purpose of this paper is to provide concise and updated criteria for protecting anadromous salmonids from impacts associated with water drafting. Criteria in this report are directed at anyone responsible for operating, permitting or overseeing small, temporary water diversion projects associated with timber harvest activities in coastal timberlands supporting salmon, steelhead or other important aquatic resources. Information in this report may not be applicable to water diversion projects in other locations. Criteria in this paper may change as a result of improved biological knowledge and/or changes associated with state or federal regulation.

Laws and policies governing the Department of Fish and Game (Department) in this matter include Section 1600 et seq. and Section 6100 of the Fish and Game Code, Section 703 of the Fish and Game Code (specifically the policies identified as "Salmon", "Steelhead Rainbow Trout", "Endangered and Threatened Species", "Water", and the "Joint Policy Statement on Coho Salmon" between the California State Board of Forestry and the California Fish and Game Commission). Fish and Game Code Section 1600 et seq. requires that the Department enter into an agreement with a person proposing to, among other actions, substantially divert or obstruct the natural flow of a river, stream, or lake. This includes water drafting. Applications can be obtained from a Department office.

Streams and rivers are used as water sources for timber harvest operations in coastal California. Water is used by itself or in combination with additives to minimize dust and improve running conditions on unpaved roads. Watering roads for dust abatement is often an enforceable condition for approved timber harvest plans. In addition to roads, water may be used in conjunction with controlled burns, wildfire suppression and watering for revegetation projects.

The typical water drafting system for a timber harvest operation involves a truck outfitted with a three to four thousand gallon storage tank, a truck-mounted centrifugal pump and an extendable intake hose. Pools are often targeted for diversion sites because they have sufficient volume to permit high diversion rates. Operators often pump at or near maximum rates to limit down time, thereby maximizing the amount of road surface that can be watered in a given period. To prevent damage to the pump, operators avoid entraining rocks or air during pumping. Typically, an operator will back next to or pull alongside a pool, position a hose with the intake end near the bottom of a pool and commence pumping. Depending on the size and condition of the pump, an operator may fill a four thousand gallon water truck in 10 to 20 minutes. For most systems, the drafting rate can be adjusted.

The following three variables should be considered when designing a small, portable water drafting operation; 1) screen size, 2) approach velocity and 3) diversion rate. The following criteria for screen size, approach velocity and diversion rate are designed to protect fry-size salmonids from water diversion activities in California's timberlands. Use of these criteria may protect other species which occupy the same streams and lakes.

Screen Mesh Size:

Openings in perforated plate and woven wire screens shall not exceed 3/32 inches (2.38 millimeters). Slot opening in wedge wire screens shall not exceed 1.75 mm.

To prevent entrainment of fish during water diversion, the pump intake shall be fitted with screen made of woven mesh, perforated plate, wedge wire, or other durable fabric. The screen medium shall be able to withstand forces related to pumping and be of sufficient size to prevent small fish from entering the intake and being pumped along with diverted water.

Approach Velocity:

The velocity of water across the screen surface shall not exceed 0.33 feet/second at any point on the screen surface. To achieve this standard, the screen shall be kept clean and free of accumulated algae, leaves or other debris which could block portions of the screen surface and increase approach velocities at any point on the screen. The screen shall be supported above the bed of the streams so that no part of the screen surface is obstructed. Water truck operators shall move drafting hoses with attached screens in and out of the water after each drafting operation. The screen should be brushed clean and inspected each time it is placed into the water. This practice will usually prevent screens from accumulating significant amounts of debris and essentially replicate the function of a self-cleaning screen. Where a stationary pump is used, the screen should be checked frequently to ensure it is kept clean and free of debris. For screens where regular cleaning cannot be guaranteed, the approach velocity across the screen surface shall not exceed 0.0825 feet/second at any point on the screen.

Diversion Rate:

Water drafting may cause adverse impacts to juvenile salmonids if flow in source streams is reduced to insufficient levels. For these cases, a specific water drafting plan shall be developed. Concerns over impacts caused by reduced flows and the subsequent need for a water drafting plan may not be necessary if the proposed water diversion conforms to all of the following standards:

a. Flow in the source stream during water drafting will remain at 2.0 $feet^3$/second or greater, and

b. If diverting from a pool, reduction in pool volume will not exceed 10 percent, and

c. Diversion rate will not exceed 10 percent of the surface flow from the source stream, and

d. Instantaneous diversion rate is less than 350 gallons per minute (0.78 $feet^3$/second)

For water diversion projects that will not meet criteria a through d above, a water drafting plan shall be prepared and approved by the Department through an Agreement pursuant to Section 1600 et seq. of the Fish and Game Code. This plan shall include the following:

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1. Determine the instantaneous flow reduction and duration of reduction from the source stream.

2. Disclose potential impacts associated with both the instantaneous flow reduction and cumulative flow reduction and total volume removed from the source stream.

3. Identify proposed recommendations for minimizing adverse impacts such as a reduced hose diameter, decrease in pumping rates, use of alternative sites and/or restrict number of water withdraws from one location.

4. Require operators to maintain a water diversion log which records the date, time, pump rate, filling time, screen cleaning and inspection, and bypass flow from the source stream.

5. Conduct a pre-operations briefing with personnel who will be operating water drafting equipment and charged with compliance of the water diversion plan.

**Additional Considerations**:

While outside the scope of this report, standards for protecting anadromous salmonids may also be sufficient for protecting other species of fish, amphibians, reptiles and invertebrates. These considerations should be made on a case-by-case and species-by-species bases.

In certain situations and at specific sites, the requirement for screen and approach velocity criteria may be disregarded if an approved watering hole or sump is constructed adjacent to a stream or river. Large gravel bars adjacent to streams may be appropriate sites for constructing temporary water drafting holes. Unaltered sections of the gravel bar which lie between the watering hole and the flowing stream may provide the functional equivalent of a screen. In addition, approach velocities along the gravel bar must meet Department standards (e.g. < 0.33 feet/second for fry-size fish). Construction and use of these watering holes will be restricted to summer periods when storms and increasing stream flows are uncommon. Pursuant to Section 1600 et seq. of the Fish and Game Code, construction and use of watering holes will likely require a Lake and Streambed Alteration Agreement.

<u>Example for Calculating Surface Area for Intake Screens</u>:

The purpose of this example is to outline steps for calculating the appropriate screen surface area necessary to meet Department guidelines for approach velocities.

Scenario:

A water drafting operation will use a 4,000 gallon truck to divert water from a small stream which supports fry-size salmon and steelhead. At the maximum rate, the truck can be filled in 15 minutes. Calculate the surface area of screen necessary to comply with Department guidelines for approach velocities not to exceed 0.33 feet/second.

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**Step 1**:

Calculate diversion rate in gallons per minute (gpm) with the pump running at full capacity.

$$\frac{\text{4,000 gallons}}{\text{15 minutes}} = 266.7 \text{ gpm}$$

**Step 2**:

Convert diversion rate from gpm to feet$^3$/second (cfs). Note, to covert gpm to cfs, multiple the gpm figure by 0.00223.

266.7 gpm X 0.00223 = 0.59 cfs

**Step 3**:

Using the maximum acceptable approach velocity of 0.33 feet/second, calculate how much surface area of screen is needed for a diversion rate of 0.59 cfs.

$$\frac{0.59 \text{ feet}^3/\text{second}}{0.33 \text{ feet/second}} = 1.79 \text{ feet}^2 \text{ (square feet)}$$

**Answer: For this example, a screen surface area of 1.79 square feet or larger will satisfy the Department's standard for approach velocity.**