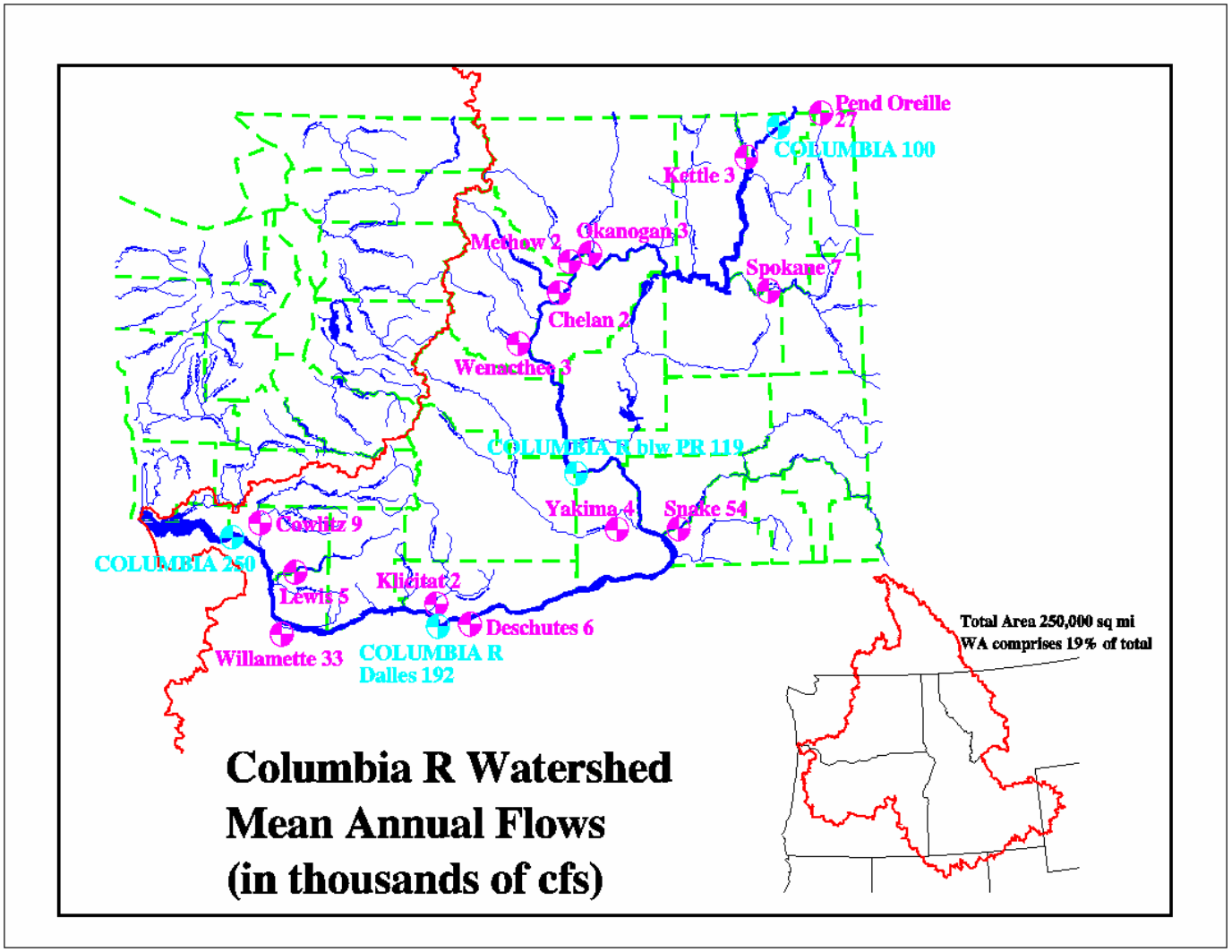
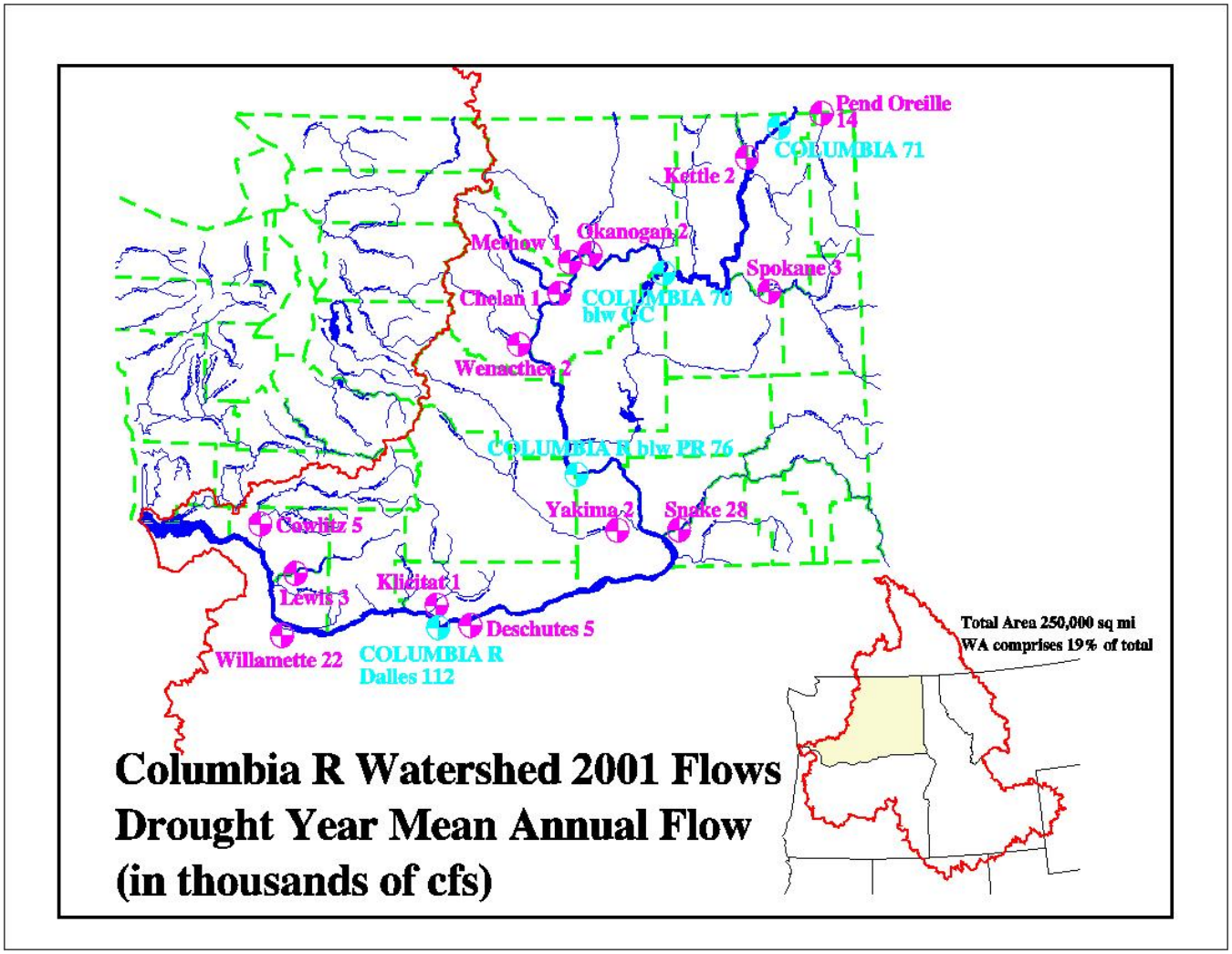
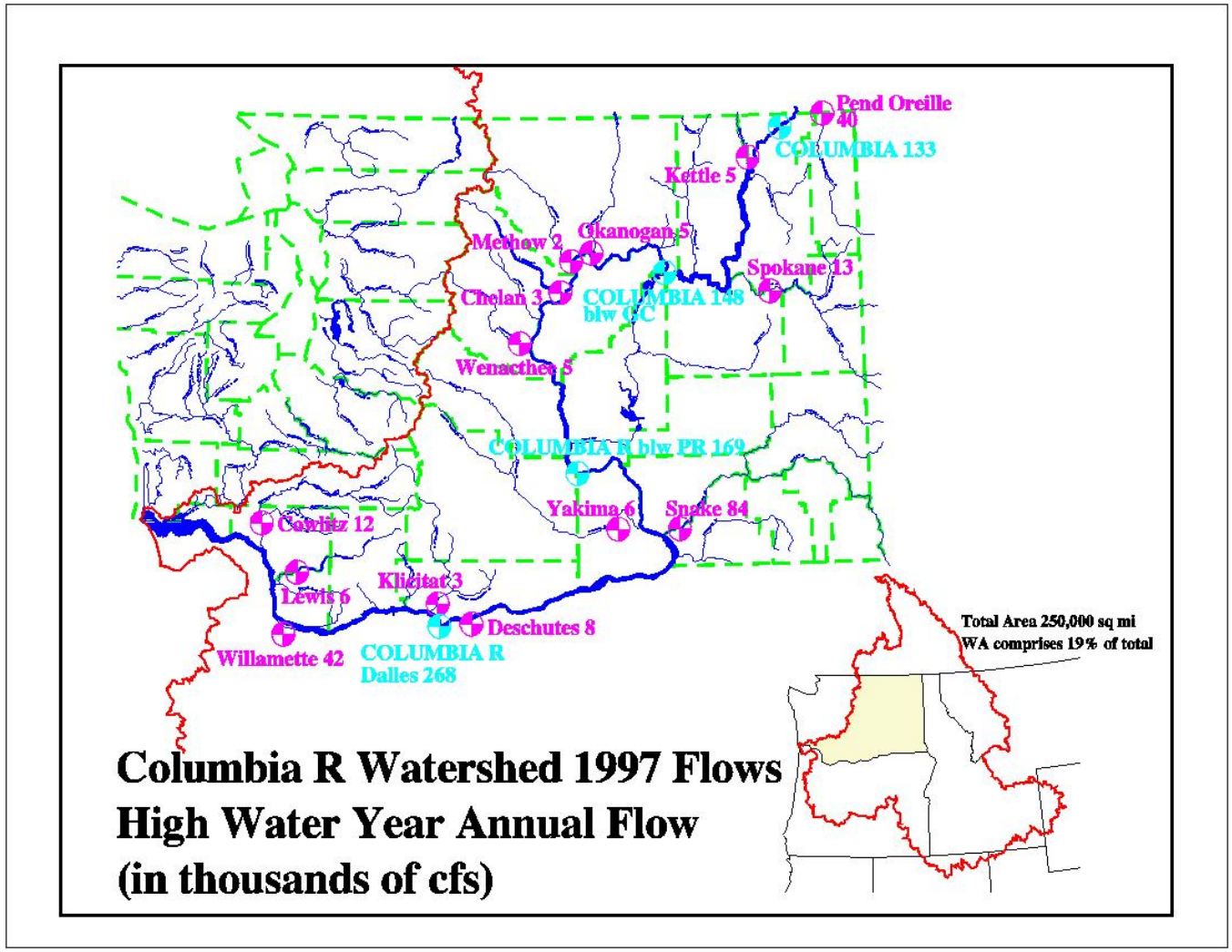


This is a watershed map with tributary contributions. (averages) Mean annual flow (in thousands of cubic feet per second) for tributary rivers to the mainstem Columbia and the mainstem Columbia River as measured at USGS gauging stations near the mouth of each respective tributary and at various points along the mainstem. Data is based on the period of record for each gage. The map displays what is known about flows in Washington state



Watershed map with tributary contributions for a drought year (2001): Mean annual flow (in thousands of cubic feet per second) for tributary rivers to the mainstem Columbia and the mainstem Columbia River as measured at USGS gauging stations near the mouth of each respective tributary and at various points along the mainstem for the 2001 calendar year.



Watershed map with tributary contributions for a high water year (1997): Mean annual flow (in thousands of cubic feet per second) for tributary rivers to the mainstem Columbia and the mainstem Columbia River as measured at USGS gauging stations near the mouth of each respective tributary and at various points along the mainstem for the 1997 calendar year.

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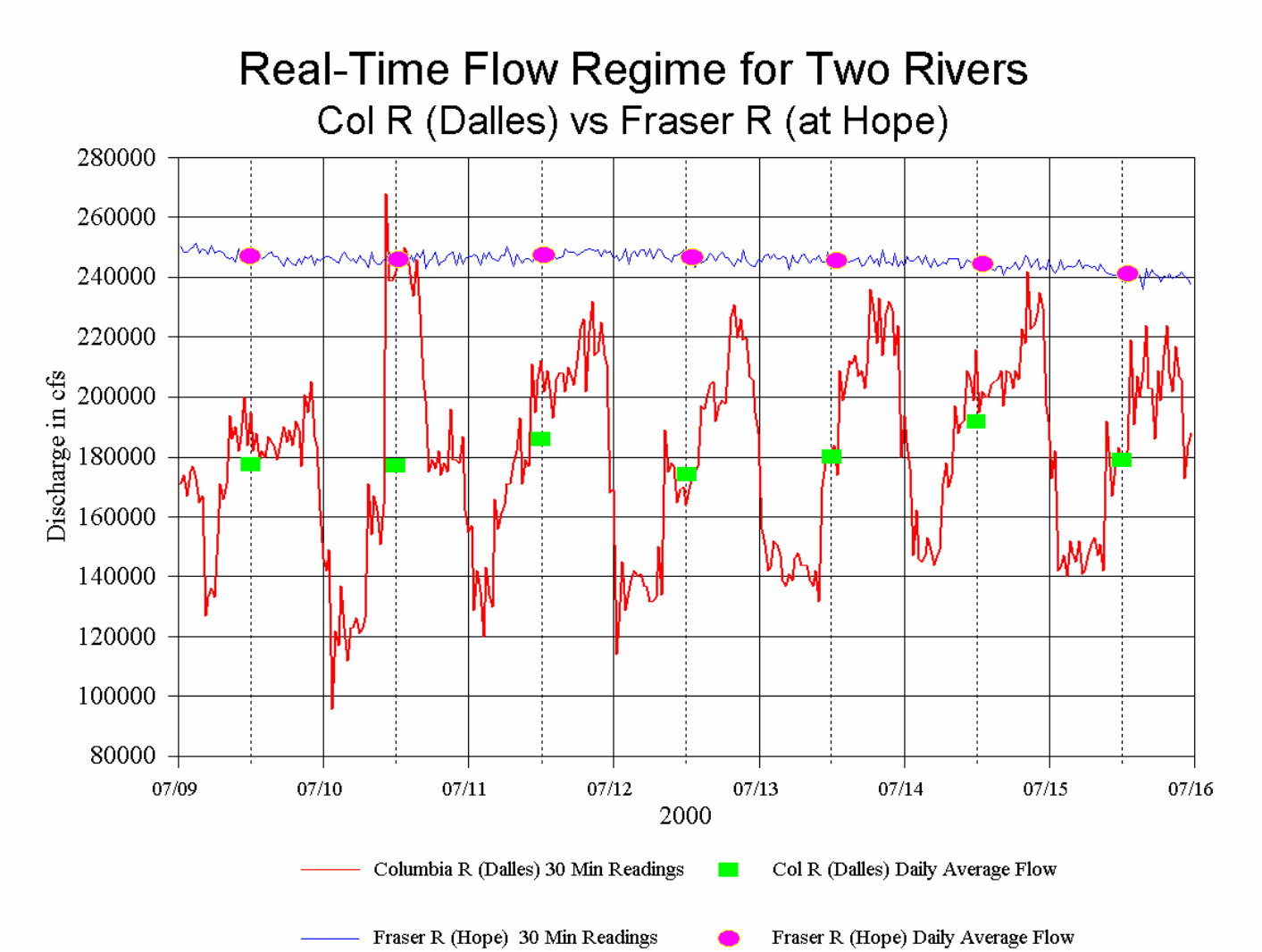
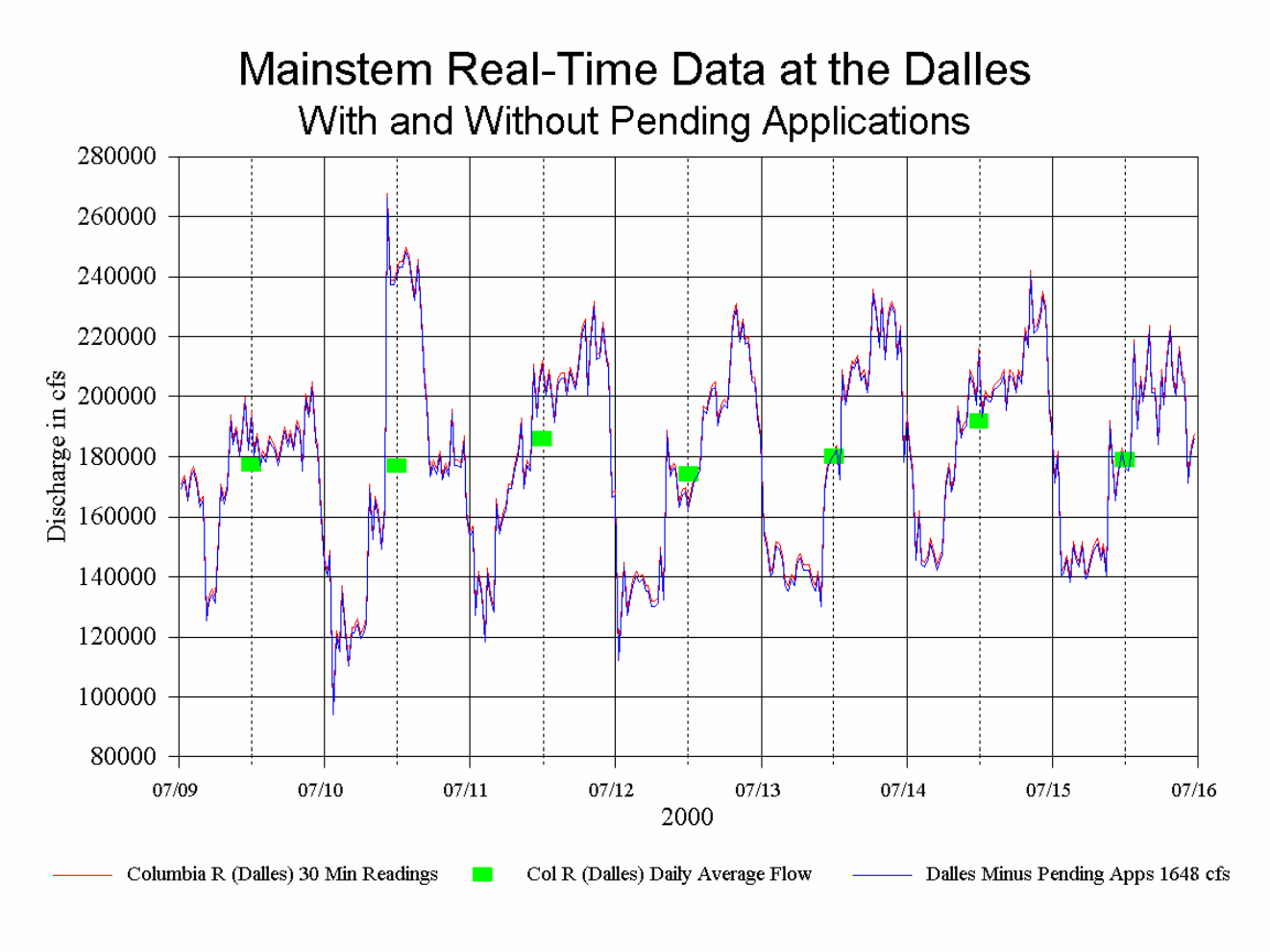
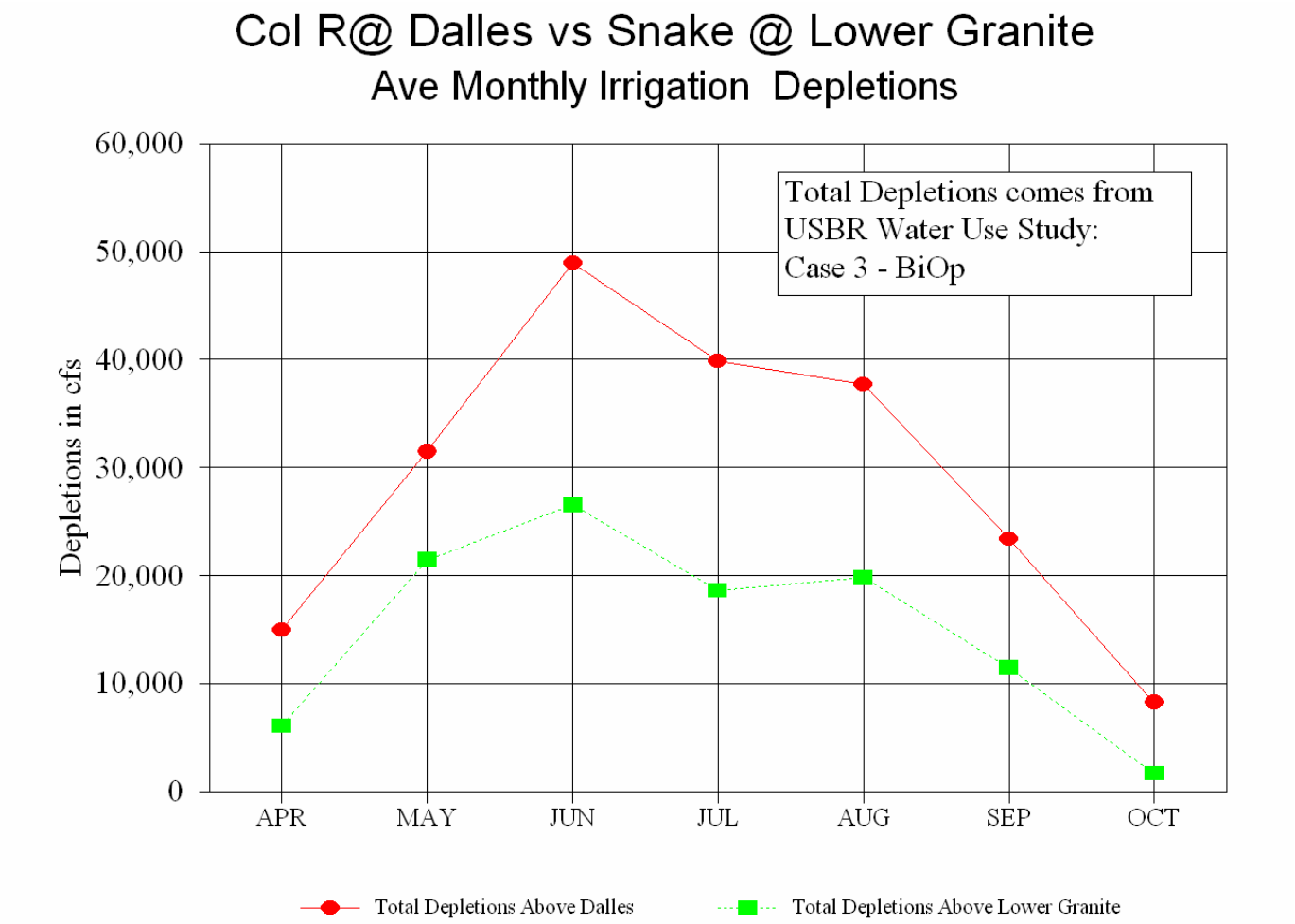


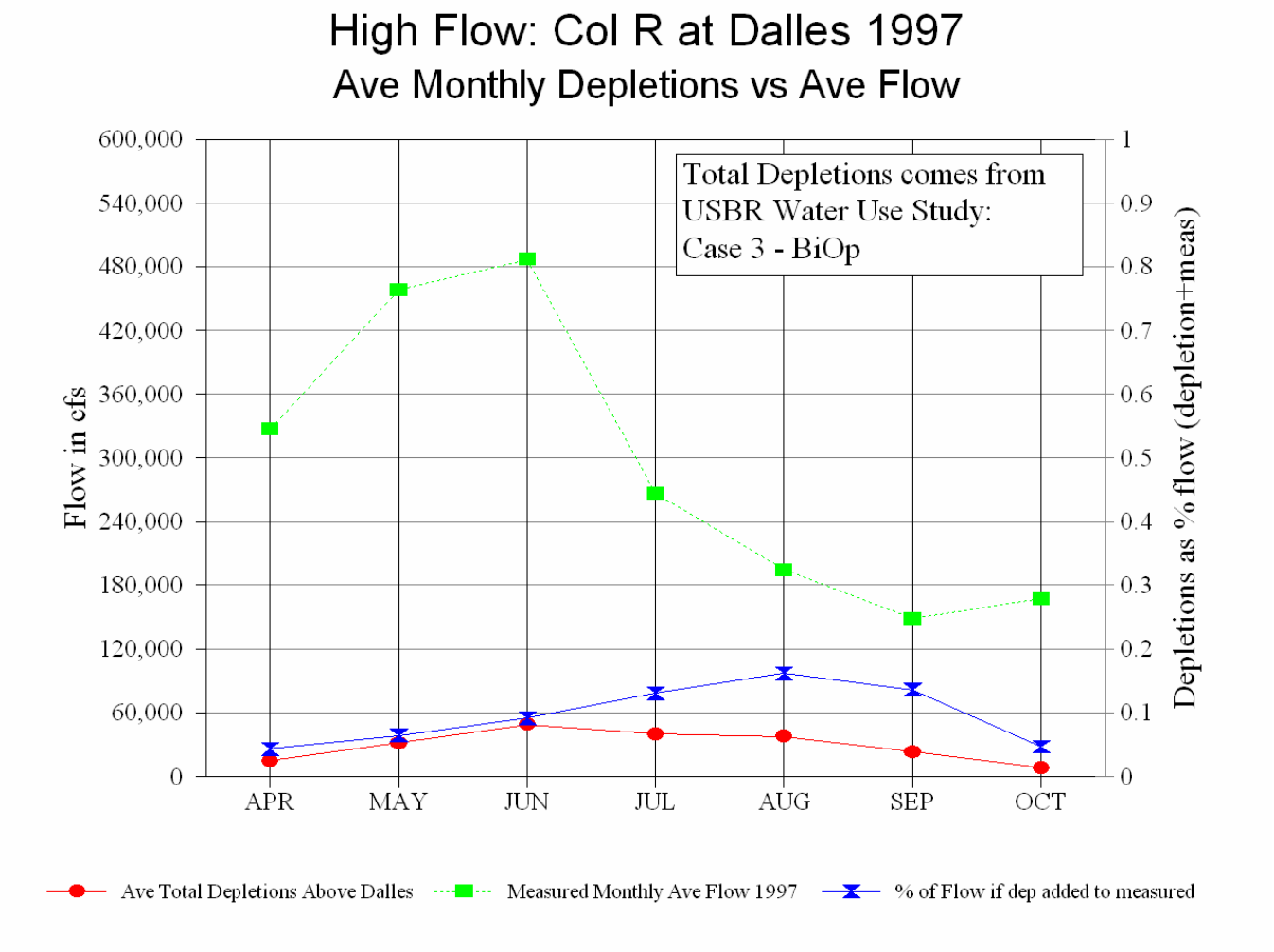
Graph depicting real-time flow (30 minute readings) for a large, unregulated river (Fraser R at Hope in BC) and the highly regulated Columbia River at the Dalles. Fraser River data came from Environment Canada and Columbia River at the Dalles data came from the USGS. The daily average flow value (green square) for the Columbia River doesn't appear to change too dramatically from day to day. However, this doesn't reflect the highly variable nature of the flow in the Columbia River on a real-time basis as compared to real-time data for a free-flowing river (Fraser River).



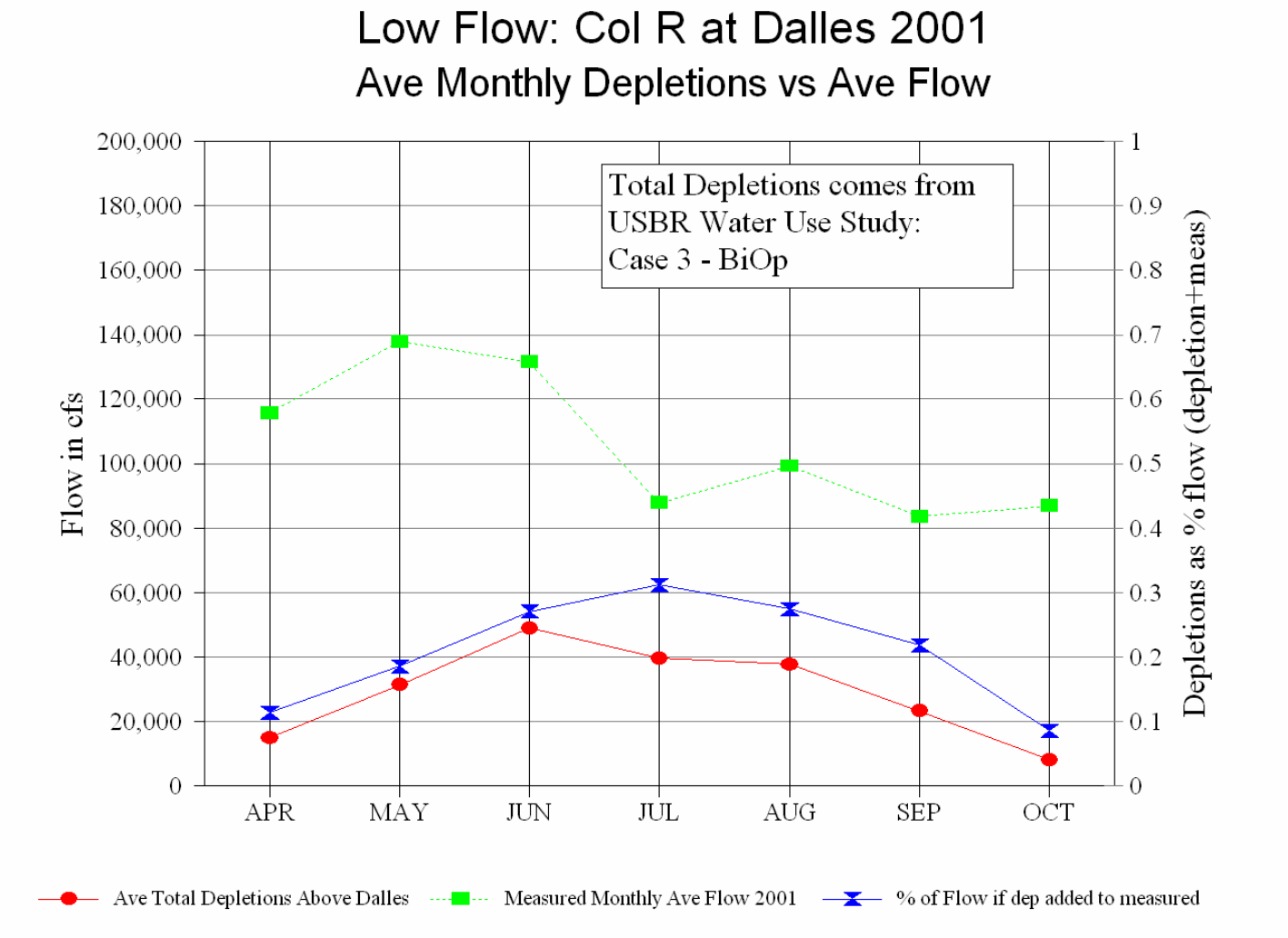
Graph depicting the real-time flow in the river with and without the pending applications (requesting 1648 cfs). Pending applications for new water rights out of the mainstem of the Columbia River (within Washington) as of September, 2002 totaled approximately 1,648 cfs (including almost 600 cfs from groundwater sources near the river). If all of those rights were granted and they all exercised their new rights at the listed quantities on their certificates, the flow in the river could conceivable be diminished by 1,648 cfs (assuming no return flows, etc). The impact on the real-time flow regime in the river would be the difference between to two curves (1648 cfs). Given the volume of water moving through the Columbia, the difference is almost imperceptible and actually not measurable (the USGS indicates that their measurements are only accurate to within 5 to 10% of the measured flow which would typically be 10,000 to 20,000 cfs).



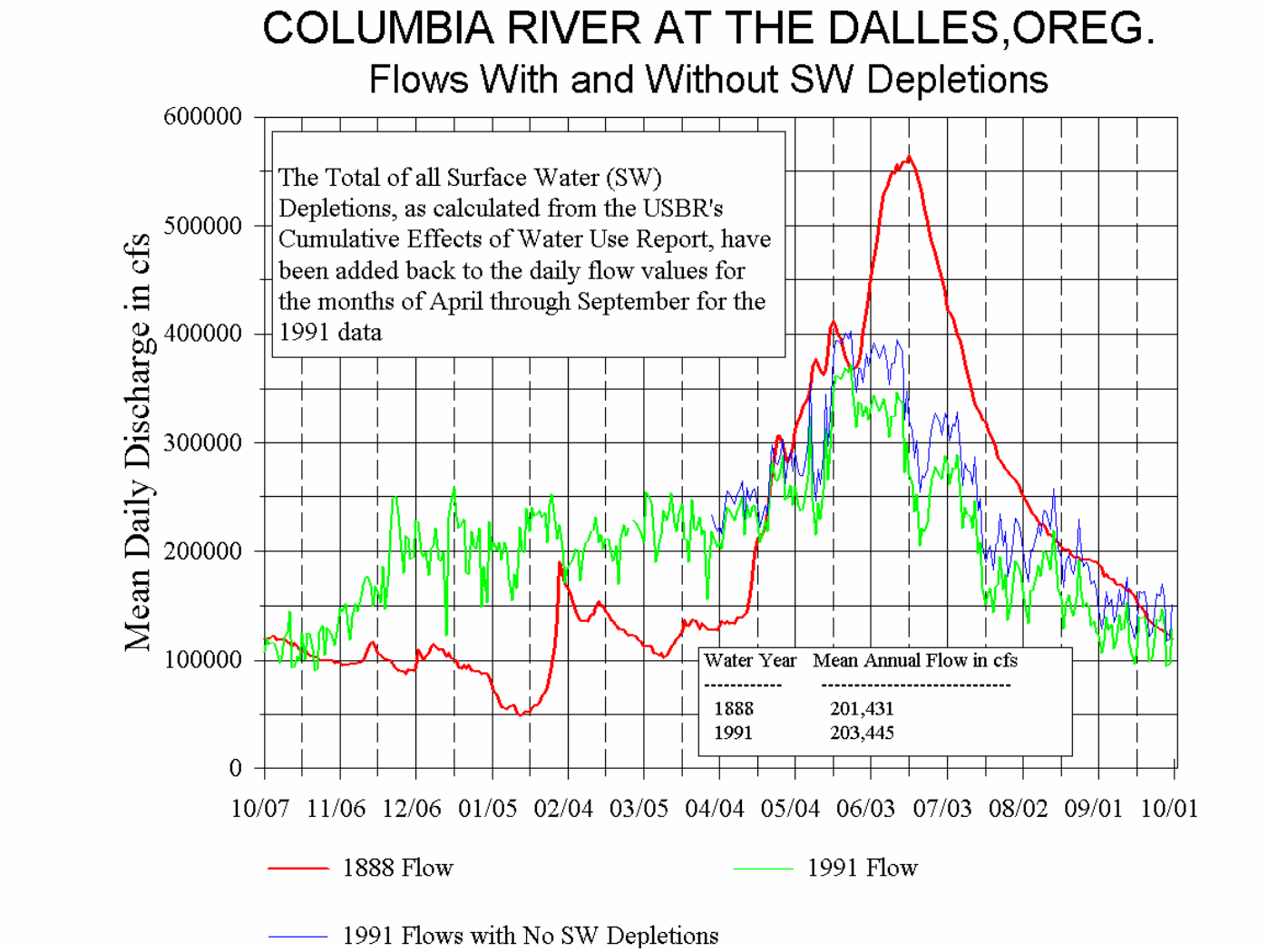
Graph depicting the USBR-calculated depletions from the mainstem Columbia and Snake Rivers. This data comes from their 1999 Cumulative Hydrologic Effects of Water Use study. This study was conducted to derive an estimate of the hydrologic impacts of water resource development in the Columbia River Basin. These numbers were derived by subtracting the report's Current Flows (1995 BiOp flows) from the report's Case 3 Flows (with the effects of diversions removed). The difference should represent the total depletions. The data in the report allows a determination of total depletions in both the mainstem Columbia and Snake Rivers.



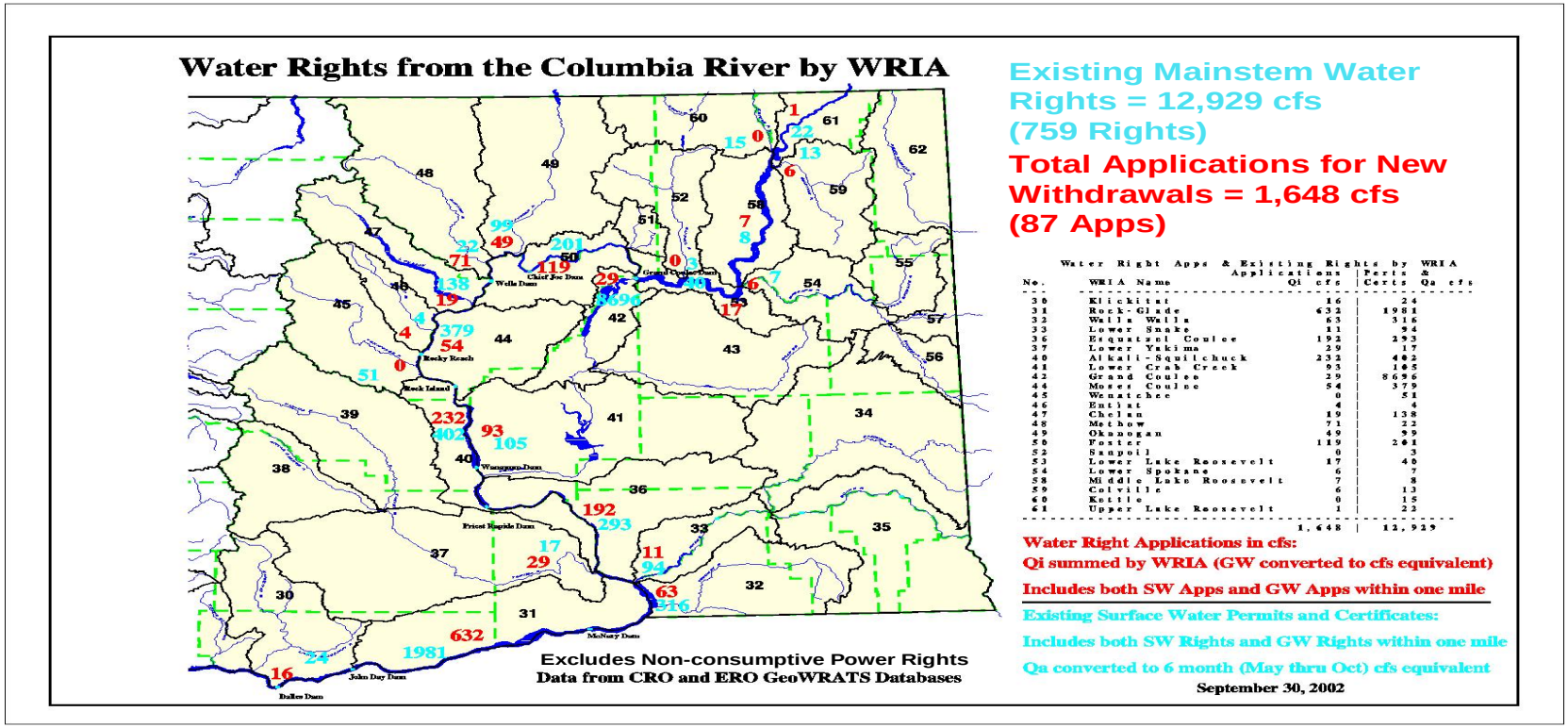
Graph depicting the monthly average flow versus monthly average depletions for a high water year (1997). Monthly average flow data for 1997 was recorded at the Columbia River at the Dalles USGS gage. The monthly average depletion numbers were derived from the USBR Water Use study. The graph also depicts the depletions as a percent of the total flow (assuming total flow equals the measured flow plus the depletions that the USBR believes are withdrawn from the river above the Dalles).



Graph depicting the monthly average flow versus monthly average depletions for a drought year (2001). Monthly average flow data for 2001 was recorded at the Columbia River at the Dalles USGS gage. The monthly average depletion numbers were derived from the USBR Water Use study. The graph also depicts the depletions as a percent of the total flow (assuming total flow equals the measured flow plus the depletions that the USBR believes are withdrawn from the river above the Dalles).



Graph depicting the daily average flow in the Columbia River at the Dalles for an average water year (1991) with and without the total monthly depletions (from the USBR Water Use study). This graph tries to depict what the daily average flow in the river would look like if all out-of-stream diversions were eliminated. The effects of reservoir storage and power loading would still be present.



Map depicting the distribution of existing water rights and pending applications for new water rights from the mainstem within eastern Washington. Quantities were summed by watershed reach along the mainstem Columbia River. Numbers for the existing water rights represent an 'effective Qi' (Qi = instantaneous withdrawal rate) calculated by taking the total annual quantity allocated by the water right (in acre-feet) and determining at what effective rate the water user would have to continuously pump to produce that quantity of water during a six month time period. It is rare for the instantaneous withdrawal rate listed on a water right to match the 'effective Qi'. Typically, the listed Qi on a water right is tied to the pump capacity and is much higher than the rate that the water user would actually withdraw at over a sustained period of time (because they would use up their allotment too quickly and they would be out of water before the end of the irrigation season). The numbers on the map for pending new applications are the listed Qi's on the water right application. Annual quantities haven't been assigned to the applications because they haven't been investigated yet. If these applications were approved and issued a water right, the effective quantity removed from the river would be significantly lower.

Q = a * V = A * v

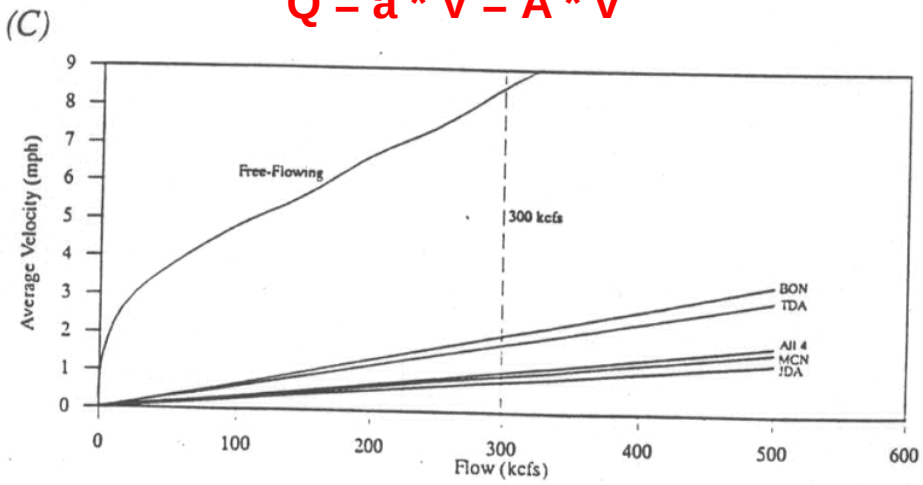


Figure 9. **Water particle velocity, in miles per hour (mph), for: (A) lower Snake River; (B) mid-Columbia River; and (C) lower Columbia River reservoirs, compared to pre-project water particle velocities.**

From: Columbia Basin Fish and Wildlife Authority, "The Biological and Technical Justification for the Flow Proposal", February, 1991.

Graph depicting the water particle velocity for the lower Columbia River for both pre-project and reservoir conditions. Flow (Q) is equal to area * velocity (whether that is a relatively small cross-sectional area of a river times a relatively high water velocity or a large cross-sectional area of a reservoir times a relatively low water velocity). Regardless of how drastically the flow in a reservoir changes, the overall water particle velocity can't be changed very much (the slope of the line is fairly flat, especially compared to the free-flowing conditions). Under virtually no conditions can the water particle velocity in a reservoir ever approach the velocity in a free-flowing, unregulated river (with the exception of the water spilling over a dam or plunging through a powerhouse turbine).