1. Flow Restoration Prioritization for the 16 Critical Basins

I. General Discussion

In an attempt to be more strategic in selecting streams and reaches throughout the state for stream flows restoration and to guide acquisitions of water rights a statewide prioritization matrix was developed. In order to develop equitable prioritization between and among streams and reaches, common parameters were selected.

When acquiring or leasing water is important to determine which streams would benefit from expenditure of acquisition monies. Evaluation and prioritization of streams within the 16 critical basins which would most benefit from increased flows, is necessary to strategically acquire water. Prioritizing streams is complex, requiring review of data regarding the size of a stream; current and future habitat conditions; historical, existing, and potential fish use; fish production potential; base flows; instream flow recommendations; the volume of water necessary to achieve the instream flows; projected future water and land use; and other factors. Unfortunately, this data is limited and is not generally available to allow meaningful comparisons of streams. Only stream and reaches in which low instream flows were noted as being a limiting factor to salmon production due to surface water diversions, were prioritized.

In many instances, especially where water has been used extensively for irrigation for more than a century, it is difficult to determine baseline flow conditions. In addition to surface diversions, there often has been significant alteration of the landscape and surface infiltration. Surface runoff coefficients have also been significantly altered in many instances due to soil compaction, roads, ditches, impervious surfaces, etc. Estimates can perhaps be made if relatively unaltered adjacent or nearby watersheds with similar fluvial, and geological characteristics, and climate are available.

These factors compound the ability to determine how much water is needed within each reach throughout the year. Where recommendations for instream flows levels have been developed or where minimum flows have been established by rule, those levels will be used to determine acquisition needs for specific streams and reaches. However, in many instances water quantity is so limiting that any additional flow that can be acquired for instream flow is desirable.

Ideally, specific information including detailed hydrologic and biological data, specific habitat data, flow data for current and baseline conditions, and existing and potential fish productivity would also be used to assess and prioritize water rights acquisition. In addition, some measure of expected participation by water right holders would desirable to maximize efficiencies in the administration of the program. Unfortunately, while there is much biological and flow data available for some stream and reaches, there is little or none available for others. In order to prioritize streams in a meaningful and equitable manner somewhat general habitat data, flow data, and species status and assemblages were used. In addition, it is desirable to use data collected using similar methodologies and techniques.

Thus, the Washington State Conservation Commission's, Limiting Factor Analysis data was used extensively in the development of the priority matrix which can be viewed at http://www.ecy.wa.gov/programs/wr/instream-flows/water_acquisition.html, as it is one of the

few recent studies in which similar methods and techniques were used to assess limiting factors to salmon production. USGS and DOE flow data was used as well. The matrix is intended to provide a relative index of the size, habitat conditions health, future condition, fish species diversity and status, which reflects the likelihood of success of stream flow restoration.

II. Prioritizing Streams and Reaches

Low flows due to surface water diversions (gravity or pump) were assumed to be limiting factors for all identified streams and reaches in the prioritization matrix. While many streams and reaches are known to have low flow which are limiting, the low flows may be natural or as a result of exempt wells, impervious surfaces, logging, or other land use practices. The water right acquisition strategy specifically targets low flows resulting from diversion of surface flow, or instances where there is relatively direct continuity between ground and surface water, which can be documented without extensive investigation.

The prioritization matrix is intended to be used as a screening tool to provide focus on streams where water rights acquisition will likely result in greatest benefit to fish and wildlife. Input from biologists with local knowledge of fish assemblages, streams with potential for recovery, life histories, flows, and habitat conditions can provide valuable assistance in prioritizing streams within sub-basins. The prioritization matrix will be considered a working document and changes can be made where appropriate, as new information becomes available. Thus, streams may be added or removed from the prioritization matrix as new information becomes available.

There are many unique variables affecting water acquisition prioritization of individual streams or watersheds. In some locations coordination with other states (such as in the Walla Walla River Basin) or even other countries (Okanogan, Nooksack, and Sumas River Basins) may be required to ensure success of stream flow restoration efforts. Flows in some streams are regulated by storage reservoirs operated by the BOR, USACOE, PUDs, irrigation districts, or other entities.

Acquisition priorities would potentially include diversions upstream and downstream of the identified reaches and tributaries to the identified streams and reaches, provided surface flows are enhanced within the target reach. Water rights with senior status will generally be favored over junior water rights to ensure that the water remains instream. Senior water lower in the sub-basin may be of highest priority if available to ensure that entire reaches remain watered. Creative leases and acquisitions may be useful in maximizing the benefits of acquisitions

While the habitat parameters included in the matrix were selected as being representative of the watershed condition, in some instances it is expected that this may lead to erroneous conclusions, especially where most or all habitat parameters are rated as being poor. This statewide index is not expected to be of sufficient sensitivity to discern differences in streams/reaches with habitat conditions suffering various degrees of poor condition. Therefore, local expertise will be sought and welcomed in the assessing various water rights.

When prioritizing streams for water acquisition, it is important to consider potential existing and future limiting factors to salmonid production. Otherwise, fish productivity may not be realized

despite increasing stream flow because other limiting factors exist. For example, if instream flow recommendations were achieved, but temperatures, or other water quality parameters were outside tolerance thresholds for salmonid survival, few if any benefits to salmon may be realized.

The expected future condition of the habitat and water quality may also be an important consideration. If other factors are expected to become limiting in the future, it is not logical to acquire water in those streams as successful salmonid recovery would be unlikely. Significant increases in the density of exempt wells in a sub-basin may perpetuate low flow conditions as a limiting factor despite surface water acquisitions. While growth and land use projections could have been generated for some watersheds using comprehensive plans, it was determined that this data was unlikely to be an good indice of habitat impact and limiting factors due to complex variables involving location and types of development. It was assumed that current floodplain conditions and off-channel habitat indices reflected developmental pressure and land use to some extent.

Other limiting factors to salmonid recovery may include temperature, passage barriers, disease, water quality, predation, and poaching. There factors must be considered when evaluating stream flow restoration projects as these factors could be compounded by providing fish access into small tributary streams where they may be more vulnerable.

1. Water Quantity

The size a stream is another determining factor in prioritizing streams for water acquisition. It is important to know what existing flow conditions and instream flow needs (targets), to determine the volume of water necessary to achieve instream flow needs. It was assumed that the acquisition of a relatively large volume of water would be necessary to effect notable or measurable fish benefits in large, main stem streams. For example, very significant increases in instream flow would be required in the Okanogan or Yakima Rivers to effect measurable benefits to salmon recovery, as it is likely that other limiting factors, such as water quality, would continue to persist.

Due to the volumes of water and costs associated with restoring large streams, it is unlikely that sufficient quantities of water and funding would be available. However, some of the larger streams did rank relatively high due to the diversity and status of salmonid stocks they support and the condition of their habitat. There may also be opportunities to acquire smaller quantities of water during critical time periods to provide additional water during critical periods of the freshwater life histories of salmonids. Foe example if stored water could be acquired it may be used to provide pulse of flow during critical out-migration periods, to temporarily supplement flows during spawning periods until fall rains increase instream flow, or provide passage for adult salmonids.

Instream flow recommendations have not been developed for most of the smaller tributary streams within the critical basins. Additionally, baseline flow data is not available for many streams as annual diversions may have been occurring for many decades. Thus, in some streams it is difficult to determine how much water must be acquired within a stream to meet instream flow needs for fish. Gage data was used where available to determine mean monthly flow

(MMF) for streams. Where gage data was not available, the basal area of the watershed was compared to the area and flow of adjacent water watersheds, to estimate instream flow.

The sizes of the streams were determined by their MMF between June 1 and September 30th, which typically is the low flow period when surface diversions are in use. There are exceptions, as the base flows for some streams actually occur during mid-winter months, when surface water is frozen.

Developing instream flow recommendations for all streams would be desirable to identify the volume of water needed for each stream. It would be desirable to determine if there is sufficient water available to achieve sufficient instream flows such that measurable benefits could be provided to fish. If only a fraction of the water needed is available, it may not be prudent to acquire of lease water within that stream or reach. However, incremental acquisitions through establishment of a Water Trust or bank may be used to secure a sufficient amount of water over a long term to provide measurable benefit.

2. Fish Species Diversity

Flow restoration in streams which would benefit a diversity of salmonids, were ranked higher than those with few species. Acquisitions which protect a diversity of species were assumed to be of higher value and diverse habitat conditions could generally be expected to exist. A diversity of species would also reflect watershed health to some degree. Some streams or reaches may provide only rearing or spawning habitat, or may just serve as a migration corridor. Those streams supporting all freshwater life histories of salmonids present should be ranked higher.

3. Fish Status

One of the most important components of the prioritization process is determining which fish species and life stages are present, and their status. Those streams supporting salmonid species most in need of protection and listed as threatened or endangered under the Endangered Species Act, or those listed as "critical" or "depressed" under the Salmon and Steelhead Stock Inventory (SASSI) were generally be ranked higher than streams healthy stocks. However, careful consideration should also be provided to important healthy, stocks of salmonids which may be at risk of becoming depressed or requiring federal protection under the ESA. While the focus of the program is directed primarily towards salmonid restoration, it is also recognized that projects benefiting a diversity of fish and wildlife species, should also be considered. In some instances it may be more prudent to protect streams with diverse, healthy stocks and habitat, rather than attempting to restore salmonids in habitat which is in poor condition with little prospect of recovery. It is generally less costly to preserve and protect healthy habitat and fish runs than to attempt to restore degraded habitat and depressed stocks. Expected future conditions of habitat and flow is a consideration.

4. Salmon Life History

Salmonids have varying life history strategies in freshwater. Some are fall spawners, such as coho, chinook, chum, pink, bull trout, and sockeye, while steelhead, cutthroat trout and rainbow

trout are spring spawners. There are also summer spawning chinook and chum salmon. Some species migrate to the sea soon after emergence from the gravel, while others may rear in freshwater from one to three years prior to emigrating. Most juvenile salmonids out-migrate in the spring between Late-March and June. Knowing which species are present and when they are present is an important factor in acquiring water for salmonid recovery to increase efficiency. Acquiring water when and where it is most beneficial will likely be more cost effective than acquiring water throughout the year.

As indicated above, some streams and reaches may not support adult spawning fish but may provide critical winter or summer rearing habitat for juvenile salmonids. Increasing flow in reaches can be very important if rearing habitat is also a limiting factor in the watershed.

5. Habitat Conditions

It is expected that salmon recovery efforts will be more successful in those streams with habitat currently in proper functioning condition. Water acquisition in streams with relatively poor habitat conditions are less likely to realize increased salmonid productivity in the near future because other limiting factors may exist. If temperatures remain excessive, large woody debris and other important rearing habitat is unavailable, or if sediment loading in spawning beds is excessive, little of no salmonid recovery may result.

Stream which have been channelized, diked, dredged, or suffer significant alteration from past and existing alterations may take many decades to recover unless significant restoration activities occur concurrent with flow restoration. Restoration efforts can accelerate recovery of various habitat parameters to proper functioning condition.

6. Altered Flow and Hydrology

In some streams flows can actually be excessive during certain times of the year, especially if water storage facilities are used to provide water for irrigation or municipal use. Artificially high stream flows during the wrong time of the year can have a variety of direct and indirect impacts to salmonids. High flows can cause scour or redds and spawning gravels, alter timing of migration and spawning, alter riparian plant communities, result in loss of redds, juvenile salmonids, and aquatic invertebrates through dewatering and stranding (if fish spawn when flows are artificially high then flows are later reduced), and other impacts. Increased frequencies of flow fluctuations can also result in significant impacts due to redd (nest) dewatering and stranding.

Care must be exercised when acquiring water to avoid unintended consequences of providing additional flows such that other sources of mortality result. If fish access were provided into upper stream reaches and tributaries which naturally dewater, fish may suffer increased predation or stranding in some circumstances. Access could also be provided for predators into critical reaches, or diseases may appear where none currently exist. There may also be consequences to the genetic integrity of listed species, such as if brook trout access were provided to stream reaches inhabited by isolated populations of bull trout.

There are many other streams other than those prioritized, which suffer from low instream flow due to a variety of reasons other than surface diversions. Stream flow is affected by climate, snow pack, geomorphology, landscape alterations, including impervious surfaces, logging, agricultural practices, density of permitted and exempt ground water wells, and many other variables.

7. Other considerations

The potential site condition or expected future condition of the stream/reach should be considered in flow restoration assessment. While it would be desirable to include this variable in the prioritization, it is difficult to assess, as there are no consistent indices of future or expected conditions. It is expected that streams with greater opportunities to achieve flows ad habitat in proper functioning conditioned would be rated higher than streams with little chance of even achieving minimal productive capacity.

Water conservation efforts can complicate water acquisition and leasing. Lining canals in some stream reaches can result in less water reaching other tributaries and wetlands. The degree of continuity between surface waters and ground water can be variable. If various ground and surface waters are appropriated it is important to identify the extent to which surface waters would benefit with water acquisition. If instream flow benefits cannot be determined or realized, or there is risk in acquiring water at risk of being lost through conservation efforts, caution should be exercised.

In some instances, acquiring junior water rights may be beneficial, especially split season leases or instances when more senior water right holders may not exist downstream, and instream flows can be preserved through the target reach.

8. Public Participation and Interest

It is recognized that one of the most determining factors regarding the success of the program will be finding willing participants in the program where water is most needed by salmonids. Outreach programs will be used to assess interest in the program prior to acquiring water. Participation is expected to be higher where community and local support exists for the program and where water right holders may be more familiar with the program. In addition, creative means of water acquisition will be explored to find solutions which address the needs of water rights holders while recovering salmonids.

The water right characteristics including its location, validity, and seniority is recognized as being a very important consideration in water acquisition. This is addressed in “Strategy Three” elsewhere in this document.

III. Restoring Streams without Fish

In general, streams in which flows are limiting and have naturally spawning populations of wild salmonids would rank higher than those not supporting fish, as recovery would be expected to occur more rapidly. However, current and future habitat conditions must also be considered.

Some streams or reaches may not support adult fish populations, but may provide critical rearing habitat for salmonid production during critical time periods. While these streams may not be prioritized as highly as streams providing both spawning and rearing habitat, they should be considered for water acquisition, especially where rearing habitat is also limiting. In other streams, spawning habitat may be precluded due to a high sediment load. If efforts are underway to restore habitat and provide passage, these streams should receive higher priority.

There are also stream reaches which currently do not support fish life because low flows over a period of many decades has precluded access to spawning and rearing habitat. If the habitat is in proper functioning condition, and the stream historically produced salmonids, it should be included in the prioritization process. Some of these dewatered streams could realize significant production potential if flows were restored. Thus, the number of salmonid species with recovery potential within a stream was also used in determining the priority indices for these streams. It is expected that natural colonization of a stream without fish would likely occur quite slowly, and may take decades, although artificial reintroduction techniques could assist in jump starting recovery efforts.

It is recognized that fish passage plays and important role in prioritization process. Improving instream flows within stream which are inaccessible to fish is obviously unproductive, unless passage can be expected in the near future. However, passage is often related to instream flows. Streams with most favorable existing passage conditions received higher priority indices than streams suffering some form of passage barrier. However, consideration should be provided in instances where significant production potential may exist above a barrier.

It is expected that additional streams will be added to the prioritization matrice as more information is available. If newly prioritized streams rank favorably, they should be considered for flow restoration efforts. In addition, if tributary flows can be preserved downstream to benefit designated target reaches, the tributaries would receive the same priority as the receiving reach. However, if acquired water can be diverted by other water right holders prior to reaching a target reach, it would not rank very high as it is unlikely that there would be significant benefit to fish.