APPENDIX A I-405 STREAM SURVEY METHODOLOGY

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To: I-405 Team
MAP Team

From: Derek Koellmann

Date: March 21, 2005

Re: Recommended Stream Survey Protocols

Overview

The I-405 Bellevue and Renton Improvement Project study areas cross or are located within the proximity of a variety of streams and rivers. As such, various elements of the projects have the potential to affect these waterbodies. To help determine the nature and extent of these effects, the habitat in these waterbodies must be assessed to quantitatively and qualitatively document in-stream and riparian conditions. This document describes the methodology that will be used to collect information on the physical characteristics of the streams and rivers in the study areas.

The specific habitat variables to be assessed in this study include:

a. Existing stream geomorphology
b. In-stream habitat type
c. Riparian vegetation
d. Substrate composition
e. Abundance of large woody debris
f. Quality of pools

The information collected will be used in conjunction with existing fisheries information (i.e., from existing reports and data, interviews, etc.) for the study areas to assess the quality and quantity of fish spawning, migration, and rearing habitat and provide information on the current and potential fish and other aquatic species use of the streams and rivers.

This methodology has been developed to document existing habitat in the study area in a manner that can be repeated so that future habitat conditions can be assessed post project construction.

Mercer Slough is located within the Bellevue study area, but does not fall under the definition of a stream or river per this section, nor would the protocols recommended herein be appropriate to assess the habitat values in Mercer Slough. A separate method for documenting habitat values in Mercer Slough is proposed at the end of this memo.

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Stream Survey Approach

Stream surveys will be performed on all streams and rivers that are crossed by I-405 and SR 167 or are located within the immediate proximity of the project area. The surveys will be conducted from approximately 300 feet upstream and 1,320 feet downstream (1/4 mile) of the proposed project footprint.

Up to eleven transects will be laid out perpendicular to stream flow at regularly spaced intervals along the streams to be surveyed. The minimum distance between transects will be 50 feet and the maximum distance will be 300 feet. The distance between transects will be based upon the bankfull width of the stream to be surveyed. For some streams that run parallel to I-405 or SR 167, such as Gilliam and Panther Creeks, two sets of transects may be established to ensure that habitat values throughout the stream reach are appropriately documented. Slightly different protocols will be used in wadeable versus non-wadeable streams and rivers.

At and in-between each transect qualitative and quantitative descriptions of in-stream and riparian habitat will be collected. A summary of the protocols to be used and habitat variables to be assessed is described further below. A field training day is scheduled prior to initiating the full field effort. It is anticipated that some minor adjustments to the protocols may be needed based on this training. Protocol adjustments would be considered where applicable to improve the characterization of target parameters and/or to improve sampling efficiency.

Summary of Habitat Variables and Associated Protocols

The following protocols will be used to quantify the various habitat variables.

Existing Stream Geomorphology

Existing stream geomorphology information will be collected using protocols detailed in the US Environmental Protection Agency's (EPA) document *Quantifying Physical Habitat in Wadeable Streams* by Kaufmann et al. (1999) (Quantifying Physical Habitat).

Quantifying Physical Habitat details the concepts, rationale, and analytical procedures for characterizing physical habitat in wadeable streams based on raw data generated from methods similar or equal to those of Kaufmann and Robison (1998) that are used by the U.S. Environmental Protection Agency (USEPA) in its Environmental Monitoring and Assessment Program (EMAP). Guidance is provided for calculating measures or indices of stream size and gradient, sinuosity, substrate size, habitat complexity and cover, riparian vegetation cover and structure, and anthropogenic disturbances. Two-person crews typically complete EMAP habitat measurements in 1.5 to 3.5 hours of field time per sampling reach. While this time commitment

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is greater than that required for more qualitative methods, these more quantitative methods are more repeatable (i.e., more precise).

Variables to be surveyed using Quantifying Physical Habitat

1) Wetted width
2) Bankfull width
3) Bankfull height
4) Stream depth
5) Reach Length
6) Sinuosity of Reach
7) Slope of Reach
8) Bank angles

Existing Stream Geomorphology Metrics

1) Mean and standard deviation (SD) of wetted width, bankfull width, bankfull height, stream depth, reach slope, and bank angles
2) Reach Sinuosity

In-Stream Habitat Type

In-Stream Habitat Type will be quantified using the *Timber Fish and Wildlife* (TFW) *Monitoring Program Method Manual for the Habitat Unit Survey* by Pleus et al (1999). (Habitat Unit Survey) and the EPA's *Rapid Bioassessment Protocols for Use in Streams and Rivers* by Plafkin et al. (1989) (Bioassessment Protocols).

The Habitat Unit Survey provides methods for identifying habitat units, measuring their surface area, and collecting information on residual pool depth and pool-forming factors. Other information produced includes pool:riffle ratio, length of side channels, and the frequency distribution of residual pool depths and pool-forming factors.

The Bioassessment Protocols were originally developed in the 1980's to provide cost-effective, efficient biological survey techniques. The assessment is done using a visually-based approach to characterizing the physical habitat structure of the stream site. The concepts underlying the Bioassessment Protocols are:

- Cost-effective, scientifically valid procedures for biological surveys,
- Provisions for multiple site investigations in a field season,

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- Quick turn-around of results for management decisions, and
- Scientific reports easily translated to management and the public.

Variables to be surveyed using the Habitat Unit Survey

1) Stream Discharge
2) Core Habitat Units (e.g. pool & riffle sequences)
3) Surface Area Measurements of Core Habitat Units
4) Residual Pool Depths
5) Pool Forming Factors (e.g. LWD, boulder, etc)

Variables to be surveyed using Bioassessment Protocols

1) Epifaunal substrate/available cover
2) Channel Alteration (including armoring)

In-Stream Habitat Type Metrics

1) Stream discharge (cfs)
2) % of Core Habitat Units
3) Habitat Units per Kilometer and Bankfull Width
4) Pools per Kilometer
5) Factors contributing to pool formation (PFF)
   a) % of units
   b) % of primary PFF
   c) % of pool surface area
6) Mean and SD residual pool depth
7) Mean and SD % epifaunal substrate/available cover
8) % Altered channel
9) % Streambank armoring

Riparian Vegetation

Riparian vegetation will be quantified using a combination of protocols from Quantifying Physical Habitat and Bioassessment Protocols.

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Variables to be surveyed using Quantifying Physical Habitat

1) Canopy Cover
2) Riparian Vegetative Structure

Variables to be surveyed using Bioassessment Protocols

1) Bank Stability
2) Bank Vegetative Protection
3) Riparian Vegetative Zone Width

Riparian Vegetation Metrics

1) Mean and SD of canopy densiometer values
2) % ground cover, mid layer vegetation cover, and canopy level cover, % total ground, mid layer vegetation, and canopy level cover, and % invasives
3) Mean and SD % Bank Stability
4) Mean and SD % Bank Vegetative Protection
5) Mean and SD % Riparian Vegetative Zone Width

Substrate Composition

Substrate composition information will be collected using protocols detailed in *Quantifying Physical Habitat* and *Methods for Evaluating Riparian Habitats with Applications to Management* by Platts et al. (1987) (Evaluating Riparian Habitats). For smaller stream segments where there is not adequate stream length to apply this method, a Wolman pebble count will be conducted to determine substrate composition. (Wolman 1954).

Evaluating Riparian Habitats is a comprehensive compilation of methods for resource specialists to use in managing, evaluating, and monitoring riparian conditions adjacent to streams, lakes, ponds, and reservoirs.

Variables to be surveyed using Quantifying Physical Habitat

1) Substrate Size
2) Substrate Composition

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Variables to be surveyed using Evaluating Riparian Habitats

1) Substrate Embeddedness (%)

NOTE: In non-wadeable systems, such as the Green River, substrate sizes will be estimated either visually (where possible) or by using the drag method as prescribed by Lazorchak et al. (2000) in the *Field Operations and Methods for Measuring the Ecological Condition of Non-Wadeable Rivers and Streams*.

Substrate Composition Metrics

1) Mean and SD of substrate size class
2) 75th percentile of substrate size class
3) Substrate median size class
4) 25th percentile of substrate size class
5) % breakdown of substrate size classes
6) Mean and SD % embeddedness

Abundance of Large Woody Debris

Abundance of Large Woody Debris (LWD) will be quantified using the Level 1 survey method from the TFW Monitoring Program (LWD Method) method manual for the large woody debris survey by Schuett-Hames et al.(1999).

The LWD Method provides methods for documenting the number, volume and characteristics of large woody debris pieces in stream channels. The Level 1 survey involves a rapid tally of pieces by size category and produces information on total and key LWD pieces per channel width.

Variables to be surveyed using the LWD Method

1) Number of LWD Pieces
2) Identification of Key LWD Pieces
3) Distribution of LWD in stream corridor
4) LWD jam composition

Large Woody Debris Metrics

1) % LWD pieces by size class and channel zone

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2) % key LWD pieces
3) LWD pieces per channel width
4) LWD pieces per kilometer
5) LWD jam composition by % size class

Quality of Pools

Quality of Pools will be measured using methods described in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* by Bauer and Burton (1993) (Water Quality Effects).

Water Quality Effects describes a monitoring system to assess grazing impacts on water quality in streams o the western United States. The monitoring methods were selected for application by natural resource professionals with backgrounds in soils, range, hydrology, fisheries biology, and water quality. Though designed to be used in an agricultural environment, many of the protocols in this document (such as assessment of pool quality) can be applied over a broad geographic range.

<u>Variables to be surveyed using the Water Quality Effects</u>

1) Pool depth (in conjunction with the Habitat Unit Survey)
2) Substrate
3) Overhead Cover
4) Submerged Cover
5) Bank Cover

NOTE: The individual variables surveyed will be assimilated into a pool quality index that will detail habitat values for individual pools.

<u>Quality of Pool Metrics</u>

1) Mean and SD pool quality index

Ordinary High Water Mark (OHWM)

OHWM measurements will be conducted in accordance with the protocols contained in *A Guide for Field Identification of Bankfull Stage in the Western United States* by the USDA, Forest Service, Stream Systems Technology Center Rocky Mountain Research Station.

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The OHWM for each stream will be marked for 60 lineal feet along the stream from the proposed toe of slope of impact line. In instances where the OHWM is located more than 60 lineal feet from the proposed toe of slope of impact line OHWM will not be marked and it will be documented in a technical memorandum that the distance to the OHWM exceeds 60 lineal feet.

Establishing Reference Points

A handheld GPS unit will be used to establish reference points at the upstream and downstream end of each surveyed stream reach to allow for future surveys to be conducted within the same reach.

Photographic Documentation

Photographs will be taken at the upstream end, downstream end, and mid-point of each survey reach. In addition, significant features (e.g. LWD jams, culvert outlets, etc) will also be photographed.

Mercer Slough

Mercer Slough is a unique feature within the Bellevue study area. Several streams in the study area outlet into the slough, however the slough itself is a lacustrine (lake influenced), rather than a riverine, system. The slough is used by a variety of aquatic species and acts as a migration corridor and rearing area for salmonids in various life stages.

To assess the habitat values of Mercer Slough, habitat survey crews will determine the extent of inundated vegetated areas and deeper channel areas (those with no vegetation breaking the surface of the slough). A Differential Global Position System (DGPS) will be used to collect data along the outer margin of the wetted perimeter and deeper channel areas of Mercer Slough within the study area. This approach will provide information on the extent of the two main habitat types in Mercer Slough. A discussion of how these habitats could be affected by the project and/or used by fish could be prepared as part of the Bellevue Nickel Improvement Project Fisheries and Aquatic Resources Discipline Report. Existing information will be used to determine fish use in Mercer Slough.

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