

## **Appendix C.**

# **Environmental Outputs of the Restoration Alternatives**

## **APPENDIX C**

### **Environmental Outputs of the Restoration Measures**

The environmental outputs—area inundated and total edge—for each restoration measure identified in Section 6.2 were calculated using FRAGSATS, a computer program for spatial pattern analysis. The rationale for using these metrics to quantify habitat benefits associated with the proposed project is described in Section 6.4.1. FRAGSTATS, developed by researchers at Oregon State University,<sup>1</sup> utilizes a GIS database to calculate several habitat metrics which characterize aspects of the landscape, including total edge.

The FRAGSTATS analysis of the project alternatives was conducted by a Seattle District GIS analyst, is described below.

#### Data sources:

- Grading Design Plan from Tetra Tech (dated November 2001)
- 2 Washington Department of Natural Resources aerial photos of the project area
- 1 Seattle District aerial photo (2000 flyover)

#### Procedural steps:

1. Aerial photos were scanned and georeferenced in ArcMap 8.2 by registering them to USGS quads in state plane coordinates, south zone, NAD 27.
2. Channel measures were digitized (heads-up) as graphics using an aerial photo marked up with channel numbers and the grading plan CADD drawings as guides.
3. The CADD drawings were not georeferenced, but did have the same dimensional units (feet) as the georeferenced aerial photos. This, therefore, made it possible to move the graphics created in step 2 so that they coincided with remnant channels evident in the photos.
4. The shape of the digitized channels were modified to better match the remnant channels in the photos.
5. The graphics showing the channels were then converted to a shape file named "all\_channels\_line".
6. A shape file named "fs\_boundary\_line" was created to model the current condition, without channels. This shape file included the Fragstats analysis boundary as well as the boundaries between different land cover types.
7. The channels from "all\_channels\_line" were added one-by-one to form Measures 2 through 7 (named alt2\_raw.shp, alt3\_raw.shp, etc). These shape files were converted to ArcInfo line coverages and cleaned to form polygon coverages (named alt2\_poly, alt3\_poly, etc.). Measure 1 was treated similarly, except that no channels were added.

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<sup>1</sup> K. McGarigal and B.J. Marks, Forest Science Department, Oregon State University (1994).

8. The ID field (e.g. alt1\_poly\_ID) was used to differentiate among landcover types for each alternative. Each polygon was assigned an ID using the following coding convention:
  - 1 = tidal channel
  - 2 = new tidal wetland created by the proposed project alternative
  - 3 = other (including upland, existing Spartina marsh, proposed levee footprints)
  - 4 = Willapa River
  - 5 = hill slope forested buffer
  - 6 = US 101
  
9. Each measure was dissolved in ArcInfo on the ID field, thereby eliminating any lines dividing polygons with the same ID. This is a prerequisite for running Fragstats. Resulting polygon coverages were named alt1\_poly\_d, alt2\_poly\_d, etc.
  
10. Fragstats analyses were run with the following steps/options:
  - o Type "fragstats" at arc prompt
  - o Select the workspace where the coverages exist
  - o Select Fragstats|Wizard from the menu
  - o Select the coverage of interest and its map units (feet)
  - o OK
  - o Fragstats automatically selected the ID field as the classification field
  - o Next
  - o Next (there are no background polygons in this case)
  - o Select edge-based
  - o Select edge weight file (weights\_all\_alternatives.wt), which were as follows:
    - ❖ Channel flowing through new or old wetland = 1
    - ❖ New wetland adjacent to the Willapa River = 0.5
    - ❖ New wetland adjacent to forested polygon = 0.25
    - ❖ All other edges = 0
  - o Turn off "Display Maps" to speed up the analysis
  - o Select Class and Landscape metrics
  - o Provide a name for the fragstats run (e.g. willapa\_alt2\_12July02)

Outputs for the parameters of interest were summarized in Table 5 below.

**Table 5. Environmental Outputs for Restoration Measures**

		<b>Area Inundated (acres)</b>	<b>Total Edge (feet)</b>
Measure 1	Dike Removal	249	1,845
Measure 2	Primary Channel #5 Secondary Channels #5 and #5b	0	8,156
Measure 3	Primary Channel #1	0	2,831
Measure 4	Primary Channel #2	0	3,926
Measure 5	Primary Channel #7 Secondary Channel #7a	0	5,095
Measure 6	Primary Channel #8 Secondary Channel #8	0	5,728
Measure 7	US 101 Bridge Secondary Channel #5a	102	12,381

**Total for all Measures:** 351 acres                      39,962 feet