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Appendix C

SUBJECT: **Land Use Assessment: Methodology and Limitations**
Birch Bay, Washington

This memorandum provides the methodology utilized for assessing current and potential land use conditions within the Birch Bay watershed per Task #4 of the agreed upon scope of work between Parametrix/ ESA Adolfson and the Multi-agency Watershed Group (MAWG)[1]. The methodology described here refines already developed land use assessment tools for integration with other tools designed to characterize ecosystem process and habitat conditions. Based on a 4-step process, the methodology described below is used to generate information regarding the vulnerability and intensity of individual sub-basins within the Birch Bay watershed to potential development based on current zoning patterns designated by Whatcom County (2005).

PURPOSE

The scope and intent of this pilot project is to develop an integrated approach that incorporates multiple methods used in watershed characterization to provide guidance for future land use planning efforts. The overall goals of the project are to:

- use watershed science-based strategies for guiding future development;
- outline comprehensive mitigation and restoration strategies to offset anticipated development impacts; and,
- identify options for streamlining local development review.

More specifically, this project seeks to facilitate protection and restoration of ecosystem processes necessary for the long term functioning of marine, freshwater, and terrestrial systems in and adjacent to the Birch Bay watershed while achieving more effective and efficient decision making related to land use management at the local level.

BACKGROUND

As part of the SMP update process Whatcom County conducted a landscape-scale characterization of ecosystem processes using the methods developed by Stanley et al. (2005). The landscape characterization examined key processes related to the movement of water, sediment, heat/light, LWD, and nutrients in each of the 26 identified watershed management units (WMUs) in the County. The characterization:

- Identified key processes within the landscape that shape and influence the health of aquatic systems including wetlands, streams, estuaries, and marine waters;
- Mapped areas on the landscape that are important to the operation and maintenance of these processes,
- Assessed how these processes have been altered by human activity, and

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[1] The MAWG includes: the Washington Department of Ecology, the Puget Sound Action Team (PSAT), the U.S. Environmental Protection Agency (EPA), Washington Department of Fish and Wildlife (WDFW), National Oceanic and Atmospheric Administration (NOAA), U.S. Fish and Wildlife Service (FWS), Washington Department of Community Trade and Economic Development (CTED), Cascade Land Conservancy, Washington Department of Transportation (WSDOT), and the Washington Association of Counties.

- Determined protection, restoration and management needs for each WMU, including Birch Bay, based on existing conditions.

This pilot project builds on this existing work by: 1) refining certain aspects of the characterization (e.g., improved wetland characterization); 2) numerically scoring two of the processes (water and nutrients) using new tools developed by Stanley et al. to depict (in conjunction with information on the other processes) the relative importance of each sub-watershed for water and denitrification processes; and 3) adding a metrics-based fish and wildlife assessment.

This pilot project is part of a larger effort by the MAWG to develop an integrated set of tools that use watershed science in a land use planning context. The Birch Bay watershed was chosen as the pilot case, because Whatcom County has been actively seeking opportunities to use watershed-based planning tools to streamline development review and improve natural resource management. As an example, Whatcom County's Critical Area Ordinance (CAO) includes provisions that allow watershed plans to "substitute" for some critical area regulations and other land use restrictions. The CAO also includes detailed standards and procedures for mitigation banking based on and consistent with State banking standards.

The approach(es) developed in the following document is/ are based on the categories and conditions outlined in the description of Task 4, below:

This task involves assessing existing development patterns and estimating future build out based on current zoning and other existing development standards. As with Task 1, the analysis will focus on non-industrial zoned areas of the watershed. We will document the impacts of projected development patterns on wetlands, land cover changes, and increased impervious surface, and further relate these impacts to water quality degradation, flooding and habitat loss using available literature. We will also develop recommendations for alternative development scenarios that incorporate 'green infrastructure' concepts, Low Impact Development techniques, transfer of development rights and/or other strategies and compare the impacts of these scenarios with the conventional development approach. This task will also include review of current development standards and permit procedures. Products of this task include a list of mitigation/restoration measures that would be needed to offset development impacts and promote a watershed-based approach for guiding development patterns and managing aquatic resources.

METHODS

Introduction

Future land use patterns are assessed using a futures scenario-planning framework. In general, futures scenario planning is an analysis technique designed to assess the relationships between human development actions and the impacts of these actions on natural processes and patterns (Hulse et al., 2000). A zoning-based, full-buildout, futures scenario plan (Planned Trend Scenario), used for the purposes of this pilot study, analyzes the expected location of future development within a defined area, and estimates the number of new dwelling units (residential land uses) when all land available for development is developed at the highest intensities possible, per current zoning regulations. The build out is correlated with future changes in impervious surface coverage to anticipate development impacts based on available scientific literature. Although this analysis technique does not project when build-out will occur, it is useful in long-term planning efforts as a way to understand the potential for future growth and the impacts of such growth on natural resource processes in a specified area such as the Birch Bay watershed.

Limitations

Zoning-based futures scenario planning for full build-out has several potential drawbacks. The first is that full build-out scenarios tend to over-estimate actual growth and associated impacts for a given study area (Nelson and Graham, 2003). For example, full build-out analysis makes the assumption that all areas will develop to the highest density allowed by the current zoning regulations, and then multiplies each zoned area by the average impervious cover for its associated zoned land use. However, full build-out rarely occurs at the densities that zoning allows. Consequently, much of the potential development based on zoning regulations may not occur due to local economic conditions or a lack of available infrastructure. Thus, zoning-based build-out scenarios can represent a worst-case scenario for development impacts to ecological processes and habitat conditions (Zielinski, 2002).

The second limitation is that this type of land use scenario development only takes into context residential zoning districts. Zoning districts with commercial or industrial classifications have minimal potential residential dwelling unit capabilities and are thus considered outside of the scope of the information generated for the scenario. For this analysis, all commercial and residential zoning districts are assumed to have the potential to develop to full capacity, and are thus integrated into the evaluations of impervious surface, but are not included in the density calculations.

Planned Trend Scenario Model

There are four (4) steps to developing a planned trend scenario model that examines the potential impact of anticipated build-out conditions on natural resource processes in Birch Bay such as surface water hydrology and water quality (Figure 1).

Figure 1: Steps for Developing a Planned Trend Scenario Model for Birch Bay, Washington.

Step 1 – Assess Current Development Patterns (Residential Location & Density)

Step 2 – Identify Buildable Areas per Whatcom County Regulations

Step 3 – Assess Future Development Patterns (Location & Density)

Step 4 – Evaluate Changes to Impervious Coverage

Step 1 – Assess Current Residential Development Patterns (Location & Density)

The first step includes identifying current residential development patterns and densities within the watershed using parcel and zoning district data provided by Whatcom County. To do this, each parcel is assigned a potential development characterization code (Figure 2) depending on current development intensities and the amount of remaining of parcel area for development.

Figure 2: Potential Development Characterization Codes

Parcel Characterization	Definition
Fully Developed	Any legal lot of record, which cannot be subdivided and already has a dwelling unit or some other structure.
Undeveloped	Any vacant parcel, which may be subdivided or developed with more than one dwelling unit.
Underdeveloped	Any parcel, which currently contains one or more dwelling units and that may be subdivided or developed with additional dwelling units.
Vacant	Any legal lot of record, which meets the minimum size requirement of the zone, but cannot be

	subdivided, and is vacant.
Non-Conforming Vacant	A legal lot of record that does not meet the minimum size requirement of the zone but is vacant.

Current development intensities are determined by examining the value of built structures on each parcel from the Whatcom County Assessors database. If the building value is greater than $3,000 an assumption is made that the parcel contains a single dwelling unit, or if zoned for multi-family meets the maximum density of multi-family units for the zoning classification. Potential development characterizations are then generated for each parcel based on the size of the parcel and the residential density requirement for the zoning district in which the parcel is located (Figure 3).

Figure 3. Residential Zoning and Density Requirements in the Birch Bay Watershed

Zoning District	Residential Density Requirement
R10A	1 du* / 10 ac
R5A	1 du / 5 ac
RC	1 du / 0.5 ac
UR3	1 du / 0.333 ac
UR4	1 du / 0.25 ac
URM24	1 du / 0.0416 ac
URM6	1 du / 0.166 ac

Step 2 – Identify Buildable Areas per Whatcom County Regulations
The second step determines the amount of remaining buildable area within each sub-basin. Coupled with the initial step, the buildable land estimate guides the determination of future land uses within the Birch Bay watershed.

In an effort to identify remaining buildable lands, protected open space and land that is undevelopable for environmental reasons such as the presence of wetlands, streams (or other habitat conservation areas), geologically hazardous areas, or critical aquifer recharge areas as defined by the Whatcom County Code (WCC 16.16 – Critical Areas) are excluded from this category. As part of this analysis buffers were applied to the wetland and riparian areas based on assumed categories of quality. Due to the lack of specific data regarding the condition of the identified wetland habitats, minimum buffer areas were applied as defined by WCC 16.16. Review Appendix B of this report for a detailed description for how wetland and riparian buffer areas were generated for this analysis. The remaining land located outside of critical areas and buffers is assumed to be available for development.

Step 3 – Assess Future Development Patterns (Location & Density)
Building from steps one and two, the third step is to assess locations and patterns of potential residential development within the watershed. This is completed by selecting all parcels with a characterization code that can accommodate future residential growth (Vacant, Undeveloped, Underdeveloped). The potential dwelling unit density for each parcel is then calculated from the buildable areas analysis. The result of these steps is a potential dwelling unit density calculation for each parcel within the watershed. For the purposes of this analysis, these density calculations per parcel are aggregated to the sub-basin scale to determine the potential vulnerability of that sub-basin to potential residential development pressure.

Step 4 – Evaluate changes to Impervious Cover
The fourth and final step for the land use-planning component is to calculate and assess the total impervious areas within the watershed sub-basins. This step is done concurrently with steps two and three to contribute to

understanding the vulnerability of each sub-basin to potential development and to aid in the impact assessment of current development patterns on ecosystem health within the watershed.

For an assessment of current impervious conditions, impervious surface coefficients for each zoning district classification are developed through a spatially derived data merger between the Whatcom County parcel data and data developed by the National Oceanic and Atmospheric Administration (NOAA) through the Coastal Change Analysis Program (C-CAP) (Figure 4). Following a qualitative comparison of other impervious surface analyses performed per land use types for relative accuracy (Nelson and Graham, 2003 and May et al., 1997), the coefficients for each land use are then aggregated to the sub-basin scale to assess current land use intensities for each WAA within the watershed. To develop a potential change in impervious surface density model for the Birch Bay watershed the potential dwelling unit density data is combined with the impervious surface data derived for each land use.

Figure 4: Average Impervious Percentage per Parcel for Each Zoning Type.

Zoning Type*	Average Impervious %	Parcel Count
Heavy Industrial	65.6	11
General Commercial	48.7	28
Light Industrial	27.3	3
Neighborhood Commercial	47.1	10
Rural Residential (10 AC)	19.3	33
Rural Residential (5 AC)	22.4	400
Recreational Commercial	40.9	271
Urban Residential (3/AC)**	38.5	18
Urban Residential (4/AC)	41.6	1684
Urban Residential, Medium Density (6/AC)	40.5	1152
Recreational Open Space	12.9	7

*Zoning district URM24 is not represented in high enough densities to generate average impervious areas.
** UR3 Zoning District is applied to land within City of Blaine jurisdiction based on growth projections and developable area available (City of Blaine, 2006)

REFERENCES

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