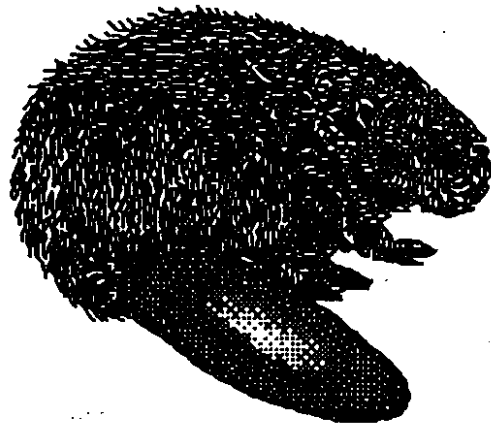


Fanno Creek and Tributaries Conservation Plan

**Volume One: Inventory, Analysis, and Regulations for the
Protection and Restoration of Fish and Wildlife Habitats,
Natural Areas, Water Bodies, and Wetlands
and
Volume Four: Revised Zoning Maps**

**Final Plan As Adopted by the City Council
City of Portland, Oregon**



**Bureau of Planning
Adopted by Ordinance Number 167293, as Amended, on January 19, 1994
Effective January 19, 1994**

**If you need a large-print copy of this report,
Please call 823-7700 (or TDD 823-6868).**

Portland City Council

Vera Katz, Mayor
Earl Blumenauer, Commissioner
Charlie Hales, Commissioner
Gretchen Kafoury, Commissioner
Michael Lindberg, Commissioner

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Fanno Creek and Tributaries Conservation Plan

Volume One: Inventory, Analysis, and Regulations for the Protection and Restoration of Fish and Wildlife Habitats, Natural Areas, Water Bodies, and Wetlands

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January 19, 1994

Substitute Ordinance No. 167293 As Amended

*Protect and Conserve Natural Resources within the Fanno Creek Watershed. (Ordinance: amend Comprehensive Plan, Zoning Maps, and Title 33, Planning and Zoning)

The City of Portland Ordains:

Section 1. The Council finds:

General Findings

1. The Fanno Creek Watershed contains many significant natural resources that are worthy of protection or conservation.
2. Protection and conservation of these resources can help achieve state and federal standards for water quality.
3. Protection and conservation of these resources can also protect public health and safety by directing development away from the portions of the City most prone to flooding or earth movement.

Statewide Goal Findings

4. State law requires that any ordinance adopting, repealing, or amending land use regulations or comprehensive plan policies comply with the Statewide Planning Goals. Because of the limited scope of this ordinance, only a few of these goals apply.
5. Statewide Planning Goal 1 addresses Citizen Involvement. Goal 1 requires citizens be given opportunities to review and influence proposed policies before they are considered in public hearings. This requirement has been met for the reasons stated in the procedural finding below. Statewide Goal 1 also requires that technical data related to energy, natural environment, political, legal, economic, social, and cultural considerations be available at a public location. All these supporting data are in public documents available for inspection at the Portland Planning Bureau. These requirements have been met.
6. Statewide Planning Goal 2 addresses Land Use Planning. Goal 2 requires that site specific ordinances be based on an analysis of alternative implementing measures. This analysis has been done. The implementing measures in Volume 1 of the *Fanno Creek and Tributaries Conservation Plan* include exemptions, standards, and approval criteria. Applicants have a choice of standards or approval criteria for development within 25 feet of significant natural resources.
7. Statewide Planning Goal 5 addresses Open Space, Scenic and Historic Areas, and Natural Resources. This Ordinance address only natural resources. Open space is protected by Chapter 33.100 of the zoning code. No significant cultural resources, or mineral and aggregate resources are known to remain within the Fanno Creek Watershed. SW Fairmount Blvd., and SW Multnomah Blvd. west of SW 45th Ave., are designated scenic resources. Scenic values will be considered as part of environmental reviews within 100 feet of these two corridors. Historic resources

are protected by Chapter 33.222 of the zoning code. Inventory maps identify the location, quantity, and quality of natural resources within the Fanno Creek Watershed Reduced. Simplified versions of these maps are in Volume 2 of the *Fanno Creek and Tributaries Conservation Plan*. Habitat evaluations support the quality determinations depicted on the inventory maps. Copies of these Habitat Evaluation Forms are in Volume 3 of the *Fanno Creek and Tributaries Conservation Plan*. Volume 1 of the *Fanno Creek and Tributaries Conservation Plan* contains an analysis of the economic, social, environmental, and energy consequences of these resources being destroyed by uses allowed by present zoning. Volume 1 contains a similar analysis for decisions to limit and prohibit these conflicting uses. Volume 1 also contains the decisions recommended by the Planning Commission and adopted by Council on April 7, 1993. This alternative is a mixture of destruction, conservation, and protection decisions. The analyses of Volume 1 are supplemented by materials and testimony presented to the Planning Commission. The selected alternative is carried out by Zoning Maps dated April 4, 1992, December 8, 1992, March 9, 1993, March 23, 1993, November 12, 1993, and December 6, 1993. These maps depict environmental conservation and environmental protection zones. Reduced versions of these maps are in Volume 4 of the *Fanno Creek and Tributaries Conservation Plan*. The areas described by the revised zoning maps are smaller than the areas identified as significant natural resources on the inventory maps. These smaller areas either represent decisions to allow some significant natural resources to be destroyed because of the overriding benefits of development, or changes in the location, quality, and quantity of resources identified after publication of the original plan inventory. Environmental Protection zones represent decisions to prohibit conflicting uses while Environmental Conservation zones represent decisions to limit conflicting uses. The policies and regulations in Volume 1 of the *Fanno Creek and Tributaries Conservation Plan* are sufficient to carry out these decisions. These regulations, considered with the new definition of "practicable" and the existing definition of "significant detrimental environmental impact," meet state requirements for clear and objective standards administered in a quasi-judicial setting. In conclusion, the City has developed a program which, as a whole, meets the requirements of Statewide Planning Goal 5.

8. Statewide Planning Goal 6 addresses Air, Water, and Land Resources. After the adoption of the April 7, 1993, ordinance, the Oregon Department of Environmental Quality amended the City of Portland's Clean Water Act compliance schedule to require the inventory and management of riparian areas within the Tualatin Watershed. The *Fanno Creek and Tributaries Conservation Plan* can help fulfill these obligations. The requirements of Goal 6 have been met.
9. Statewide Planning Goal 7 addresses Areas Subject to Natural Disasters and Hazards. Ninety-eight percent of lands within environmental zones are also identified as those most likely to experience natural disasters. Identified disaster include floods, earthquakes, and landslides. Environmental review has the effect of directing development away from hazard areas, and when this is not possible, requiring engineered safeguards. Flood conveyance and soil stability are values considered during environmental reviews. Public health, safety, and welfare will be protected by environmental regulation. Environmental regulation will help prevent public nuisances. The requirements of Goal 7 have been met.

10. Statewide Planning Goal 10 addresses Housing. Lands subject to natural disasters, and lands containing significant natural resources are not part of the City's inventory of lands needed for housing. Nevertheless, the City does allow housing in environmental conservation zones, and in certain cases, does allow the transfer of housing density precluded within environmental protection zones. The overall effect of these regulations is that new housing is matched to the site, rather than having sites extensively modified to match stock building plans. The market response to this regulation is a trend is from speculation to custom housing. The difference in degree reflects both the extent of regulation and the amount of undeveloped or underdeveloped land remaining within the respective resource sites. Environmental regulation increases the cost of housing, in some cases by several thousand dollars. Little affordable housing will be provided in environmental zones. Nevertheless, the Requirements of Goal 10 have been met because the Goal 10 administrative rule excludes all land in environmental zones from the "needed for housing" category.
11. Statewide Planning Goal 11 addresses Public Facilities. This requirement has been met because the regulations in Volume 1 of the *Fanno Creek and Tributaries Conservation Plan* allow will encourage clustered development patterns, that in turn will provide a more efficient, safe, and orderly provision of services.
12. Statewide Planning Goal 12 addresses Transportation. This requirement has been met because the regulations in Volume 1 of the *Fanno Creek and Tributaries Conservation Plan* allow existing transportation facilities to be improved to minimum City standards, and when there are no viable alternatives, allows land to be served by public facilities through environmental protection zones in the Fanno Creek Watershed and other parts of Portland's Southwest Hills. The clustered development patterns encouraged by these regulations will be more supportive of public transit than a dispersed pattern.
13. Statewide Planning Goal 13 addresses Energy. This requirement has been met because the regulations in Volume 1 of the *Fanno Creek and Tributaries Conservation Plan* encourage a clustered development pattern. This pattern supports utility and transportation facilities that will conserve energy.

Comprehensive Plan Findings

14. State law, the Portland Comprehensive Plan, and the City Planning and Zoning Code require that land use regulations comply with comprehensive plan goals and policies. Because of the limited scope of this ordinance only Comprehensive Plan Goals 1, 2, 3, 4, 7, 8, 9, and 11 apply.
15. Goal 1 addresses Metropolitan Coordination. This goal has been met because areas identified as significant in the Metropolitan Greenspaces Inventory are included within the City's inventory of significant natural resources.
16. Goal 2 address Urban Development. Policy 2.8 requires that urban density be limited in forested areas. This policy has been met for the reasons stated above for Statewide Planning Goals 5 and 10.
17. Goal 3 addresses Neighborhoods. This Goal has been met because environmental zoning will help preserve the physical character of neighborhoods. Neighborhoods have been involved in the planning process described in the procedure finding below.

18. Goal 4 addresses Housing. This Goal has been met for the reasons stated in the findings for Statewide Planning Goals 2, 5, 7, and 10 above. The environmental regulations will ensure that housing, if not affordable, will at least be safe to occupy. Environmental zones will provide housing opportunities mainly for persons with incomes above median for the Portland Metropolitan Area. The availability of housing within environmental zones mainly to persons with higher incomes is still consistent with the policy to provide housing "... appropriate to the varied financial capabilities of city residents" because environmental zones constitute only a fraction of the total area of the City. Environmental zones can also provide medium and low income housing, but only with increased levels of public subsidy.
19. Goal 7 addresses Energy. This Goal has been met because environmental zoning will provide a more easily serviced development pattern of clustered housing and open areas. Less energy will be lost in transmission in a clustered pattern than in a homogeneous distribution of allowed housing density throughout the City. Fire wood is a renewable energy source. The protection of forests will constrain this source. This constraint is not contrary to this policy, because of overall energy efficiency is provided by environmental zoning.
20. Goal 8 addresses the Environment. This goal has been met for the reasons stated in the finding for Statewide Planning Goals 5 and 6. Some City Goal 8 policies address natural hazards. These policies have been met for the reasons sated in the finding for Statewide Planning Goal 7.
21. Goal 9 addresses Citizen Involvement. This goal has been met for the reasons stated in the procedure finding and the finding for Statewide Planning Goal 1.
22. Goal 11 addresses Public Facilities. This goal has been met for the reasons stated in the Finding for Statewide Planning Goal 11.

Procedure Findings

23. This ordinance contains amended comprehensive plan policies and land use regulations (at the end of Volume 1 of the *Fanno Creek and Tributaries Conservation Plan*) and amended zoning maps (Volume 4 of the *Fanno Creek and Tributaries Conservation Plan*) which can only be adopted through a legislative procedure. The requirements for a legislative procedure has been met because required notice was provided for the Planning Commission Hearings of October 29, 1991, April 14, 1992, December 8, 1992, March 9, 1993, and March 23, 1993. When the scope of the project was expanded to affect environmental regulation outside the Fanno Creek Watershed, an additional thirty-days notice was provided for these provisions. The Planning Commission recommended adoption on March 23, 1993. The Council's meeting of April 7, 1992, provided the required two weeks between the Commission's recommendation and Council's consideration. More than two weeks notification was provided for the Council's August 4, 1993, November 17, 1993, December 16, 1993, and January 19, 1994 meetings. The City Auditor has also provided required notice of the Council's deliberations.

Post Acknowledgment Findings

24. State post acknowledgment procedures have been met because this Ordinance is part of the Environmental Mapping of the West Hills work described on page 115 of the City of Portland's Proposed Local Review Order adopted by Council Resolution 34523 on March 1, 1989, and described on page two of the Final Periodic Review Order adopted by Council Resolution 35226 on December 12, 1993. Both the Proposed and Final Orders were forwarded to the Oregon Land Conservation and Development Commission. Even though the City had fulfilled its post acknowledgment obligations through its periodic review submittals, a courtesy "Notice of Proposed Adoption" was hand delivered to a representative of the Department of Land Conservation and Development on February 26, 1993. This delivery met the forty-five days advanced notice requirement of state law. The April 7, 1993, Ordinance did not vary in any significant way from the February 26, 1993, Notice of Proposed Adoption. Nevertheless, copies of differences were provided to the Department of Land Conservation and Development, and all persons requesting such changes, on March 26, 1993. Another courtesy "Notice of Proposed Action" was submitted to the Department of Land Conservation and Development on September 16, 1993. This last notice was for the actions described by this ordinance.

Substitute Ordinance No.

NOW, THEREFORE, The Council directs that:

- a. Ordinance No. 166430 of April 7, 1993, as amended, is repealed in its entirety.
- b. Volumes 1, 2, 3, and 4 of the *Fanno Creek and Tributaries Conservation Plan* dated January 19, 1993, are adopted. This adoption has the following effects:
 - i. Amendment of Goal 8, Environment, of the Portland Comprehensive Plan,
 - ii. Amendment of Title 33, Planning and Zoning, by deleting Chapter 430, Environmental Zones, in its entirety and replacing it with a new chapter,
 - iii. Amendment of Chapter 910 of Title 33, Planning and Zoning, by adding two new definitions, and
 - iv. Amendment of the Official Zoning Maps by deleting existing water feature and scenic designations, and by adding new environmental protection and environmental conservation overlay zones depicted on maps dated April 4, 1992, December 8, 1992, March 9, 1993, March 23, 1993, and December 6, 1993.
- c. This ordinance shall apply to permits, limited land use decisions, and zone changes within the meaning and in the manner prescribed by Oregon Revised Statutes 227.178(3).
- d. If any portion of the comprehensive plan, zoning code, or zoning maps amended by this ordinance is held to be invalid or unconstitutional by a court of competent jurisdiction, that portion is to be deemed severed, and in no way affects the remaining portions.

Section 2. The Council declares that an emergency exists because of the need to control development in areas subject to flooding and earth movement. Failure to regulate development during the seasonal rains expected through the winter and spring of 1994 would represent a threat to public health, safety, and welfare; therefore, this Ordinance shall be in full force and effect from and after January 19, 1994, in the manner prescribed by Oregon Revised Statutes 197.623(3).

Passed by the Council, JAN 19 1994

Commissioner Charlie Hales
A Burns
January 7, 1994

Barbara Clark
Auditor of the City of Portland

By

Betta Olson

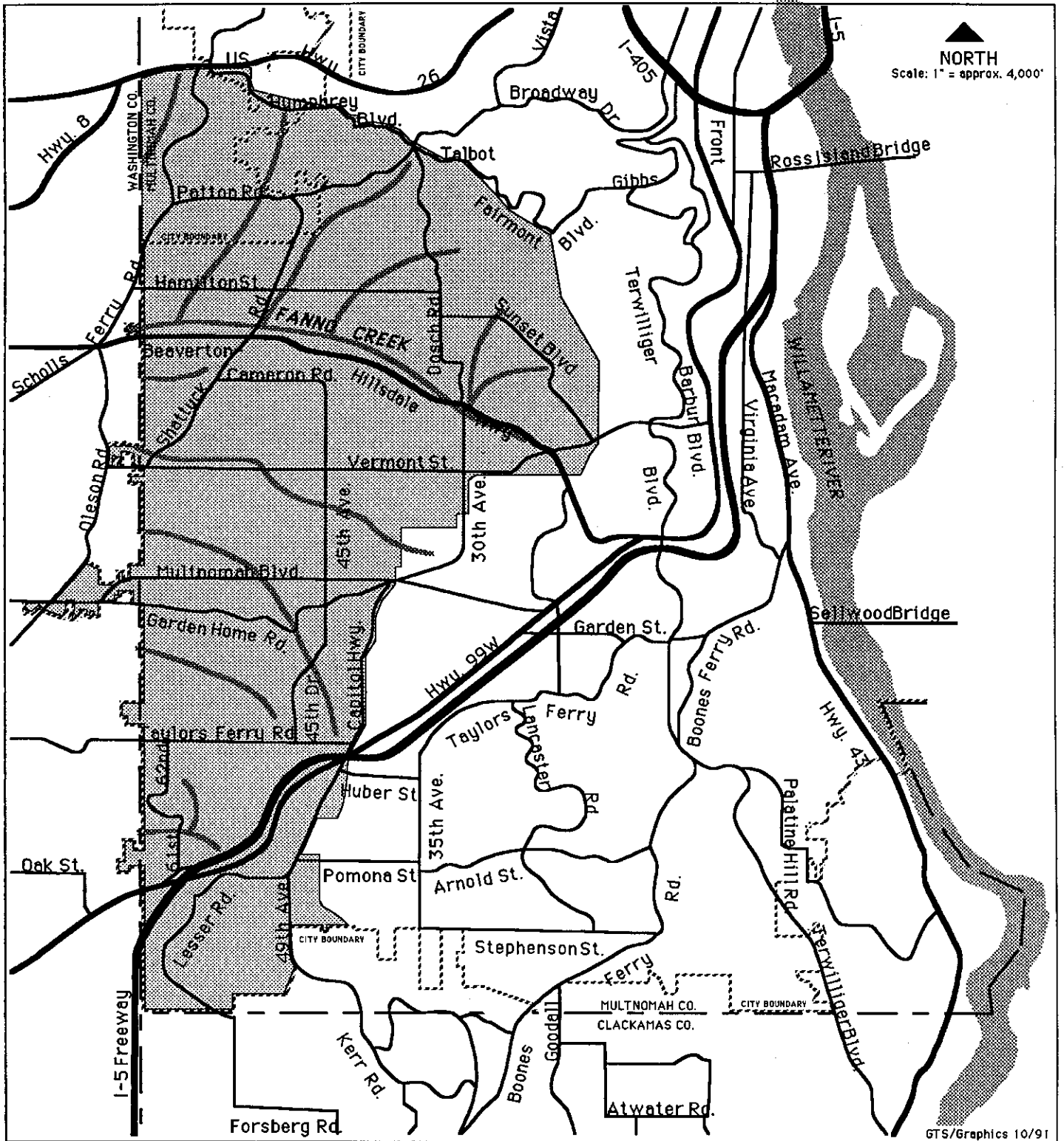
Deputy

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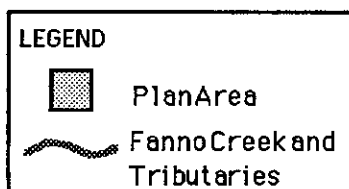
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INTRODUCTION



FANNO CREEK and TRIBUTARIES CONSERVATION PLAN



Purpose of the Plan

The Fanno Creek Plan has the following objectives:

1. To bring the City's comprehensive plan, zoning code, and zoning maps into compliance with State Wide Planning Goal 5;
2. To reduce the threat to public health safety and welfare from erosion, land slides, earthquakes, and flooding;
3. To help achieve compliance with state and federal water quality regulations; and
4. To facilitate development designed to maintain and enhance natural values provided by Fanno Creek and its tributaries.

Organization of the Plan

The Fanno Creek Plan is divided into five volumes. This is the first volume which contains the following six sections:

1. A brief introduction to the Fanno Creek Watershed explaining where it is and its present condition;
2. A detailed inventory of the watershed identifying the location, quantity, and quality of natural areas (the information needed for the designation of resource sites);
3. A description of those uses of the watershed that are both allowed by city zoning, and if allowed to continue, would degrade or destroy natural areas (an identification of conflicting uses);
4. An analysis explaining the relative merits of protecting remaining resources and, in the alternative, allowing development to continue (the economic, environmental, and social consequences);
5. A mixture of preservation, conservation, or development decisions for each resource site (decisions to allow, limit, and prohibit conflicting uses);
6. Regulations needed to carry out each of these decisions; and

Four supplemental volumes containing maps of significant natural resources, habitat evaluation forms, maps of proposed zoning, and maps of existing zoning.

Overview of the Plan Area

The following overview of the Fanno Creek Watershed includes sections on history, topography, geology, soils, climate, hydrology, vegetation, and fish and wildlife.

History

Fanno Creek is named after one of Oregon's earliest settlers, Augustus Fanno, a native of Portland, Maine, who settled in the area of 8300 S.W. Highway 217 in 1847. Augustus, his wife, and young son, crossed the plains from Independence, Missouri, traveled down the Columbia River by flat boat, and arrived in the Oregon City area in 1846. Mrs. Fanno died that year at Linn City, and the next year Augustus settled a 640 acre donation land claim. His claim was on the lowlands along Fanno Creek. His nearest neighbor was five miles away. Native Americans used parts of his claim to pick huckleberries; and with their help, he cleared the dense forest and started an onion farm in the rich bottom land.¹ Augustus married a second time, and died on June, 30, 1884.

The Fanno family farmed portions of the original claim until 1971, when the last 83 acres was offered for sale after some 124 years in the family. The seller, Norman Fanno, recalled in a newspaper interview, that he caught an 18 inch cutthroat trout in the creek when he was a boy. He also remembered being able to hear the falls at Oregon City on a quiet day, and that deer and an occasional cougar crossed the farm in the 1960's.²

The part of the Fanno drainage system between its eastern edge at Hillsdale, and the communities of Multnomah, Maplewood, and Gardenhome to the west, were settled gradually during the late 1800's. The area was heavily forested and wild, without roads or good communication with Portland. Settlers sighted bear and deer frequently. Francis and Caroline Niebur filed for a donation land claim of 320 acres in 1873. Their farm buildings were at the current site of April Hill Park in Maplewood. A history of the Maplewood area compiled in 1976 by Marjorie Hoffman, relates that the Niebur's had no neighbors, and had to carry their provisions over Council Crest from Portland. Early settlers reported finding many arrowheads at about S.W. Fifty-first and Vermont, near the Niebur farm site. The Niebur's related, that like Augustus Fanno; they had frequent and friendly contact with the original inhabitants of the watershed.³

¹The Oregon Journal, July 30, 1937.

²The Oregonian, April 11, 1971.

³History of Oregon, Volume 3: The Pioneer Publishing Company, 1921.

These early settlers were mostly woodsmen, farmers and dairymen. An early dairyman and Portland native, John P. Hoffman, built his house that is still standing at S.W. Fifty-third Avenue and Vermont Street, in the 1880's. He hired Swiss immigrants to help build and operate his dairy farm; but the road from Portland ended at Hillsdale. This made it impossible to transport milk during rainy periods, so he built a plank road. This road, first called Hoffman Road and later Vermont Street, was built to Hillsdale with the help of Chinese laborers. He also employed these laborers in cutting down large fir trees that were burned into charcoal in a pit at S.W. Fifty-third Avenue and Texas Street. He sold the wood to Portland restaurants for cooking fuel.⁴

John Hoffman's son, Frank, was born in Maplewood in 1889 and died there in 1971. He remembered catching trout in Fanno Creek as a boy. He also hunted pheasant, ducks, and deer along the creek bottoms. The settlers depended on the groundwater that feeds the creek for domestic needs. Fanno Creek crossed the Hoffman farm and Frank's father built a windmill near the creek to supply his dairy operation. In 1911 he drilled a well at S.W. Fiftieth Avenue and Custer Street, installed a three-inch wooden main to a 1200 gallon wooden tank at S.W. Fifty-third Avenue and Nevada Street, and thus began Oregon's oldest water company.⁵ Frank Hoffman recalled that the tank usually ran dry about 10:00 a.m. on Monday, wash day. The water company became a municipal corporation in 1919, connected to the Portland system in 1920, and operated as an independent water district until 1964.

One of the earliest families in the Multnomah area, Thomas and Polly Ann Price, settled their 640 acre claim in 1850.⁶ Their claim, which contained the present day Multnomah business district, was heavily wooded. By the turn of the century several large tracts of forests had been cleared for the local dairy industry. This industry grew to 17 dairies at its peak, but Multnomah was still sparsely settled, and contained substantial forested areas. Children from Maplewood and Multnomah walked or rode wagons to West Portland grade school. The school was built between S.W. Forty-first Avenue and Capitol Highway on Taylor's Ferry Road in 1901. The route of the footpath from Maplewood to the school was marked by rags tied to trees so the children could find their way in the dense forest.

The pace of settlement of the Fanno Creek Watershed increased with development of the Southern Pacific railway in the late 1800's, and the Oregon & Electric railway in the early 1900's. Communities with stations on these interurban passenger lines still bear the names of the stops, and the location of the old rights-of-way can still be seen on the city zoning maps.

⁴Hoffman, Marjorie E., Maplewood Centennial 1875-1975, 1976

⁵Portland Reporter, March 16, 1964.

⁶Davis, Marguerite Norris, and Tully, Cecil R., The Building of a Community, 1976.

Construction of the first twenty miles of the Southern Pacific railroad line to Hillsboro was completed in December of 1871.⁷ The route followed Fourth Street from downtown Portland, then along Barbur Boulevard to Bertha,⁸ next along the south side of Beaverton-Hillsdale Highway to Beaverton, then from Hillsboro to Forest Grove. The Southern Pacific station at Hillsdale was originally named Summit, because it was at the divide between the Tualatin River⁹ and Willamette River drainages. The railroad renamed the station Bertha about 1890 rejecting its original name because of other places in the state named "Summit" and wishing to avoid confusion of the names Hillsdale and Hillsboro.¹⁰

The route of the Oregon Electric originated at S.W. Jefferson and Front Street and followed the Interstate Five alignment up out of Portland, along Multnomah Boulevard through Maplewood to Garden Home, where it split into Salem and Forest Grove branches. Most of the 49,000 mile system was built between 1903 and 1915, with passenger revenues reaching a peak of \$891,000 in 1920.¹¹ Multnomah received its name, and many new residents from the opening of the Oregon Electric railway station in 1908. The station was located at S.W. Thirty-fifth Avenue and Capitol Highway, and was named "Multnomah" by the railroad company. The Oregon Electric Company had a policy of giving the names of famous Native Americans to its new stations.

Multnomah Station, coupled with the paving of Slavin Road¹², in 1903, opened up the Fanno Creek Watershed to more rapid development. Multnomah residents could travel in comfort to S.W. Broadway and Washington Street in 15 minutes on the rail line. People looking for a little elbow room and the country life could move to Multnomah and easily commute to their jobs downtown. The population around Multnomah, Maplewood, Hillsdale, and West Portland Park had increased to 2,000 by 1915 when the Portland General Electric Company installed electricity to the area. In 1926 the *Oregonian* described growth in the Multnomah area as "phenomenal" as large numbers of houses were being built for speculation. These houses were generally well built and sold for an average price of \$3,500.¹³

⁷Southern Pacific Bulletin, January, 1930.

⁸Bertha is now called Hillsdale.

⁹Fanno Creek is a tributary of the Tualatin River.

¹⁰McArthur, Lewis A., Oregon Geographic Names: Western Imprints.

¹¹"Oregon Electric Railway", Souvenir of Excursion, October 23, 1955.

¹²Slavin Road is now called Capitol Highway

¹³The Oregonian, May 16, 1926.

The Southern Pacific lines began electrification in 1912, becoming the Red Electric trains. It was on this line in May of 1920 that there was a collision between two commuter trains at Bertha. This collision killed nine people and injured 101 more. The last train ran in July of 1929, after which Southern Pacific replaced interurban rail passenger service with electric busses.¹⁴ The rapid improvement of roads and the advent of more affordable automobiles reduced rail travel. By the last full-year of inter-urban operations in 1932, Oregon Electric passenger revenue had decreased to \$17,313.

The major automobile route through the Fanno Creek Watershed is Beaverton-Hillsdale Highway. This Highway follows the upper main-stem of Fanno Creek to the Multnomah/Washington County line where the creek crosses under the Highway in a long culvert. The road was named Bertha-Beaverton in 1917 when it was an unpaved Multnomah County road. In 1920 the State Highway Department loaned the Multnomah County the funds to pave the road to the Washington County line.¹⁵

Topography

Fanno Creek drains the southwest portion of the Tualatin Mountains. The highest part of the Fanno Creek basin is 1,060 feet above sea level at Council Crest. The upper portion of the Watershed contains streams in deep ravines. Some of the upper streams drop more than 400 feet in elevation per mile traveled. Fanno Creek and its tributaries flow west as they leave the Portland City Limits. All creek elevations are less than 300 feet at the city limits.

Geology

The Fanno Creek Watershed is on the southeast slope of the Tualatin Mountains. In Portland these mountains are commonly known as the West Hills. They are composed mostly of Columbia River Basalt. The mountains contain remnant volcanoes, and these are composed of Boring Basalt. Basalt is an igneous rock that begins as lava and fractures as it cools. It usually has a medium gray to almost black color. When it weathers, the surface can turn brown and red. This color is a crust of iron and manganese oxides. The inside of the rock will still be black. In a tropical climate basalt can break down into a red clay called laterite. The spot on the globe where Portland is now was enjoying a tropical-like climate 50,000 years ago. Much Columbia River Basalt was exposed during this time. This explains why patches of brown and red clay are common in the West Hills.

¹⁴Hedene, Phil, The Red Electrics of Portland, Oregon: Interurbans, 1949.

¹⁵Report of the Oregon State Highway Commission, 1919-1920.

Red, brown, and black basalt flows are exposed in ravines. In other places the basalt is covered by about 25 feet of wind deposited silt. Because basalt fractures when it cools, it stores water in honey-combed shaped spaces between the rock. Underground streams flowing through these cracks are called aquifers. This is why springs are common in areas of exposed basalt. Fractures and faults in the West Hills are also identified as severe earthquake hazards. Soil that is saturated, but not consolidated, amplifies the motion of earthquakes.

Soils

Fanno Creek watershed soils are mostly silts and clays. The United States Soil Conservation Service has identified five soil types (Cascade, Cornelius, Delena, Goble, and Saum) in the watershed. Prior to urban development, almost 95 percent of Portland's portion of the Fanno Creek Watershed was composed of Cascade Silt-loam. This is a wind-deposited soil that erodes easily and does not soak-up storm water very quickly. This top soil is over a harder layer of soil called a "fragipan." Very little water can soak down through this fragipan; plant roots also have a hard time growing through this layer. When it rains, the top two to five feet of soil saturate because water can penetrate no lower. This situation causes aquifers to perch on fragipans during the winter. This is a naturally occurring but dangerous situation. Erosion potential is high; there is a lot of storm water run-off, and land slides result if vegetation is removed from slopes. In the steep headwaters of Fanno Creek, forests hold soil to the sides of the hills. In fully vegetated sites, there is still a high natural rate of soil erosion. This rate is about three tons, per acre, per year.

Since Portland contains almost all the steep headwaters of Fanno Creek, the City is the only place where water runs fast enough to flush eroding soil from gravel stream beds at a rate faster than the natural rate of erosion can silt them up. Most of Fanno Creek has, and has always had, a mud bottom.

Climate

The Fanno Creek Watershed, like the rest of Portland, enjoys mild wet winters and cool dry summers. The climate results from Pacific Maritime air affected alternately by the warming and cooling Japan and the Humbolt Currents. In short, for the latitude, climate is warmer than usual in the winter (average range of 25° to 45°F), and cooler in the summer (average range of 70° to 90°F). Photoperiod (length of darkness at night versus light during the day) is typical of temperate climates with summer daylight much brighter and longer than in the winter. This makes for a March to November growing season.

The Fanno Creek Watershed gets about 50 inches of precipitation (98% rain and 2% snow) per year. A little more than the official measuring station at the Portland Airport that records 45 inches per year. Almost all (88%) this rain falls between October to May, with half the annual total falling in November, December, and January.

Hydrology

Fanno Creek and many of its tributaries originate in southwest Portland. The main-stem begins near Wilson High School and flows along the north side of S.W. Beaverton-Hillsdale Highway. This main-stem is supplemented by several small streams in deep ravines flowing from the north and east. Small creeks flow in underground culverts through fills in S.W. Hewett, Patton, Hamilton, Scholls Ferry, Shattuck, and Dosch Roads. Four other small streams, all east of S.W. Forty-fifth Avenue and north of S.W. Multnomah Boulevard, flow to the north, disappear in culverts under Beaverton-Hillsdale Highway; they then reappear, and join the main-stem slightly north of the highway. The supplemented main-stem of Fanno Creek drains 1,920 acres within Portland's City Limits.

Another set of Fanno Creek tributaries, all south of S.W. Beaverton-Hillsdale Highway, flow to the west where they join the main-stem of Fanno Creek beyond the Portland City Limits. Some of these tributaries flow parallel to S.W. Pendelton, Vermont, and Canby Streets. These tributaries are in culverts crossing under Taylor's Ferry Road, Multnomah Boulevard, and Forty-fifth Avenue. The Woods Creek and South Fork Ash Creek watersheds include some land south and east of Interstate 5. Another small watershed is east of Interstate 5 and west of the Portland Community College's Sylvania Campus. The 515 acre area between the Community College and the Interstate-5 Freeway appears to be the only part of the Fanno Creek Watershed that does not have a creek that flows all year.

These southern tributaries drain the following areas within Portland's City Limits: Pendelton Tributary, 246 acres; Vermont Tributary, 641 acres; Multnomah Tributary (called Woods Creek in its upper reaches), 596 acres; North Fork of Ash Creek, 341 acres; and South Fork of Ash Creek, 397 acres. Fanno Creek does not flow directly to the Willamette River. It flows west and south through Tigard before joining the Tualatin River near the Unified Sewage Agency's treatment plant outfall at Durham.

There has not been a 100 year flood since the Fanno Creek watershed has become urban. Significant flooding did occur in December of 1977, putting portions of S.W. Fifty-sixth, Sixtieth, Olsen Road, and Beaverton-Hillsdale Highway under water. Urbanization has made severe flooding more likely. Some stream segments flow to culverts and pipes that are too small to pass a large flood. There are more than 50 acres of the Fanno Creek Watershed in

the 100 year flood plain, and property could be submerged during a large flood. A benefit of urbanization is those small tributaries of Fanno Creek, which would usually dry up in the summer, are now perennial. Summer flows are the result of municipal water service. This service has the effect of importing Bull Run water to Fanno Creek through drain fields and lawn sprinklers. The added water is good for fish and wildlife.

Vegetation

The Fanno creek watershed is in a transition area between the *Tsuga heterophylla* (Western Hemlock) and Willamette Valley vegetation zones. Although western hemlock is the theoretical dominant species in the first zone, Douglas fir, western red cedar, or grand fir are just as likely to dominate mature stands. Immature stands have a great deal of red alder and big-leaf maple. The characteristic understory plant is the sword fern. This zone contains the headwaters of Fanno Creek.

The Willamette Valley zone begins where Fanno Creek flattens out into a more slowly moving stream. This zone includes Oregon white oak, mixed conifers, black cottonwood, willows, alder, and grasslands. Native Americans preferred grassland environments to forest, and would set fire to forests to reestablish grasslands. Early settlers continued the practice. A few thousand years of prehistoric management makes it difficult to say what a "natural" flat-land Fanno Creek environment would be. Logging, pasturing, and urbanization are more recent disturbances to the environment.

This plan compiles information on plant communities and successional patterns from several sources. Information on vegetation types, distribution, and resource values was gathered through aerial photo-interpretation and on-site reconnaissance. Field surveys were conducted throughout the study area from 1991 to 1993. Current scientific literature on the subject was consulted during this time, with primary sources including *Natural Vegetation of Oregon and Washington* (Franklin and Dyrness 1973), *Flora of the Pacific Northwest* (Hitchcock and Cronquist 1973), *Forest Park--One City's Wilderness: Its Wildlife and Habitat Interrelationships* (Houle 1982) and *Portland Bureau of Planning Goal Five Study: West Hills* (Lev 1986).

Many hillsides within the Fanno Creek Watershed are clothed by coniferous forest of the *Tsuga heterophylla* (western hemlock) vegetation zone.¹⁶ This zone extends throughout the wet, mild, maritime climate of the western portions British Columbia, Washington, and Oregon. A vegetation zone, as defined by Franklin and Dyrness (1973), delineates a region of "essentially uniform macroclimatic conditions with similar moisture and temperature gradients where one plant association predominates." The lowlands next to

¹⁶Evidence of historic vegetation types is presented in Houle (1982) and Munger (1960).

the forest are part of the more prairie-like Willamette Valley Zone. Emergent, scrub-shrub and forested wetland plants grow along some of the creeks and in the palustrine wetlands that occur within the study area.

Western hemlock and western red cedar (*Thuja plicata*) are considered climax species within the Western Hemlock Zone because of their potential to dominate mature stands. The subclimax Douglas fir (*Pseudotsuga menziesii*), however, tends to dominate large areas within this region. Historically, Douglas fir has dominated forest regeneration over much of the zone in the last 150 years (Munger 1930, 1940).

The expected plant species of a Western hemlock forest do cover many hillsides within the Fanno Creek Watershed, but two hardwood trees, bigleaf maple and red alder, are more widely established than typical. The overabundance of these hardwoods is result of repeated disturbances caused by logging, brush fires, and urbanization. Over time, these events have depleted soil nutrients. The depletion of nutrients, coupled with the depletion of mycorrhizal fungi, which help to process nutrients for plant uptake and are particularly important to conifers, has given the hardwoods an edge over the firs, cedars, and hemlocks. Pioneer species such as red alder,¹⁷ commonly found only in riparian areas, quickly colonize these disturbed areas and are now widely established on the upland slopes. Thus, past disturbances have strongly influenced the composition of the plant communities in the Fanno Creek Watershed.

The *Tsuga heterophylla* with *Polystichum munitum* (Western hemlock with sword fern) association generally characterizes the herb-rich community found in the Fanno Creek Watershed forests.¹⁸ Overstory species of this association typically include Douglas fir, western red cedar, grand fir, and western hemlock. The understory is dominated by a lush growth of herb species including sword fern, wild ginger, inside-out flower, Oregon oxalis, trillium, and Smith's fairybells. Understory shrubs include the following: red huckleberry, Oregon grape, vine maple, red elderberry, wood rose, and salmonberry. (Franklin and Dyrness 1973:58)

¹⁷Red alder helps to heal degraded land by replenishing the soil with nutrients: they can provide 40-150 kg/hectare of nitrogen per year. Alders also colonize sites that are plagued by laminated root rot and facilitate regeneration of the pre-existing plant community. Recent studies have shown that alders serve as hosts to mycorrhizal fungi, the same fungi which colonize Douglas fir roots, process nutrients and enable the trees to grow (Norse 1990).

¹⁸Related West Hills plant associations include *Tsuga heterophylla/Berberis nervosa/Polystichum munitum*, *Tsuga heterophylla/Athyrium filix-femina*, *Tsuga heterophylla/Tiarella trifoliata*, *Tsuga heterophylla/Holodiscus discolor*, and *Tsuga heterophylla/Gaultheria shallon*.

Early observations of Portland's forests point to the dynamic pattern of successional stages active within the forest community over the past two centuries. The predominantly old growth coniferous forest that William Clark, of Lewis and Clark, recorded in 1806 has been transformed through logging and fire into a younger, mixed hardwood and coniferous forest (Munger 1960). Despite these disturbances, signs of a returning Western hemlock climax forest are widely apparent. The forest types occurring in the Fanno Creek Watershed may be viewed as a sequence of successional stages of forest regeneration following logging and fire. These stages closely follow those of the Western Hemlock Zone as described by Franklin and Dyrness (1973) and Hall (1980). Six distinct successional stages are evident on forested slopes; their patchwork distribution reflects the location, degree and chronology of past disturbances.

Houle (1982) describes the following stages for West Hills forest succession: Grass-forb, Shrub, Hardwood with young conifer, Hardwood topped by conifer, Mid-aged conifer, and Old growth vegetation types (see Figure 1 below).

The grass-forb stage contains low, herbaceous plants such as fireweed, bracken fern, and Canadian thistle. These plants are the first colonizers of an area after removal of vegetation. This stage lasts approximately two to five years and occurs along roads, power-line right-of-ways, and in open fields throughout the Fanno Creek Watershed.

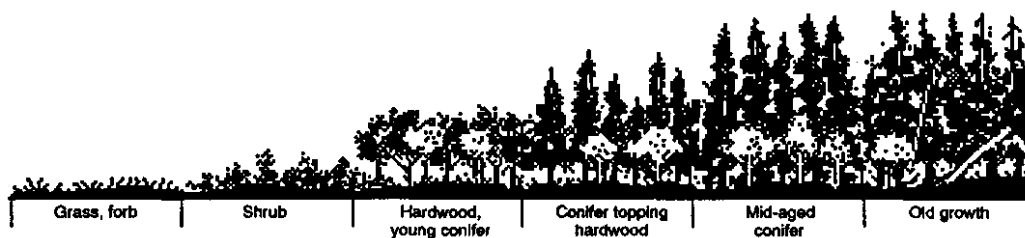


Figure 1. Stages of Fanno Creek Watershed Forest Succession

The shrub stage often develops as a thicket of such species as thimbleberry, salmonberry, blackberry, red huckleberry, salal and Indian plum. This stage typically lasts between three and ten years, but will persist as long as 30 years if conifer regeneration is delayed.

The hardwood with young conifer stage is a young, vigorous broadleaf forest predominantly made up of red alder and big-leaf maple, though it often includes bitter cherry, black cottonwood and juvenile Douglas fir. Understory species include sword fern, Oregon grape, and red elderberry. This young, second growth forest usually occurs ten to 35 years following a disturbance.

The fourth stage of succession, conifer topping hardwood, is still a vigorous, though now mixed, hardwood and conifer forest. While the alders and maples approach 100 feet in height during this stage, conifers, primarily Douglas fir, break through the hardwood canopy and grow to heights of 180 feet or more. Characteristic conifer species also include young western red cedar, grand fir, and western hemlock. This mixed stage of second growth forest follows 30 to 80 years after disturbance, and is the most widely distributed vegetation type on forested slopes within the Fanno Creek Watershed.

The next successional stage, mid-aged conifer, is dominated by Douglas fir. Young, shade-tolerant western hemlock, western red cedar, grand fir, and pacific yew are gradually making their way up through the understory, while some of the older hardwoods such as alder and cherry, are beginning to fall to the forest floor. Sword fern, salal, Oregon grape, red huckleberry, and vine maple thrive as the older trees begin to fall. This stage develops between 80 to 250 years after the last major disturbance. Several areas within the Fanno Creek Watershed display these characteristics.

If the forest is left undisturbed following the mid-aged conifer stage, it progresses into an old growth forest community. The *old growth* stage is self-perpetuating and will continue indefinitely unless fire, logging or other disturbances set back the forest to an earlier stage of succession. Though Western hemlock and Western red cedar are climax species, long-lived serial species can remain a component of the community for several hundred years. Several areas within the deep ravines of the Fanno Creek Watershed are beginning to develop old growth characteristics. These characteristics include the presence of large snags and downed logs in various stages of decay.

Native forests represent a unique urban amenity. Forested hillsides in the Fanno Creek Watershed provide fine examples of the Pacific Northwest's Western hemlock forest community, which is unique among all temperate forests in the world (Waring and Franklin 1979).¹⁹ Forested hillsides also help to define Portland as a place, and contribute to the identity of the region.

Forests within the Fanno Creek Watershed are home to several plant species with newly discovered uses. The pacific yew (*Taxus brevifolia*), for example, is an exceptionally slow growing tree species that is abundant only in climax forests of the Pacific Northwest. In recent years, a cancer-fighting substance known as "taxol" was discovered in the bark of the yew. Taxol has proven effective in fighting ovarian cancer²⁰ and early results indicate that the

¹⁹The western hemlock forest of the Pacific Northwest has the greatest biomass accumulation of any plant community in the temperate zone and in it are found the largest and (usually) longest lived species of conifers within the zone.

²⁰Ovarian cancer kills 12,400 women annually in the United States (High Country News 11/19/90).

substance may also prove effective for treating leukemia and colon, lung, mammary, prostate, and pancreatic cancers (Wood 1990, Norse 1990).

Fish and Wildlife

The Fanno Creek Watershed is used by about a hundred bird species, several small and medium sized mammals, and a few fish species. Commonly seen mammals include beaver, raccoon, opossum, spotted skunk, Douglas Squirrel, and Townsend's Chipmunk. Occasional visitors include black-tail deer and coyote. There was one coyote sighting in 1993. The last elk sighting was in 1992, the last black bear sighting was about ten years ago, and the last cougar sighting was about 30 years ago.

Fanno Creek contains Cutthroat trout (*Oncorhynchus clarki*). There are different types of these trout, and each type has a distinct life cycle. Some live in the ocean and spawn in streams; others live in lakes and spawn in streams; a third kind lives in large streams and spawns in small streams, and the last kind spends its entire life in small streams. This last kind doesn't grow very large (about seven inches). These small fish are full year residents of Fanno Creek and may only migrate a few hundred yards in an entire life time. Ocean and lake dwelling cutthroat do not visit Fanno Creek, but an occasional large trout will swim up the Willamette and Tualatin Rivers to spawn in Fanno Creek. The spawning beds for both these cutthroat types are in the faster, gravel-bottomed headwaters. The portion of the watershed within Portland contains almost all known spawning areas. This is because the small hillside tributaries north of Beaverton-Hillsdale Highway, and the Woods Creek tributary south of Beaverton-Hillsdale Highway, have gravel bottoms. Topography flattens out as the creeks near the Washington County line. These flat-land creeks have mud bottoms that are not suitable for spawning, but they are very important for rearing and feeding, especially during seasonal low water and droughts. Other fish species observed include sculpins, dace, and mosquito fish.

The Piliated woodpecker (*Dryocopus pileatus*) is a species dependent on standing dead and dying trees in older forests. The bird is a cavity nester, and is disappearing from rural areas because of timber harvest and the use of agricultural chemicals. The woodpecker is doing surprisingly well in some urban areas, and can be observed in the Fanno Creek Watershed. Protection of older forests in urban areas is an important conservation strategy for the survival of this species.

Different species use different habitat during different stages of their life cycle. These stages include mating, feeding, and the rearing of young. The vegetative structure of the habitat (downed logs, standing snags, and live herbs, shrubs, and trees) is a key factor in determining the distribution and abundance of wildlife (Thomas 1979). Each stage of forest succession in the

Fanno Creek Watershed has its own specific structure. Most species have known preferences for structural components found in distinct successional stages and use these vegetative types to meet all or part of their life cycle requirements (Maser and Thomas 1978; Harris 1984).

The balanced relationship between the Fanno Creek Watershed's geologic formations, soils, groundwater, and surface water is perpetuated by the extensive canopy cover and root system of the forest which shelters and stabilizes the hillside slopes. Activities that disturb this fragile relationship can substantially degrade resource values by causing landslides, flooding, erosion, and sedimentation. Groundwater and precipitation feed the many creeks within the Fanno Creek Watershed. These creeks provide habitat for fish, amphibians, and other aquatic organisms and, which in turn, provide a source of food for terrestrial wildlife. These creeks are also the most important source of water for terrestrial wildlife. The mosaic of Fanno Creek Watershed forest types provides a range of habitat for a diverse population of indigenous wildlife. These interacting and interdependent elements play vital roles in protecting the balance, health, and vitality of the Fanno Creek Watershed forest and of watershed ecology as a whole.

Authorities Guiding the Plan

Several authorities have guided the preparation of this plan. They include state, federal, and local authorities. Some of these authorities are advisory and others are mandatory.

Statewide Planning Goal 5 and Administrative Rule

Statewide Planning Goal 5 requires all city and county governments to, "Conserve open space and protect natural and scenic resources." The Oregon Land Conservation and Development Commission adopted this Goal in 1974, and provided further guidance for carrying it out in 1981. Between 1974 and 1981 the City enacted a variety of land use regulations to meet Statewide Planning Goal 5. The State agreed that these regulations were sufficient, and approved the Portland Comprehensive Plan on May 1, 1981.

The State did not draft an administrative rule describing how local governments should apply Statewide Planning Goal 5 until after the Portland Plan had been submitted for approval. Land Conservation and Development Commission records show that the Goal 5 Administrative Rule was adopted during the same meeting in which the Portland Plan received state approval. The rule was not, however, applied to the Portland Plan because the rule was not effective until it was filed with the Secretary of State's office on May 8, 1981. The new rule established substantive and procedural requirements for the protection of resources that the City of Portland had not followed in formulating its Comprehensive Plan. Inventory methods, forms of analysis, and protective measures were the most obvious examples. The Oregon

Legislative Assembly also enacted legislation in 1981 authorizing periodic review of all previously approved land use plans. The combined effect of the 1981 legislation and Goal 5 Administrative Rule was a requirement that the City bring its Comprehensive Plan, land use regulations, and zoning maps into compliance with the new rule before its first periodic review. The Portland City Council adopted ordinances in 1982 and 1988 correcting most deficiencies relating to Statewide Planning Goal 5 requirements, but the Goal 5 Administrative Rule has never been applied to natural resources in the Fanno Creek Watershed. Fanno Creek natural resources must, therefore, be identified, and in certain cases protected, before the State will allow the City to complete periodic review. The following paragraphs outline the content of the Fanno Creek Plan and describe process required by the 1981 administrative rule to identify, evaluate, and protect natural resources.

Natural resources are identified in the inventory section of this plan. The inventory describes the location and size of each resource site in the Fanno Creek Watershed. This section compares the amounts of resources present on each site, and provides information needed to rank the quality of each site. The location of resource sites is shown on maps.²¹ Resource quantity was determined by inventorying each site in several places, and noting the type and abundance of resources. There are several inventory sites for each resource site. The quality of a site was determined by comparing its resource values with all other sites of the same resource category. Resource values were identified through field surveys, published national wetland inventories, and aerial photography. The photographs are false color infrared images at the same scale as the official city zoning maps; one inch representing 200 feet. The photographs were taken on June 11, 1989. Comparisons are made with all Fanno Creek Watershed sites. The only portions of the Fanno Creek Watershed excluded from the inventory were seven portions of the Portland City Limits extending west of the Willamette Meridian²². The small size and discontinuous nature of these portions made them insignificant. All other portions of the watershed within the City Limits are significant and are included within a resource site. Enough information was collected for each resource site to perform analyses required by state law.

²¹These maps contain hand colored resource designations at a scale of one inch representing 200 feet. These maps are dated October 18, 1991. Reduced blank-and-white versions of these maps were included as Appendix Two of the April 4, 1992, draft of this plan. Because of the expense of reproduction, they have not been reprinted with this draft.

²²This meridian is the Multnomah/Washington County line. This line is often S.W. Sixty-fifth Avenue.

The next section of this plan is an identification of all allowed uses in the Fanno Creek Watershed. This identification pays particular attention uses allowed by existing zoning, which if allowed to continue, would degrade or destroy natural resources. The Goal 5 Administrative Rule calls these uses, "Conflicting Uses."

An evaluation section follows. This evaluation describes and analyzes the economic, social, energy, and environmental consequences of two possible futures. One future is the degradation and destruction of resources by conflicting uses. The other possibility is protection of known resources by prohibiting conflicting uses. The purpose of the analyses is to weigh potential harm to resources against expected benefits of continued development. Effects on both resources and uses are described.

Following the inventory, identification of conflicting uses, and analysis is a section describing decisions. Decisions are made for each resource site. Decisions can be of one of three kinds: protection of the site by prohibiting conflicting uses; conservation of the site by limiting conflicting uses; or destruction of the site by allowing conflicting uses.

Decisions to limit or prohibit conflicting uses require regulations. These regulations comprise the final section of this conservation plan. Regulations can be written to prohibit conflicting uses in resource sites and in buffer areas surrounding resource sites. The Goal 5 Administrative Rule provides for the adoption of regulations when an analysis demonstrates the following: that existing zoning is not adequate to protect a resource, and that a local government has reasons to believe that a resource is more important than benefits expected from continuing the conflicting uses. New zoning can also be enacted to limit, but not prohibit, conflicting uses. The rule provides for this decision when an analysis demonstrates that existing zoning is not adequate to protect a resource, but a local government has reasons to believe that both the conflicting use and the resource are important. Decisions can also be made to leave in place existing zoning in place; even though this zoning is not adequate to protect a known resource. The rule provides for this decision when a local government has reasons to believe that an expected benefit of allowing a conflicting use is more important than a harmed resource.

This plan also examines conflicting uses for cumulative effects on the entire Fanno Creek Watershed and effects that may extend between or beyond the City's designated resource sites. Many regulations are designed to preserve watershed functions as well as to protect specific resources within specific resource sites. Examples of protected functions include flood conveyance and erosion control. The adequacy of site specific and general regulations was determined by comparing the restrictions and prohibitions to be established by this plan against the requirements of state and federal law. Individual

resources of the same type were examined for their contribution to a resource category as a whole. In situations where a resource of moderate importance was near a similar resource of high importance, proximity often justified the protection of both resources. Similar situations arose when clustered or continuous resources of only moderate importance comprised a functional unit of high importance. Uses with widespread benefits were allowed whenever harm was limited to resources of only moderate importance. All of these factors were considered in the Fanno Creek Plan. This Plan is the City of Portland's program to achieve the purpose of Statewide Planning Goal 5.

Other Statewide Planning Goals

Goal 5 is only one of nineteen Statewide Planning Goals. Ten other goals also apply to this plan. Two of the applicable goals establish a decision making process. These are Goal 1, Citizen Involvement, and Goal 2, Land Use Planning. These mandated procedures were applied during the preparation, review, and presentation of the various drafts of this plan.

Three of the applicable Statewide Planning Goals have objectives that are fully compatible with Goal 5. They are Goal 6 - Air, Water, and Land Resources; Goal 7, Areas Subject to Natural Disasters and Hazards; and Goal 13, Energy Conservation. The comprehensive plan and land use regulation amendments recommended by this plan are designed to carry out the purposes of these goals as well as those of Goal 5. The benefits of avoiding pollution, disasters, and hazards; and of conserving energy are described in the analyses for each resource site.

Five of the applicable Statewide Planning Goals address uses which can be "conflicting uses" within the meaning of the Goal 5 Administrative Rule. These are Goal 8, Recreational Needs; Goal 9, Economic Development, Goal 10, Housing; Goal 11, Public Facilities and Services; and Goal 12, Transportation. The effects of providing these uses in the same locations as significant natural resources are described in the analyses for each resource site.

Statewide Planning Goals inapplicable to this plan include Goal 3, Agricultural Lands, and Goal 4, Forest Lands. These Goals apply only to lands outside urban growth boundaries. Since this plan does not amend the Metropolitan Urban Growth Boundary, Goal 14, Urbanization, is also inapplicable. Goals 15 through 19 are inapplicable because they address resources that do not exist in the Fanno Creek Watershed (Willamette River Greenway, Estuarine Resources, Coastal Shorelands, Beaches and Dunes, and Ocean Resources).

Portland Comprehensive Plan Goal 8 - Environment

The purpose of Portland's Environment Goal is, "To maintain and improve the quality of Portland's air, water and land resources and protect neighborhoods and business centers from detrimental noise pollution." The policies and objectives of this goal generally meet or exceed the requirements of the Statewide Planning Goals 5.

Ordinances adopted through 1993 have added new Goal 8 policies controlling development in groundwater areas, drainage ways, natural areas, scenic areas, wetlands, riparian areas, water bodies, uplands, wildlife habitats, aggregate sites, and in areas affected by noise and radio frequency emissions. These ordinances also established new Goal 8 objectives. These objectives include controlling hazardous substances; conserving aquifers, drainage ways, wetlands, water bodies, riparian areas, and fish and wildlife habitat; prioritizing properties for public acquisition; coordinating City regulations with the regulations of state, federal, and other affected local governments; avoiding harm to natural resources; mitigating unavoidable harm to natural resources; maintaining vegetative cover; improving water quality; and preventing soil erosion and stormwater flooding. Each of these new policies and objectives is acknowledged as complying with Statewide Planning Goal 5.

Other Portland Comprehensive Plan Goals

There are ten Portland Comprehensive Plan goals besides the City environment goal. These goals address metropolitan coordination, urban development, neighborhoods, housing, economic development, transportation, energy, citizen involvement, plan review and administration, and public facilities. As with the Statewide Planning Goals, the required procedures were addressed in the preparation, review, and presentation of this plan.

Relation to Other Goal 5 Studies

The City has completed several Goal 5 studies. These completed studies, and their relationship to this plan, are described below.

Mineral and Aggregate Sites

Mineral and aggregate resources in the Portland metropolitan area are identified in the 1988 *Mineral and Aggregate Resources Inventory*. This document, together with amendments to the Comprehensive Plan Policies and Zoning Code adopted in 1982, satisfies Statewide Planning Goal 5 requirements for mineral and aggregate resources. The Bureau of Planning reviewed information collected from the State Department of Geology and Mineral Industries and the *Mineral and Aggregate Resources Inventory*, and determined that there were no significant mineral and aggregate sites within

the Fanno Creek Watershed. This inventory is acknowledged as complying with statewide Planning Goal 5.

Scenic Resources

City Council adopted the *Scenic Resources Protection Plan* on March 20, 1991. The plan preserves significant scenic resources. The plan contains policies, land use regulations, and zoning maps that protect and enhance scenic resources. This plan is acknowledged as complying with Statewide Planning Goal 5.

The *Scenic Resources Protection Plan* identifies two scenic corridors that within the boundaries of the *Fanno Creek and Tributaries Conservation Plan*. These are S.W. Fairmount Boulevard and the portion of S.W. Multnomah Boulevard west of S.W. Forty-fifth Ave.

A scenic corridor is a linear resource that may include streets, bikeways, trails or waterways (rivers, creeks, sloughs) through parks, natural areas, or urban areas. The corridor may include scenic views along it, but may also be valued for its intrinsic scenic qualities such as a winding road through a wooded area. All development and vegetation within a scenic corridor are subject to special regulations. A scenic corridor preserves and enhances linear scenic character, and where possible, provides scenic vistas. This is accomplished by limiting the length of buildings, preventing development in side setbacks, screening mechanical equipment, and restricting signs.

The City's acknowledged land use regulations provide that when an environmental zone has been applied at the location of a designated scenic resource, the scenic designation is removed, but the environmental review must include consideration of the scenic qualities of the resource as identified in *Scenic Resources Protection Plan*.²³ The analyses of the *Scenic Resources Protection Plan* are not repeated in the analyses of this plan.

Historic Resources

The location and quality of several historic resources in the Fanno Creek Watershed were identified in an inventory published by the Planning Bureau in May of 1984. This inventory has not been accepted by either the Planning Commission or the City Council. This work is being completed by a separate Goal 5 study and is not addressed by the Fanno Creek Plan. Known historic sites are currently protected by Chapter 33.222 of the City Planning and Zoning Code, and are not addressed by this report. Chapter 33.222 is acknowledged as complying with Statewide Planning Goal 5.

²³Portland City Code, 33.480.060.

Cultural Resources

There are no known significant archaeological or cultural resources within the Fanno Creek Watershed. The best information suggests that an average of one significant site may exist per 40 acres in the upper watershed.²⁴ This hypothesis is extrapolated from sites found in similar areas in Washington and Clackamas Counties. All of these sites are associated with drainages. Frequencies ranged between a high of one site per 195 acres to a low of one site per seven acres. Headwaters appear to have been preferred sites for prehistoric use, particularly as travel routes and temporary camps. The identification of cultural resources in the Fanno Creek Watershed is not part of the City of Portland's Periodic Review workprogram.

A separate study is underway to identify and protect archaeological resources, but only for the Columbia South Shore. The Fanno Creek Plan does not propose environmental zones for the protection of cultural and archaeological sites. But, because many headwaters are protected for other reasons, a high degree of incidental protection may be afforded to unknown archaeological sites.

Open Space

Open space is conserved by existing base zones and comprehensive plan designations. While the *Fanno Creek Plan* does not provide open space *per se*, it will provide for environmentally sensitive development and a visually appealing city. The City's open space designations are acknowledged as complying with Statewide Planning Goal 5. The review of these designations is not part of the City of Portland's Periodic Review workprogram.

Relation to Other Planning Studies

The following are not Goal 5 studies, but their topics bear an important relationship to this plan.

²⁴Ellis, David V., March 19, 1992, Letter to Al Burns, 1 page, with references and map attachment.

The strategic plan includes an action plan for managing regional growth. The first strategy of this action plan is:

1. Maintain livability in the Portland Metropolitan region through an integrated planning process that focuses appropriate growth in the Central City, protects the natural environment and open spaces, strengthens cultural programs and enhances neighborhoods.

Several action items under this strategy are consistent with the provisions of the Fanno Creek Plan. These action items include:

- 1.2 Create a regional system of linked greenways and greenspaces. As part of its Metropolitan Greenspaces Program, METRO should institute a cooperative regional system of natural areas, open space, recreational trails, crop lands and greenways. The system should integrate landscape features, natural areas, wildlife refuges, rivers and streams. The Greenspaces network should be served by a regional trail system: the 40-Mile Loop, Chinook Trail, and other trails.
- 1.3 Institute ecosystem protection, restoration and management program that integrates landscape ecology, protection of open space, wildlife refuge parks, crop lands and the maintenance of air and water quality with economic development. The programs should include waste management and recycling. Functions of the Bureau of Environmental Services, Planning, Parks and Recreation, Transportation and Water should be integrated as they relate to ecosystem protection.

Carrying out the provisions of the Fanno Creek Plan will also carry out Future Focus action items.

Greenspaces Program

The Metropolitan Greenspaces Program is underway to identify and protect natural areas within the Portland metropolitan area and Clark County, Washington. The project's study area includes the Fanno Creek Watershed. The program is a cooperative effort with cities, counties, special districts, nonprofit environmental and conservation organizations, and citizens. The goal is to establish a regional system of natural areas, parks and open spaces that are connected by trails and greenways. The inventory of areas needed for this purpose is not adopted as a regional "functional plan" under the Metropolitan Service District's statutory and charter authorities, but was considered in the Fanno Creek Plan.

Regional Urban Growth Goals and Objectives

Along with the Greenspaces Program, the Metropolitan Service District has developed the *Regional Urban Growth Goals and Objectives*. These objectives are not adopted as a regional "functional plan" under the Metropolitan Service District's statutory and charter authorities, but were considered in the Fanno Creek Plan.

Goal 2, Natural Environment states:

Preservation, use and modification of the natural environment of the region should maintain and enhance environmental quality while striving for the wise use and preservation of a broad range of natural resources.

Objective 9, Natural Areas, Parks and Wildlife Habitat, would require local governments to acquire, protect and manage (1) open spaces to provide passive and active recreational opportunities, and (2) an open space system providing habitat for native wildlife and plant populations. Strategies 9.1 and 9.2 require local governments to accomplish several tasks to meet this objective. The development and implementation of the Fanno Creek Plan addresses the following strategies:

9.1 Open Space Assessment: This strategy calls for local governments to establish quantifiable targets for setting aside certain amounts and types of open space. The city's Goal 5 update process carries out this strategy.

9.2 Corridor Systems: This strategy calls for the development of interconnected recreational and wildlife corridor systems within the metropolitan region. The Fanno Creek Plan will advance this objective by preservation of natural areas where passive recreational opportunities exist. The individual site inventories included in the Fanno Creek Plan will also aid in the development of recreational and wildlife corridors. This strategy also requires a detailed biological inventory of the region to be maintained to establish an accurate baseline of native wildlife and plant populations. The resource inventories contained in the Fanno Creek Plan provide new data for this regional inventory.

Oregon Benchmarks

The report *Oregon Benchmarks, Setting Measurable Standards for Progress, Report to the 1993 Legislature* was adopted by the Oregon Progress Board. The report embodies a statewide consensus, and defines a preferred future for Oregon as both a people and a place. The report includes both short and long term benchmarks, and whenever present circumstances fall significantly

short of the ideal, incremental steps are established. Benchmarks are divided into following three categories: People; Quality of Life; and Economy. All benchmarks are clear, objective, numerical standards that focus on results. Quality of Life Benchmark 28 is the, "Percentage total land within the Portland metropolitan area preserved as open space." The report calls for 20 percent open space, and recognizes that only three percent is protected. The *Fanno Creek and Tributaries Conservation Plan* is part of an overall program that will result in 17 to 18 percent of the City being placed in environmental zones. While environmental zones are not open space *per se*, they will achieve the benchmark purpose of environmentally sensitive development and quality of life. Other relevant benchmarks address a no net loss of wetlands and affordable housing. Since it is difficult to achieve environmental protection and affordable housing in the same place, most affordable housing will occur in the 82 percent of the City not in environmental zones. Areas with environmental zones are generally excluded from the City's inventory of lands needed for housing, because 98 percent of them are on slopes of 30 percent or greater, or are within floodways. The portion of the Fanno Creek Watershed within the Portland City Limits has an area of 4,660 acres. Within this area, the Fanno Creek Plan proposes 306 acres of environmental protection zones and 757 acres of conservation zones. This is six percent protection zoning and 17 percent conservation zoning.

INVENTORY

Process

The following information was used to define the study area: the United States Fish and Wildlife Service's National Wetlands Inventory (scale 1:24,000), false color infrared photography commissioned jointly by the Portland Audubon Society and the Metropolitan Service District in 1989 (scale 1:200), City base topography maps (1:100 and 1:200 scales), and 151 field visits.

The study area, with minor exceptions, is the Fanno Creek Watershed within Multnomah County and the Portland City Limits. The inventory was prepared jointly with Multnomah County, but regulations are, of course, only proposed for lands within the political jurisdiction of the City of Portland. Small portions of the city limits extend west of the Willamette Meridian into Washington County and these lands were also examined.

Site Selection

The study area is divided into eight resource sites. These divisions are generally drainage sub-basins. The resource areas include Fanno Tributaries north of S.W. Hamilton Road and west of S.W. Dosch Road, the mainstream of Fanno Creek, the Pendelton Tributary, the Vermont Tributary, the Multnomah Tributary (also called Woods Creek), the North Fork of Ash Creek, the South Fork of Ash Creek, and an unnamed tributary east of Interstate-5.

Because road fills have significantly altered natural drainage, existing roads have been used to approximate boundaries between sub-basins. This approach is more reflective of reality than strictly topographic boundaries. Its also facilitates public review, because people are more likely to know the name of the nearest major street than the elevation of their lot.

Field Inventory Method

The field inventory for Fanno Creek Plan Inventory was done differently than the City's earlier environmental studies. In other study areas a single field examination could represent several acres of fairly homogeneous resources. Because the Fanno Creek Watershed is more developed than other study areas, a single examination might not be representative of an entire forest or stream segment. To gain a better understanding of the ecological functions state and city goals seek to maintain, each of the eight resource sites contains more than one inventory site. Scores taken at several inventory sites were aggregated to gain a general understanding of the resource site as a whole. There are a total of 151 inventory sites. Since the same evaluator was present at every examination, any subjectivity is canceled out, and scores reflect the relative values of all resources present in the watershed.

General Inventory

The following is a general description of the natural resources of the Fanno Creek Watershed. The inventory includes only ecologically significant natural areas. The Portland City Code defines ecologically significant natural areas as, "Land and water that has substantially retained its natural character, but is not necessarily completely natural or undisturbed, and which is significant for historic, scientific, paleontological, or natural features." This Code definition is very similar to the definition of "Natural Areas" in the Statewide Planning Goals, but the State definition stresses the importance of habitat for plants and animals. The Statewide Planning Goals define ecosystem as, "The living and non-living components of the environment which interact or function together, including plant and animal organisms, the physical environment, and the energy systems in which they exist. All the components of an ecosystem are interrelated."

The common meaning of term "significant" is, "noticeable, meaningful, or measurable." The term allows the Portland City Council to exercise its proper judgment to determine which areas have meaningful natural character. Council provided guidance for the identification of "ecologically significant natural areas" through enactment of new Comprehensive Plan Policies beginning with Ordinance No. 160890, June 1988. The following policies are especially relevant:

- 8.8 Groundwater Protection. This policy directs the conservation of groundwater by protecting ground and surface waters, and areas of groundwater recharge from pollution.
- 8.10 Drainageways. This policy directs the regulation of development in drainageways to control stormwater runoff, and to protect riparian vegetation for water quality and wildlife. Drainageways are especially important as corridors which allow passage of wildlife between natural areas and throughout the City. They can also be important habitat whenever they provide food, water, or cover; or breeding, nesting, resting, or wintering areas. Drainageways must, however, be maintained on a regular basis to allow them to adequately control stormwater runoff.
- 8.11 Special Areas. This policy recognizes that different parts of the City have unique land qualities and directs the adoption of specific planning objectives for special areas.
- 8.12 National Flood Insurance Program. This policy directs measures to ensure continued City eligibility for this program.
- 8.13 Natural Hazards. This policy directs that development density be controlled in areas of natural hazards.

- 8.14 Natural Resources.** This policy establishes a framework for resource conservation. It includes directives to avoid impacts, mitigate unavoidable impacts, and to prevent soil erosion.
- 8.15 Wetlands/Riparian/Water Bodies Protection.** This policy directs the regulation of development to retain the ecological functions and natural values of these areas. It requires the protection of buffers around resources, and the restriction of non-water dependent and non-water related development within riparian areas. It also directs the improvement of water quality and the conservation of flood control values.
- 8.16 Uplands Protection.** This policy directs the conservation of upland wildlife habitats, particularly important are uplands that connect habitats and buffer wetlands and water bodies. It also requires the protection of slopes from landslides and erosion through the retention and use of vegetation.
- 8.17 Wildlife.** This policy directs the conservation of existing habitats and encourages activities that increase the variety and quantity of fish and wildlife throughout the City. It directs the regulation of development which is detrimental to the provision of food, water, and cover for fish and wildlife.

Through the application of this policy guidance the Portland Planning Bureau and Planning Commission determined that "ecologically significant natural areas" within the Fanno Creek Watershed are limited to certain upland forests, certain riparian areas, and certain drainageways, wetlands, and water bodies. These are natural resources that provide values through their ecological functions. For example, a forest provides habitat for plants and animals. The forest is the "resource." Urban wildlife and the other benefits of the forest are "values." The ways that resources provide these values are ecological "functions." Our example forest might provide habitat for a certain animal species, but only if it contained plant species providing the necessary food and cover. These plant species would not exist unless all the ecological functions (interactions between the physical, chemical, and biological components of an environment) such as light, temperature, moisture, and substrate were within proper limits. The Planning Bureau identified resources, values, and functions from secondary sources, aerial photography, and original field work. Resources were identified at a scale of one inch representing 200 feet on a hand colored maps dated October 18, 1991. Because of their size, and the expense of color reproduction, these maps are not included in volume. A simplified and reduced set of these maps is included in a supplemental volume. Copies of the Habitat Evaluation forms are also included in a supplemental volume. More detailed descriptions of resources are included in the Decisions section of this volume.

Resources

The Planning Bureau identified the following types of ecologically significant natural features in the Fanno Creek Watershed:

Streams - These are flowing bodies of water and seasonal drainageways. Flow may be perennial, intermittent, or seasonal. Fanno creek and its tributaries are streams. Since these streams are small, they are identified as palustrine wetlands in the National Wetlands Inventory, but the Fanno Creek Plan inventory borrows terms from the United States Fish and Wildlife Service's riverine classification scheme to give a better definition of stream flow and substrate. Technically, all forested wetlands are palustrine, and the riverine classification is used for only streams so wide that they cannot be completely overarched by trees. Forested wetland types are listed as riparian habitats in the Fanno Creek Plan inventory.

Riparian Areas - These are transitional areas between uplands and wetlands. Water bodies, wetlands, riparian areas, and uplands function together as ecological units. Values cannot be maintained by protecting just a water body, just a wetland, just a riparian area, or just an upland.

Forests - These areas include upland forests, riparian forests, and wetland forests. Any of these forests may be completely coniferous, mixed coniferous and deciduous, or completely deciduous.

Ponds - These are still open bodies of water. In Fanno Creek the only ponds are small reservoirs constructed by placing check dams in the stream channel. Since these ponds are small, they are identified as palustrine wetlands in the National Wetlands Inventory, but the Fanno Creek Plan inventory borrows terms from the United States Fish and Wildlife Service's lacustrine classification scheme to give a better definition of substrate types and amounts of open water. Technically, all forested wetlands are palustrine, and the lacustrine classification is used for ponds so wide that they cannot be completely overarched by trees.

Marshes - These are palustrine wetlands dominated by grasses.

Scrub-Shrubs - These are palustrine wetlands dominated small woody plants.

Urban Landscapes - These are lawns and gardens. Although some native trees remain, most native plants are replaced by exotic shrubs and grasses. Urban landscapes provide habitat for exotic animal species, and certain adaptive native animal species. They also contribute to watershed values as a whole.

Values and Functions

Natural resources provide the following values through the listed functions. Since some functions contribute toward two or more values (For example, soil stabilization contributes to both public safety and pollution control.) the lists of functions should be considered illustrative rather than exhaustive.

Public Safety - The natural resources of the Fanno Creek Watershed make significant contributions to public safety by stabilizing slopes and banks, and by controlling floods.

1. Anchoring of shorelines and stream-banks. Vegetation provides natural armor for stream banks and shorelines. In some situations vegetation can serve as a natural alternative to rip-rap or concrete stream liners.
2. Dissipation of the erosive forces of stormwater. Vegetation slows the velocity of stormwater. To the extent that stormwater is held in check, less erosion and bank failures result.
3. Retention of soils and stabilization of slopes. Forests root systems hold soil on hillsides. When forests are removed, and when the stumps and roots either rot or are pulled out, landslides can result. These slides usually occur in the rainy season when soils become saturated.
4. Storage, conveyance, and desynchronization of stormwater. Rain falling on a forest bounces off leaves and twigs, drips into the spongy forest floor, and drains slowly down hill. Rain falling on pavement runs immediately downhill. Forest can lower peak flood heights by slowing stormwater runoff. Older coniferous forests do this better than younger deciduous forests. Ponds and marshes also store and desynchronize flood water. Forests can also store water from the wet season and release it during dry spells. The extra water can help aquatic life.

Pollution Control - Vegetation within Fanno Creek Watershed resource sites helps maintain and improve air and water quality.

1. Trapping air-born pollutants. A mature tree can intercept up to 50 pounds of atmospheric particles every year. To the extent that particulates are trapped in forests, water quality benefits as well. Many stormwater born pollutants in the Fanno Creek Watershed originate as particulates from construction sites, others originate from motor vehicles.

2. Trapping sediment from stormwater - Stormwater flowing through vegetation can loose between 10% and 57% of its sediment bound phosphorous and nitrogen based pollutants by natural filtering and slowing of runoff.²⁵ Streams bordered by wide amounts of vegetation provide higher biofiltration values than denuded banks. Vegetated stream-side areas that are wide enough to provide good quality wildlife habitat, are also wide enough to provide a measurable degree of biofiltration.
3. Assimilating and breakdown of water-born pollutants. Dissolved phosphorous cannot be filtered out of stormwater runoff, but it can be assimilated in water bodies by aquatic plants. Aquatic bacteria can also break down some toxins to less harmful chemicals, but toxic chemical runoff is not a known problem in the Fanno Creek Watershed. Both assimilation and breakdown take time, so these processes are most effective in slow moving, shallow water. Assimilation by algae is a problem. These microscopic plants can grow, die, and rot all in one summer, and entire streams can be deprived of the dissolved oxygen necessary for aquatic life. Marsh grasses also grow, die, and rot, but grasses decompose in the winter when temperatures are lower (stream water can carry more dissolved oxygen at lower temperatures) and flows are higher, so stream life is not usually threatened. Woody plants incorporate nutrients into long-lived tissue, and thus retain nutrients for several seasons.

Fish and Wildlife - Every Fanno Creek Watershed resource site contains important habitat for fish and wildlife. Two species of special concern are the pilliated woodpecker and the cutthroat trout. These species are becoming more rare, and will disappear entirely from the urban environment unless their habitat is maintained.

1. Provide for spawning, rearing, feeding, and migration of fish. All water bodies in the Fanno Creek Watershed contain significant fish habitat because they provide for spawning, rearing, feeding, and migration of fish. Many drainageways, seasonal streams, and stream segments where fish are not present, or not present year-round, are also significant because they provide the quantity and quality of water to support down-stream fisheries.
2. Provide food, water, cover, and dispersion for wildlife. All Fanno Creek Watershed resources sites contain significant wildlife habitat. Each site is assigned a numerical habitat value. Habitat value was determined by the presence of food, water, and cover; connections to

²⁵Martin, E. and Smoot, J., Load Changes in Urban Stormwater Runoff, USGS Report 85-430. Tallahassee, Florida. 77 pages.

other resource areas; and the amount of degradation caused by existing development. Connections to other resource areas are particularly important in the Fanno Creek Watershed. All vegetated stream banks are significant for wildlife, because they provide a sheltered means of dispersion between resource areas in the same sub-basins. S.W. Maplewood, Multnomah, and Fairvail are forested, abandoned, rail right-of-way embankments with seasonal wetlands on their up-hill sides. They provide the only significant wildlife dispersion opportunities between the sub-basins of the Fanno Creek Watershed.

Climate - Forests help maintain temperatures within normal ranges on both local and global scales. All Fanno Creek Watershed sites have their own important microclimates. These sites, in total, can make a measurable contribution toward maintenance of the regional climate.

1. Maintenance of microclimates. Mature forests establish their own climates. These microclimates are cooler, darker, and more moist than urban landscapes. These microclimates are important habitat components, and are essential for the perpetuation of native plant and animal species. These microclimates also provide "passive air conditioning" that reduces domestic energy use in the summer.
2. Maintenance of global climate. Portland is one of twelve local governments designated by the United Nations' 1988 Toronto "World Conference on the Changing Atmosphere" to retard global warming by slowing the build-up of carbon dioxide. Urban forests in the United States store approximately 800 million tons of carbon, or about five percent of all forest carbon storage in the entire country. A mature tree absorbs about 13 pounds of atmospheric carbon dioxide every year. The City of Portland's draft *Carbon Dioxide Reduction Strategy* demonstrates that maintenance of existing trees, and the planting of new trees, will cause a measurable reduction in atmospheric carbon dioxide. This is the only "sink increase" element in the strategy; the others are "source reduction" elements.

Recreation and Scenery - The city regulations that protect and conserve natural resources do not authorize public use. The only significant scenic resources in the Fanno Creek Watershed are corridors along the portion of S.W. Multnomah Boulevard west of S.W. Forty-fifth Avenue, and along S.W. Fairmont Boulevard. Some natural resources are on public park land, and these areas are significant for recreation.

Research and Education - Resources significant for scientific investigation probably do not exist in the Fanno Creek Watershed. Some natural resources are, however, on school grounds or in parks. These areas provide significant educational values.

Water Supply - Surface water is supplied through seasonal recharge and discharge of groundwater. The silt-clay soils in the Fanno Creek Watershed are so impervious that recharge is a very slow process, and most groundwater tends to remain confined in seasonal perched aquifers. Discharge is most apparent in areas with exposed basalt or fragipans. While recharge is not recognized as particularly significant at individual resource sites, it is important to the watershed as a whole. Discharge is not an important domestic source of water, but groundwater discharge contributes water to streams during critical periods of low flow. This water is extremely important for fish and wildlife.

Site Specific Inventories

The following pages list the resources, values, and functions that were identified at eight resource sites. Since the Portland Comprehensive Plan emphasizes the use of drainageways for a variety of values, hydrographic considerations drove the selection of resource sites. The resource sites are the main stem tributary sub-basins of the Fanno Creek watershed. Standard habitat evaluation methods were employed at several times and at several places within each resource site.²⁶ Each Resource Site has several inventory sites because 151 inventory sites are divided among eight resource sites.

²⁶Field notes are transcribed as Volume 3 of the Fanno Creek Plan.

Resource Site 124

Location: Fanno Creek Tributaries North of S.W. Hamilton Road and East of S.W. Dosch Road

Area: 579 Acres

Dates of Field Inventories: 7/10/91 to 9/11/91

Inventory Sites (total of 72) Included in this Resource Site:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 79, 81, 82, 83, 84, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, and 97.

Significant Wetland Habitats:

Palustrine, Intermittent stream, Unconsolidated cobble-gravel bed;
Palustrine, Upper perennial stream, Unconsolidated cobble-gravel bed;
Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Limnetic pond, Unconsolidated silt-loam bed;
Palustrine, Littoral pond, Unconsolidated silt-loam bed;
Palustrine, Emergent, Unconsolidated silt-loam bed; and
Palustrine, Scrub-shrub.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous; and
Palustrine, Forested, Mixed Coniferous and Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 92, Low 17, Average 62.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Retention of soils

Spawning, rearing, feeding, and migration areas for fish

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 125

Location: Fanno Creek Mainstream and Tributary Junctions

Area: 1,341 Acres

Dates of Field Inventories: 8/22/91 to 9/24/91

Inventory Sites (total of 35) Included in this Resource Site:

56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 80, 85, 98, 99, 100, 101, 102, 103, 104, 105, 106, 125.

Significant Wetland Habitats:

Palustrine, Upper perennial stream, Unconsolidated cobble-gravel bed;
Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Limnetic pond, Unconsolidated silt-loam bed;
Palustrine, Littoral pond, Unconsolidated silt-loam bed; and
Palustrine, Emergent marsh, Unconsolidated silt-loam bed.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous;
Palustrine, Forested, Mixed Coniferous and Deciduous; and
Palustrine, Forested, Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 77, Low 22, Average 49.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Retention of soils

Spawning, rearing, feeding, and migration areas for fish

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 126

Location: Pendelton Tributary of Fanno Creek

Area: 246 Acres

Dates of Field Inventories: 9/13/91 to 9/19/91

Inventory Sites (total of 6) Included in this Resource Site:
107, 108, 109, 110, 111, and 112.

Significant Wetland Habitats:

Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Emergent marsh, Unconsolidated silt-loam bed; and
Palustrine, Scrub-shrub.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous;
Palustrine, Forested, Mixed Coniferous and Deciduous; and
Palustrine, Forested, Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 82, Low 21, Average 43.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Rearing, feeding, and migration areas for fish

Retention of soils

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 127

Location: Vermont Tributary of Fanno Creek

Area: 641 Acres

Dates of Field Inventories: 9/20/91 to 10/4/91

Inventory Sites (total of 17) Included in this Resource Site: 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 126, 127, 128, 129, and 130.

Significant Wetland Habitats:

Palustrine, Upper perennial stream, Unconsolidated cobble-gravel bed;
Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Limnetic pond, Unconsolidated silt-loam bed;
Palustrine, Littoral pond, Unconsolidated silt-loam bed;
Palustrine, Emergent marsh, Unconsolidated silt-loam bed; and
Palustrine, Scrub-shrub.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous;
Palustrine, Forested, Mixed Coniferous and Deciduous; and
Palustrine, Forested, Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores: High 82, Low 23, Average 49.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Retention of soils

Spawning, rearing, feeding, and migration areas for fish

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 128

Location: Woods (Multnomah) Tributary of Fanno Creek

Area: 596 Acres

Dates of Field Inventories: 10/4/91 to 10/11/91

Inventory Sites (total of 12) Included in this Resource Site:

131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, and 143.

Significant Wetland Habitats:

Palustrine, Intermittent stream, Unconsolidated cobble-gravel bed;
Palustrine, Upper perennial stream, Unconsolidated cobble-gravel bed;
Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Emergent marsh, Unconsolidated silt-loam bed; and
Palustrine, Scrub-shrub.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous; and
Palustrine, Forested, Mixed Coniferous and Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 90, Low 37, Average 65.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Retention of soils

Spawning, rearing, feeding, and migration areas for fish

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 129

Location: North Fork Ash Creek Tributary of Fanno Creek

Area: 341 Acres

Dates of Field Inventories: 10/9/91 to 10/11/91

Inventory Sites (total of 4) Included in this Resource Site:
144, 146, 142, and 145.

Significant Wetland Habitats:

Palustrine, Intermittent stream, Unconsolidated cobble-gravel bed;
Palustrine, Upper perennial stream, Unconsolidated cobble-gravel bed;
Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Emergent marsh, Unconsolidated silt-loam bed; and
Palustrine, Scrub-shrub.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous;
Palustrine, Forested, Mixed Coniferous and Deciduous; and
Palustrine, Forested, Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 60, Low 44, Average 52.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Retention of soils

Spawning, rearing, feeding, and migration areas for fish

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 130

Location: South Fork Ash Creek Tributary of Fanno Creek

Area: 397 Acres

Date of Field Inventories: 10/11/92 and 2/3/93

Inventory Sites (total of 2) Included in this Resource Site: 147 and 148.

Significant Wetland Habitats:

Palustrine, Lower perennial stream, Unconsolidated silt-loam bed;
Palustrine, Emergent marsh, Unconsolidated silt-loam bed; and
Palustrine, Scrub-shrub;

Significant Riparian Habitats:

Palustrine, Forested, Mixed Coniferous and Deciduous; and
Palustrine, Forested, Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 79, Low 40, Average 60.

Significant Values:

Public Safety
Pollution Control
Fish Habitat
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Rearing, feeding, and migration areas for fish

Retention of soils

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

Resource Site 131

Location: Far Southwest Tributary of Fanno Creek East of I-5

Area: 515 Acres

Date of Field Inventories: 10/11/91

Inventory Sites (total of 2) Included in this Resource Site: 149 and 150.

Significant Wetland Habitats:

Palustrine, Intermittent stream, Unconsolidated cobble-gravel bed;
Palustrine, Upper perennial stream, Unconsolidated cobble-gravel bed; and
Palustrine, Lower perennial stream, Unconsolidated silt-loam bed.

Significant Riparian Habitats:

Palustrine, Forested, Coniferous; and
Palustrine, Forested, Mixed Coniferous and Deciduous.

Significant Upland Habitats:

Forest Coniferous;
Forest Mixed Coniferous and Deciduous;
Forest Deciduous; and
Urban Landscape.

Wildlife Habitat Assessment Scores:

High 66, Low 60, Average 63.

Significant Values:

Public Safety
Pollution Control
Wildlife Habitat
Scenery
Education
Recreation
Water Supply

Significant Functions:

Anchoring of shorelines and stream-banks

Assimilation of water-born pollutants

Dissipation of the erosive forces of stormwater

Feeding, watering, hiding, and dispersion areas for fish

Groundwater discharge

Maintaining native forest microclimate

Retention of soils

Stabilization of slopes

Storage, conveyance, and desynchronization of stormwater

Trapping air-born pollutants

Trapping sediment from stormwater

ALLOWED USES

Statewide Planning Goal 5 states that "programs shall be provided that will 1) insure open space, 2) protect scenic and historic areas and natural resources for future generations, and 3) promote healthy and visually attractive environments in harmony with the natural landscape character." According to the Oregon Administrative Rules (OAR) Chapter 660, Division 16, the next step in the Goal 5 process after resource inventory is identification of potential land use conflicts with inventoried resources. This is done primarily by examining the uses allowed in broad zoning categories. A conflicting use is one which, if allowed, could negatively impact the resource. The following section examines land uses and activities permitted by existing zoning. Uses which are compatible with resource protection are described first.

Compatible Uses

Compatible uses are those that can be conducted in a manner which would not result in resource degradation or destruction. Only three uses are compatible with every resource in the Fanno Creek Watershed. These uses are the following:

1. Aesthetic enjoyment of natural features from existing public roads and trails;
2. Educational use of public natural areas by individuals and groups; and
3. Low intensity recreation on established public trails or roads, such as walking, hiking and nature observation.

These uses are not regulated by the zoning code. All other known uses are conflicting uses.

Conflicting Uses

Conflicting uses are those uses which are incompatible with natural resource protection but permitted by City of Portland zoning. Just because a use is categorized by the State Goal 5 Administrative Rule as a "conflicting use" does not mean that resource preservation is the only good use, and that all other uses are bad. This is usually not the case. For example natural resources, housing, and urban infrastructure all good things. If done carelessly, or at the same time, or in the same place, conflicts may arise, but these are conflicts between conflicting goods rather than conflicting evils.

The following are ways that the City Zoning Code permits conflicting uses: allowed-by-right, allowed subject to special use limitations, by conditional use permit, by recognition of lawful nonconforming status, by temporary use agreement, and by revocable permit. Uses allowed by the City Zoning Code within the various zoning classifications may be primary or accessory.

Primary uses are the principle uses of land within a zone. Examples include a park in an open space zone, a house in a residential zone, a store in a commercial zone, and a factory in an industrial zone. Accessory uses are subordinate to primary uses. Examples include a detached garage in a residential zone and a parking lot in a commercial zone. New allowed uses have to conform to certain measurable standards such as height, lot line building setbacks, and total lot coverage; and usually require a building, development, or public works permit.

Limited uses can also be primary or accessory. It is common for some zones to allow several primary uses. For example the Mixed Commercial (CM) zone allows both commercial and residential uses, but the commercial use of buildings is generally limited to no more than half the total floor area. Manufacturing, an industrial use, is allowed in the General Commercial (CG) zone, but is subject to special limitations, not applicable to industrial zones, on the exterior display and storage of equipment. Use limitations are also measurable standards.

Conditional uses are allowed only if they can demonstrate compliance with approval criteria. These approval criteria are clear and objective, but are not measurable standards. Whether or not they are met depends on the gathering of relevant facts and the exercise of judgment. Reasonable people can disagree about conditional use decisions. An example of a discretionary approval criteria is , "does not pose an unreasonable safety threat to nearby uses and residents." The terms "unreasonable" and "nearby" are discretionary and their application requires informed judgment. These decisions always involve notice to people believed to be affected, opportunity for a public hearing, and opportunity to appeal the City's decision to a state tribunal.

Nonconforming uses and development are often informally referred to as "grandfathered." They are uses which are not allowed by present zoning, but began before present zoning (and in some cases any zoning) was adopted, and have been in continuous use to the present. Nonconforming status is lost if the use is discontinued and not reestablished within certain time periods. Nonconforming uses can be expanded under certain circumstances.

Other activities not allowed by current zoning have revocable permits. The City does not issue new revocable permits. Expiring permits may be extended only once, and for a period of no more than three years. Ownership of revocable permits is not transferable. Some older revocable permits do not have expiration dates; these permits will expire when the ownership changes or when the owner dies.

Conflicting uses are those uses which are both incompatible with resource protection and permitted by present City of Portland zoning. If these uses actually occurred at the intensities and during the times allowed by the

Comprehensive Plan, they would diminish or destroy the identified resources and functional values of the Fanno Creek Watershed. Only two uses allowed by the City Zoning Code, railroad yards and waste related industrial facilities, are not allowed by any existing zone or comprehensive plan designation in the Fanno Creek watershed. Because these uses are never allowed, they are not conflicting uses for the purpose of this plan. Prohibited uses occurring unlawfully are also not conflicting uses. This conservation plan identifies several allowed uses which conflict with at least one Fanno Creek Watershed resource. These uses are described below.

Categories of Conflicting Uses

Conflicting uses are broken down into residential, commercial, industrial, and institutional categories. There is also a miscellaneous "other" category. These categorized uses along with infrastructure, nonconforming, temporary, and revocable uses are discussed below.

Residential Categories

Residential categories include household and group living. These uses are allowed in single-dwelling and multi-dwelling residential zones.

Household Living

Household Living is characterized by the residential occupancy of a dwelling unit by a household. The average length of stay is 60 days or longer. Uses where people stay, on average, less than 60 days are not considered residential. They are considered to be a form of transient lodging (see the Retail Sales And Service, Essential Service Provider, and Community Service categories). Apartment complexes that have accessory services such as food service, dining rooms, and housekeeping are included as Household Living. Single Room Occupancy housing (SROs), that do not have totally self contained dwelling units are also included if the average length of stay in at least two thirds of the units is 60 days or longer. SROs may have a common food preparation area, but meals are prepared individually by the residents. Accessory uses commonly found are recreational activities, raising of pets, hobbies, and parking of the occupants' vehicles. Home occupations, accessory rental units, and bed and breakfast facilities are accessory uses that are subject to additional regulations. Uses include living in houses, duplexes, apartments, condominiums, retirement center apartments, manufactured housing, houseboats, and other structures with self-contained dwelling units. Examples also include living in SROs if the provisions are met regarding average length of stay and separate meal preparation.

Household living is prohibited in open space zones. It is allowed in all single-dwelling zones, multi-dwelling residential zones, and commercial zones.

Group Living

Group Living is characterized by the residential occupancy of a structure by a group of people who do not meet the definition of Household Living. The size of the group will be larger than the average size of a household. The average length of stay is 60 days or longer. Uses where people stay, on average, less than 60 days are not considered residential. They are considered to be a form of transient lodging (see the Retail Sales And Service, Essential Service Provider, and Community Service categories). Generally, Group Living structures have a common eating area for residents. The residents may or may not receive any combination of care, training, or treatment, as long as they also reside at the site. Accessory uses commonly found are recreational facilities, parking of autos for the occupants and staff, and parking of vehicles for the facility. Examples include dormitories; communes; fraternities and sororities; monasteries and convents; nursing and convalescent homes; group homes for the physically disabled, mentally retarded, or emotionally disturbed; residential programs for drug and alcohol treatment; and alternative or post incarceration facilities.

Group living is prohibited in open space zones. It is a conditional use in all single-dwelling zones. Living groups are limited to seven to 15 persons in multi-dwelling residential zones. Alternative or post incarceration group living facilities, and facilities for groups of more than 15 persons are conditional uses in multi-dwelling residential zones. Groups living facilities for any number of persons are allowed in all commercial zones. Alternative or post incarceration group living facilities are conditional uses in all commercial zones.

Commercial Categories

Commercial Categories include Retail Sales and Service, Office, Quick Vehicle Servicing, Vehicle Repair, Commercial Parking, Self-Service Storage, Commercial Outdoor Recreation, and Major Event Entertainment

Retail Sales and Service

Retail sales and service firms are involved in the sale, lease or rent of new or used products to the general public. They may also provide personal services or entertainment, or provide product repair or services for consumer and business goods. Accessory uses may include offices, storage of goods, manufacture or repackaging of goods for on-site sale, and parking. Examples include uses from four subgroups. (1.) Sales-oriented: Stores selling, leasing, or renting consumer, home, and business goods including art, art supplies, bicycles, clothing, dry goods, electronic equipment, fabric, furniture, garden supplies, gifts, groceries, hardware, home improvements, household products, jewelry, pets, pet food, pharmaceuticals, plants, printed material, stationary, and videos; food sales, and sales or leasing of consumer vehicles

including passenger vehicles, motorcycles, light and medium trucks, and other recreational vehicles. (2.) Personal service-oriented: Branch banks; urgency medical care; laundromats; photographic studios; photocopy and blueprint services; hair, tanning, and personal care services; business, martial arts, and other trade schools; dance or music classes; taxidermists; mortuaries; veterinarians; and animal grooming. (3.) Entertainment-oriented: Restaurants, cafes, delicatessens, taverns, and bars; indoor or outdoor continuous entertainment activities such as bowling alleys, ice rinks, and game arcades; pool halls; indoor firing ranges; theaters, health clubs, gyms, membership clubs, and lodges; hotels, motels, recreational vehicle parks, and other temporary lodging with an average length of stay of less than 30 days. (4.) Repair-oriented: Repair of TVs, bicycles, clocks, watches, shoes, guns, appliances and office equipment; photo or laundry drop off; quick printing; recycling drop-off; tailor; locksmith; and upholsterer.

Retail sales and services are conditional uses in open space zones, but only when they are associated with park and open area uses. Retail sales and services not associated with park and open area uses are prohibited in open space zones. These uses are also prohibited in all single-dwelling zones, and in all R3, R2, and R1 multi-dwelling residential zones. They are limited to no more than 5,000 square feet of total floor area in CN1 commercial zones, ten percent of total floor area in CO2 commercial zones, and half of total floor area in CM commercial zones. They are prohibited in CO1 commercial zones. They are allowed in CN2, CS, CG, and CX commercial zones.

Office

Office uses are characterized by activities conducted in an office setting and generally focusing on business, government, professional, medical, or financial services. Accessory uses may include cafeterias, health facilities, parking, or other amenities primarily for the use of employees in the firm or building. Examples include professional services such as lawyers, accountants, engineers, or architects; financial businesses such as lenders, brokerage houses, bank headquarters, or real estate agents; data processing; sales offices; government offices and public utility offices; TV and radio studios; medical and dental clinics, medical and dental labs; and blood-collection facilities.

Offices are prohibited in open space zones, in all single dwelling residential zones, and in R3, R2, and R1, multi-dwelling residential zones. They are limited to 5,000 square feet of total floor area in CN1 commercial zones and to half the total floor area in CM commercial zones. They are allowed in all other commercial zones.

Quick Vehicle Servicing

Quick vehicle servicing uses provide direct services for motor vehicles where the driver generally waits in the car before and while the service is performed. The development will include a drive-through facility, the area where the service is performed. Full-serve and mini-serve gas stations are always classified as a primary use, rather than an accessory use, even when they are in conjunction with other uses. Accessory uses may include auto repair and tire sales. Examples include full-serve and mini-serve gas stations, unattended card key stations, car washes, quick lubrication services, and Department of Environmental Quality vehicle emission test sites.

Quick vehicle servicing is prohibited in open space zones, in all single dwelling residential zones, in all multi-dwelling residential zones, in CN1, CN2, CO1, CO2, CM, and CS commercial zones. It is allowed in CG commercial zones.

Vehicle Repair

Vehicle Repair firms service passenger vehicles, light and medium trucks and other consumer motor vehicles such as motorcycles, boats and recreational vehicles. Generally, the customer does not wait at the site while the service or repair is being performed. Accessory uses may include offices, sales of parts, and vehicle storage. Examples include vehicle repair, transmission or muffler shop, auto body shop, alignment shop, auto upholstery shop, auto detailing, and tire sales and mounting.

Vehicle repair is prohibited in open space zones, in all single dwelling residential zones, in all multi-dwelling residential zones, in CN1, CN2, CO1, CO2, and CM commercial zones. It is allowed in CS and CG commercial zones.

Commercial Parking

Commercial parking facilities provide parking that is not accessory to a specific use. A fee may or may not be charged. A facility that provides both accessory parking for a specific use and regular fee parking for people not connected to the use is also classified as a Commercial Parking facility. In a parking structure only, accessory uses may include gasoline sales, car washing, and vehicle repair activities if these uses provide service to autos parked in the garage, and not towards general traffic. Examples include short- and long-term fee parking facilities, commercial district shared parking lots, commercial shuttle parking, and mixed parking lots (partially for a specific use, partly for rent to others).

Commercial Parking is prohibited in open space zones, in all single dwelling

residential zones, in R1, R2, and R3 multi-dwelling residential zones, and in CN1, CN2, CO1, CO2, and CM commercial zones. It is allowed in CS and CG commercial zones.

Self-Service Storage

Self-Service Storage uses provide separate storage areas for individual or business uses. The storage areas are designed to allow private access by the tenant for storing or removing personal property. Accessory uses may include living quarters for a resident manager or security and leasing offices. Use of the storage areas for sales, service and repair operations, or manufacturing is not considered accessory to the Self-service storage use. The rental of trucks or equipment is also not considered accessory to a Self-Service Storage use. Examples include single story and multistory facilities that provide individual storage areas for rent. These uses are also called mini-warehouses.

Self-service storage is prohibited in open space zones, in all single dwelling residential zones, in all multi-dwelling residential zones, in CN1, CN2, CO1, CO2, CM, and CS commercial zones. It is limited to the standards set out in Chapter 33.284 of the City Zoning Code in CG commercial zones.

Commercial Outdoor Recreation

Commercial outdoor recreation uses are large, generally commercial uses that provide continuous recreation or entertainment oriented activities. They generally take place outdoors. They may take place in a number of structures which are arranged together in an outdoor setting. Accessory Uses. Accessory uses may include concessions, restaurants, parking, caretaker's quarters, and maintenance facilities. Examples include amusement parks, theme parks, golf driving ranges, miniature golf facilities, zoos, and marinas.

Commercial outdoor recreation is a conditional use in open space zones. It is prohibited in all single dwelling residential zones, in all multi-dwelling residential zones, and in CN1, CN2, CO1, and in CO2 commercial zones. It is allowed in CM, CS, and CG commercial zones.

Major Event Entertainment

Major event entertainment uses are characterized by activities and structures that draw large numbers of people to specific events or shows. Activities are generally of a spectator nature. Accessory uses may include restaurants, bars, concessions, parking, and maintenance facilities. Examples include stadiums, sports arenas, coliseums, race tracks (auto, horse, dog, etc.), auditoriums, exhibition and meeting areas, and fairgrounds.

Major event entertainment is prohibited in open space zones, in single dwelling residential zones, in all multi-dwelling residential zones, and in CN1, CN2, CO1, CO2, and CM commercial zones. It is a conditional use in CS and CG commercial zones.

Industrial Categories

Industrial categories include Manufacturing and Production, Warehouse and Freight Movement, Wholesale Sales, and Industrial Service.

Manufacturing and Production

Manufacturing and production firms are involved in the manufacturing, processing, fabrication, packaging, or assembly of goods. Natural, man-made, raw, secondary, or partially completed materials may be used. Products may be finished or semi-finished and are generally made for the wholesale market, for transfer to other plants, or to order for firms or consumers. Goods are generally not displayed or sold on site, but if so, they are a subordinate part of sales. Relatively few customers come to the manufacturing site. Accessory activities may include offices, cafeterias, parking, employee recreational facilities, warehouses, storage yards, rail spur or lead lines, docks, repair facilities, truck fleets, and caretaker's quarters. Living quarters, except for caretakers, are subject to the regulations for residential uses in the zone. Examples include processing of food and related products; catering establishments; breweries, distilleries, and wineries; slaughter houses, and meat packing; feed lots and animal dipping; weaving or production of textiles or apparel; lumber mills, pulp and paper mills, and other wood products manufacturing; woodworking, including cabinet makers; production of chemical, rubber, leather, clay, bone, plastic, stone, or glass materials or products; movie production facilities; ship and barge building; concrete batching and asphalt mixing; production or fabrication of metals or metal products including enameling and galvanizing; manufacture or assembly of machinery, equipment, instruments, including musical instruments, vehicles, appliances, precision items, and other electrical items; production of artwork and toys; sign making; production of prefabricated structures, including mobile homes; and the production of energy.

Manufacturing and production are prohibited in all open space zones, single dwelling residential zones, and multi-dwelling residential zones. They are limited to 5,000 square feet of total floor area in CN1 and CN2 commercial zones. They are limited 5,000 square feet of total floor area or half the total floor area, whichever is smaller, in the CM commercial zone. They are limited to 10,000 square feet of total floor area in the CS and CG commercial zones, but exterior display and storage is prohibited in the CG commercial zone. Manufacturing and production are entirely prohibited in CO1 and CO2 commercial zones.

Warehouse and Freight Movement

Warehouse and freight movement firms are involved in the storage, or movement of goods for themselves or other firms. Goods are generally delivered to other firms or the final consumer, except for some will-call pickups. There is little on-site sales activity with the customer present. Accessory uses may include offices, truck fleet parking and maintenance areas, rail spur or lead lines, docks, and repackaging of goods. Examples include separate warehouses used by retail stores such as furniture and appliance stores; household moving and general freight storage; cold storage plants, including frozen food lockers; storage of weapons and ammunition; major wholesale distribution centers; truck, marine, or air freight terminals; bus barns and light rail barns; parcel services; major post offices; grain terminals; and the stockpiling of sand, gravel, or other aggregate materials.

Warehouses and freight movement are prohibited in all open space zones, single dwelling residential zones, and multi-dwelling residential zones. They are also prohibited in the CN1, CN2, CO1, CO2, CM, and CS commercial zones. They are conditional uses limited to 10,000 square feet of total floor area in the CG commercial zone, but exterior display and storage is prohibited.

Wholesale Sales

Wholesale sales firms are involved in the sale, lease, or rent of products primarily intended for industrial, institutional, or commercial businesses. The uses emphasize on-site sales or order taking and often include display areas. Businesses may or may not be open to the general public, but sales to the general public are limited. Products may be picked up on site or delivered to the customer. Accessory uses may include offices, product repair, warehouses, parking, minor fabrication services, and repackaging of goods. Examples include sale or rental of machinery, equipment, heavy trucks, building materials, special trade tools, welding supplies, machine parts, electrical supplies, janitorial supplies, restaurant equipment, and store fixtures; mail order houses; and wholesalers of food, clothing, auto parts, building hardware.

Wholesale sales are prohibited in all open space zones, single dwelling residential zones, and multi-dwelling residential zones. They are also prohibited in CN1, CN2, CO1 and CO2 commercial zones. They are limited to 5,000 square feet of total floor area or half the total floor area, whichever is smaller, in the CM commercial zone. They are limited to 10,000 square feet of total floor area in the CS and CG commercial zones, but exterior display and storage is prohibited in the CG commercial zone.

Industrial Service

Industrial Service firms are engaged in the repair or servicing of industrial, business or consumer machinery, equipment, products or by-products. Firms that service consumer goods do so by mainly providing centralized services for separate retail outlets. Contractors and building maintenance services and similar uses perform services off-site. Few customers, especially the general public, come to the site. Accessory activities may include offices, parking, storage, rail spur or lead lines, and docks. Examples include welding shops; machine shops; tool repair; electric motor repair; repair of scientific or professional instruments; sales, repair, storage, salvage or wrecking of heavy machinery, metal, and building materials; towing and vehicle storage; auto and truck salvage and wrecking; heavy truck servicing and repair; tire retreading or recapping; truck stops; building, heating, plumbing or electrical contractors; printing, publishing and lithography; exterminators; recycling operations; janitorial and building maintenance services; fuel oil distributors; solid fuel yards; research and development laboratories; drydocks and the repair or dismantling of ships and barges; laundry, dry-cleaning, and carpet cleaning plants; and photo-finishing laboratories.

Industrial service is prohibited in all open space zones, single dwelling residential zones, and multi-dwelling residential zones. They are also prohibited in CN1, CN2, CO, CO2, and CM commercial zones. They are conditional uses limited to 10,000 square feet of total floor area in the CS and CG commercial zones, but exterior display and storage is prohibited in the CG commercial zone.

Institutional Categories

Institutional categories include Basic Utilities, Community Service, Essential Service Providers, Parks and Open Areas, Schools, Colleges, Medical Centers, Religious Institutions, and Daycare.

Basic Utilities

Basic utilities are infrastructure services which need to be located in or near the area where the service is provided. Basic utility uses generally do not have regular employees at the site. Services may be public or privately provided. Examples include water and sewer pump stations; electrical substations; water towers and reservoirs; stormwater retention and detention facilities; telephone exchanges; mass transit stops or turn-arounds, and park-and-ride facilities for mass transit.

Basic utilities are conditional uses in all open space, single dwelling residential zones, and multi-dwelling residential zones. They are allowed in all commercial zones.

Community Service

Community services are uses of a public, nonprofit, or charitable nature generally providing a local service to people of the community. Generally, they provide the service on the site or have employees at the site on a regular basis. The service is ongoing, not just for special events. Community centers or facilities that have membership provisions are open to the general public to join at any time, (for instance, any senior citizen could join a senior center). The use may also provide special counseling, education, or training of a public, nonprofit or charitable nature. Accessory uses may include offices; meeting areas; food preparation areas; parking, health and therapy areas; daycare uses; and athletic facilities. Examples include libraries, museums, senior centers, community centers, publicly owned swimming pools, youth club facilities, hospices, police stations, fire stations, ambulance stations, drug and alcohol centers, social service facilities, vocational training for the physically or mentally disabled, crematoriums, columbariums, and mausoleums.

Community service is a conditional use in open space zones; in single dwelling residential zones; in R1, R2, and R3 multi-dwelling residential zones. It is allowed in all commercial zones. These uses have the same effects as commercial development.

Essential Service Providers

Essential service provider uses are primarily engaged in providing on-site food or shelter beds, for free or at significantly below market rates. Accessory uses include offices, counseling, and facilities for recreation, restrooms, bathing, and washing of clothes. Examples include temporary or permanent emergency shelters, night time shelters, rescue missions, soup kitchens, and surplus food-distribution centers.

Essential service providers are prohibited in all open space zones. They are conditional uses in all single-dwelling residential zones. Most essential service providers are conditional uses in multi-dwelling residential zones. The exception is for services provided exclusively to victims of sexual or domestic violence; these are allowed in all multi-dwelling residential zones. Most essential service providers are limited uses in all commercial zones. Again the exception is for services provided exclusively to victims of sexual or domestic violence; these are allowed in all commercial zones. These uses have the same effects as commercial development.

Parks and Open Areas

Parks and open areas are uses of land focusing on natural areas, large areas consisting mostly of vegetative landscaping or outdoor recreation,

community gardens, or public squares. Lands tend to have few structures. Accessory uses may include club houses, maintenance facilities, concessions, caretaker's quarters, and parking. Examples include parks, golf courses, cemeteries, public squares, plazas, recreational trails, botanical gardens, boat launching areas, nature preserves, and land used for grazing that is not part of a farm or ranch.

Swimming pools, concession areas, playing fields for organized sports, and facilities which draw spectators to events are conditional uses in park open space zones, in single dwelling residential zones, and in multi-dwelling open space zones; they are allowed in all commercial zones. Mausoleums, chapels, and similar structures are conditional uses in cemetery open space zones, in single dwelling open space zones, and in R3, R2, and R1 multi-dwelling zones; they are allowed in all commercial zones. Club houses and driving ranges are conditional uses in golf course open space, single dwelling residential areas, and R3, R2, and R1 multi-dwelling residential zones. Parking areas and boat ramps are conditional uses in all open space zones. Lawns, gardens, and natural areas are allowed in all open space zones.

Schools

Schools include public and private schools at the primary, elementary, middle, junior high, or high school level that provide state mandated basic education. Accessory uses include play areas, cafeterias, recreational and sport facilities, auditoriums, and before- or after-school daycare. Examples include public and private daytime schools, boarding schools and military academies.

Schools are conditional uses in all open space zones, in all single dwelling zones and in R3, R2, and R1 multi-dwelling zones. They are allowed in all commercial zones.

Colleges

Colleges include institutions of higher learning which offer courses of general or specialized study leading to a degree. They are certified by the State Board of Higher Education or by a recognized accrediting agency. Colleges tend to be in campus-like settings or on multiple blocks. Accessory uses include offices, housing for students, food service, laboratories, health and sports facilities, theaters, meeting areas, parking, maintenance facilities, and supporting commercial uses. Examples include universities, liberal arts colleges, community colleges, nursing and medical schools not accessory to a hospital, and seminaries.

Colleges are prohibited in all open space zones. They are conditional uses in all single-dwelling residential zones and multi-dwelling residential zones. They are allowed in all commercial zones.

Medical Centers

Medical centers includes uses providing medical or surgical care to patients and offering overnight care. Medical centers tend to be on multiple blocks or in campus settings. Accessory uses include out-patient clinics, offices, laboratories, teaching facilities, meeting areas, cafeterias, parking, maintenance facilities, and housing facilities for staff or trainees. Examples include hospitals and medical complexes that include hospitals.

Medical centers are prohibited in all open space zones. They are conditional uses in single dwelling residential zones and multi-dwelling residential zones. They are allowed in all commercial zones.

Religious Institutions

Religious institutions are intended to primarily provide meeting areas for religious activities. Accessory uses include facilities for instruction, parking, caretaker's housing, one transitional housing unit, and group living facilities such as convents. A transitional housing unit is a housing unit for one household where the average length of stay is less than 60 days. Examples of religious institutions include churches, temples, synagogues, and mosques.

Religious institutions are prohibited in all open space zones. They are conditional uses in single dwelling residential zones and multi-dwelling residential zones. They are allowed in all commercial zones.

Daycare

Daycare use includes day or evening care of two or more children outside of the children's homes, for a fee. Daycare uses also include the daytime care of teenagers or adults who need assistance or supervision. Accessory uses include offices, play areas, and parking. Examples include preschools, nursery schools, latch key programs, and adult daycare programs.

Daycare is a conditional use in all open space zones. In single dwelling residential zones and in R3, R2, and R1 multi-dwelling zones daycare is allowed in existing buildings used by colleges, medical centers, schools, religious institutions, and community services; it is a conditional use in all other buildings.

Other Categories

The miscellaneous "Other" Category includes the following: Daycare, Agriculture, Aviation and Surface Passenger Terminals, Detention Facilities, Mining, Radio and Television Broadcast Facilities, and Rail Lines and Utility Corridors.

Agriculture

Agriculture includes activities which raise, produce or keep plants or animals. Accessory uses include dwellings for proprietors and employees of the use, and animal training. Examples include breeding or raising of fowl or other animals; dairy farms; stables; riding academies; kennels or other animal boarding places; farming, truck gardening, forestry, tree farming; and wholesale plant nurseries.

Agriculture is allowed in all open space zones, and in RF and R20 single dwelling residential zones. It is a conditional use in R10 and R7 single dwelling residential zones and in CM and CS residential zones. It is prohibited in R5 and R2.5 single dwelling residential zones, in all multi-dwelling residential zones, and in CN1, CN2, CO1, CO2, and CM zones.

Aviation and Surface Passenger Terminals

Aviation and surface passenger terminals include facilities for the landing and takeoff of flying vehicles, including loading and unloading areas. Aviation facilities may be improved or unimproved. Aviation facilities may be for commercial carriers or for shared use by private aircraft. Aviation And Surface Passenger Terminals also include passenger terminals for aircraft, regional bus service, regional rail service, and regional marine transportation. Accessory uses include freight handling areas, concessions, offices, parking, maintenance and fueling facilities, and aircraft sales areas. Examples include airports, bus passenger terminals for regional bus service, railroad passenger stations for regional rail service, passenger docks for regional marine travel such as ocean-going cruise ships, air strips, seaplane facilities, and helicopter landing facilities.

Aviation and surface passenger terminals are prohibited in all open space zones, in the R20, R10, R7, R5, and R2.5 single dwelling residential zones, in all multi-dwelling residential zones, and in the CN1, CN2, CO1, CO2, CS, and CM commercial zones. They are conditional uses in RF single-dwelling residential zones and CG commercial zones. These uses completely destroy natural resources.

Detention Facilities

Detention facilities include facilities for the judicially required detention or incarceration of people. Inmates and detainees are under 24 hour supervision by sworn officers, except when on an approved leave. Accessory uses include offices, recreational and health facilities, therapy facilities, maintenance facilities, and hobby and manufacturing activities. Examples include prisons, jails, probation centers, and juvenile detention homes.

Detention facilities are prohibited in all open space zones, all single dwelling residential zones, all multi-dwelling residential zones, and in the CN1, CN2, CO1, CO2, CS, and CM commercial zones. They are a conditional use in the CG commercial zones. Their effects on resources are no more intensive than commercial zoning.

Mining

Mining includes mining or extraction of mineral or aggregate resources from the ground for off-site use. Accessory uses include storage, sorting, stockpiling, or transfer off-site of the mined material. Examples include quarrying or dredging for sand, gravel or other aggregate materials; mining; and oil, gas, or geothermal drilling.

Mining is a conditional use in all open space zones and in the RF single dwelling zone. It is prohibited in R20, R10, R7, R5, and R2.5 single dwelling zones, in all multi-dwelling residential zones, and in all commercial zones. Mining completely destroys natural resources.

Radio and Television Broadcast Facilities

Radio and television broadcast facilities include all devices, equipment, machinery, structures or supporting elements necessary to produce non-ionizing electromagnetic radiation within the range of frequencies from 100 KHz to 300 GHz and operating as a discrete unit to produce a signal or message. Towers may be self supporting, guyed, or mounted on poles or buildings. Accessory use may include transmitter facility buildings. Examples include broadcast towers, communication towers, and point to point microwave towers.

Most low powered transmitters such as cordless telephones, citizen band radios, etc. are allowed in all zones. Other radio and television broadcast facilities are conditional uses in all open space zones, all single dwelling residential zones, all multi-dwelling residential zones, and in all commercial zones. Their effects are the same as basic utilities, but with greater adverse visual effects.

Rail Lines and Utility Corridors

Rail lines and utility corridors include railroad tracks and lines for the movement of trains. The land may be owned or leased by the railroad. The category also includes public or private passageways, including easements, for the express purpose of transmitting or transporting electricity, gas, oil, water, sewage, communication signals, or other similar services on a regional level. Examples include rail trunk and feeder lines; regional electrical transmission lines; and regional gas and oil pipelines.

Rail lines and utility corridors are conditional uses in all open space zones, all single-dwelling residential zones, all multi-dwelling residential zones, and in all commercial zones.

Uses not Assigned to a Single Zoning Code Category

There are a few allowed uses that are not assigned to a single category by the city zoning code. These include infrastructure; various temporary, nonconforming, and revocable uses; and land divisions, partitions, and property line adjustments.

Infrastructure Uses

These uses include roads; water, sewer, electric, and cable television lines; other public and private utilities; and public safety facilities not described by the zoning code category "Basic Utilities." Infrastructure uses are allowed in all city zones, but only the city's State Goal 5 (environmental zone) and Goal 15 (greenway) regulations apply to public rights-of-way.

Nonconforming Uses

These are uses lawfully established under repealed provisions of the zoning code or maps, or established before the existence of any city zoning. They can be of any category listed above, and can occur in any zone.

Temporary Activities

These are uses that last one year or less. They can be of any category listed above, and can occur in any zone.

Revocable Permit Uses

These are uses that violated city zoning, but were allowed to continue by zoning code provisions that were repealed on January 1, 1991. These permits are no longer issued, and extensions are limited to three years, so most of these permits will expire before January 1, 1997. Revocable permit uses can be in any category, and can occur in any zone.

Land Divisions, Partitions, and Property Line Adjustments

These are City procedures that establish lots. These procedures apply to every zone, and prescribe where every allowed use can be carried out. The approved new lots usually allow more conflicting uses than the lots from which they were created.

Identification of Site Specific Conflicting Uses

The following pages describe which conflicts exist within each resource site.

Resource Site 124

Location: Fanno Creek Tributaries North of S.W. Hamilton Road and East of S.W. Dosch Road

Comprehensive Plan Designations:

Open Space

Single-Dwelling Residential

Conflicting Uses Present:

Household Living

Group Living

Retail Sales and Service

Commercial Outdoor Recreation

Basic Utilities

Community Service

Essential Service Providers

Parks and Open Areas

Schools

Colleges

Medical Centers

Religious Institutions

Daycare

Agriculture

Mining

Radio and Television Broadcast Facilities

Rail Lines and Utility Corridors

Infrastructure

Temporary

Land Divisions, Partitions, and Property Line Adjustments

Resource Site 125

Location: Fanno Creek Mainstream and Tributary Junctions

Comprehensive Plan Designations:

Open Space
Single-Dwelling Residential
Multi-Dwelling Residential
Neighborhood Commercial
Office Commercial
General Commercial

Conflicting Uses Present:

Household Living
Group Living
Retail Sales and Service
Office
Quick Vehicle Servicing
Vehicle Repair
Commercial Parking
Self-Service Storage
Commercial Outdoor Recreation
Major Event Entertainment
Manufacturing and Production
Warehouse and Freight Movement
Wholesale Sales
Industrial Service
Basic Utilities
Community Service
Essential Service Providers
Parks and Open Areas
Schools
Colleges
Medical Centers
Religious Institutions
Daycare
Agriculture
Aviation and Surface Passenger Terminals
Detention Facilities
Mining
Radio and Television Broadcast Facilities
Rail Lines and Utility Corridors
Infrastructure
Temporary
Revocable
Land Divisions, Partitions, and Property Line Adjustments

Resource Site 126

Location: Pendelton Tributary of Fanno Creek

Comprehensive Plan Designations:

Open Space

Single-Dwelling Residential

Conflicting Uses Present:

Household Living

Group Living

Retail Sales and Service

Commercial Outdoor Recreation

Basic Utilities

Community Service

Essential Service Providers

Parks and Open Areas

Schools

Colleges

Medical Centers

Religious Institutions

Daycare

Agriculture

Mining

Radio and Television Broadcast Facilities

Rail Lines and Utility Corridors

Infrastructure

Nonconforming

Temporary

Revocable

Land Divisions, Partitions, and Property Line Adjustments

Resource Site 127

Location: Vermont Tributary of Fanno Creek

Comprehensive Plan Designations:

Open Space
Single-Dwelling Residential
Multi-Dwelling Residential
Neighborhood Commercial
Storefront Commercial
General Commercial

Conflicting Uses Present:

Household Living
Group Living
Retail Sales and Service
Quick Vehicle Servicing
Vehicle Repair
Commercial Parking
Self-Service Storage
Commercial Outdoor Recreation
Major Event Entertainment
Manufacturing and Production
Warehouse and Freight Movement
Wholesale Sales
Industrial Service
Basic Utilities
Community Service
Essential Service Providers
Parks and Open Areas
Schools
Colleges
Medical Centers
Religious Institutions
Daycare
Agriculture
Aviation and Surface Passenger Terminals
Detention Facilities
Mining
Radio and Television Broadcast Facilities
Rail Lines and Utility Corridors
Infrastructure
Nonconforming
Temporary
Revocable
Land Divisions, Partitions, and Property Line Adjustments

Resource Site 128

Location: Woods (Multnomah) Tributary of Fanno Creek

Comprehensive Plan Designations: Open Space

Single-Dwelling Residential

Multi-Dwelling Residential

Neighborhood Commercial

Office Commercial

General Commercial

Conflicting Uses Present:

Household Living

Group Living

Retail Sales and Service

Office

Quick Vehicle Servicing

Vehicle Repair

Commercial Parking

Self-Service Storage

Commercial Outdoor Recreation

Major Event Entertainment

Manufacturing and Production

Warehouse and Freight Movement

Wholesale Sales

Industrial Service

Basic Utilities

Community Service

Essential Service Providers

Parks and Open Areas

Schools

Colleges

Medical Centers

Religious Institutions

Daycare

Agriculture

Aviation and Surface Passenger Terminals

Detention Facilities

Mining

Radio and Television Broadcast Facilities

Rail Lines and Utility Corridors

Infrastructure

Temporary

Revocable

Land Divisions, Partitions, and Property Line Adjustments

Resource Site 129

Location: North Fork Ash Creek Tributary of Fanno Creek

Comprehensive Plan Designations:

Single-Dwelling Residential
Neighborhood Commercial

Conflicting Uses Present:

Household Living
Group Living
Retail Sales and Service
Office
Quick Vehicle Servicing
Manufacturing and Production
Basic Utilities
Community Service
Essential Service Providers
Parks and Open Areas
Schools
Colleges
Medical Centers
Religious Institutions
Daycare
Agriculture
Radio and Television Broadcast Facilities
Rail Lines and Utility Corridors
Infrastructure
Temporary
Land Divisions, Partitions, and Property Line Adjustments

Resource Site 130

Location: South Fork Ash Creek Tributary of Fanno Creek

Comprehensive Plan Designations:

Open Space
Single-Dwelling Residential
Multi-Dwelling Residential
Neighborhood Commercial
Office commercial
General Commercial

Conflicting Uses Present:

Household Living
Group Living
Retail Sales and Service
Office
Quick Vehicle Servicing
Vehicle Repair
Commercial Parking
Self-Service Storage
Commercial Outdoor Recreation
Major Event Entertainment
Manufacturing and Production
Warehouse and Freight Movement
Wholesale Sales
Industrial Service
Basic Utilities
Community Service
Essential Service Providers
Parks and Open Areas
Schools
Colleges
Medical Centers
Religious Institutions
Daycare
Agriculture
Aviation and Surface Passenger Terminals
Detention Facilities
Mining
Radio and Television Broadcast Facilities
Rail Lines and Utility Corridors
Infrastructure
Temporary
Land Divisions, Partitions, and Property Line Adjustments

Resource Site 131

Location: Far Southwest Tributary of Fanno Creek East of I-5

Comprehensive Plan Designations:

Open Space
Single-Dwelling Residential
Multi-Dwelling Residential
Neighborhood Commercial
Office Commercial
General Commercial

Conflicting Uses Present:

Household Living
Group Living
Retail Sales and Service
Office
Quick Vehicle Servicing
Vehicle Repair
Commercial Parking
Self-Service Storage
Commercial Outdoor Recreation
Major Event Entertainment
Manufacturing and Production
Warehouse and Freight Movement
Wholesale Sales
Industrial Service
Basic Utilities
Community Service
Essential Service Providers
Parks and Open Areas
Schools
Colleges
Medical Centers
Religious Institutions
Daycare
Agriculture
Aviation and Surface Passenger Terminals
Detention Facilities
Mining
Radio and Television Broadcast Facilities
Rail Lines and Utility Corridors
Infrastructure
Temporary
Land Divisions, Partitions, and Property Line Adjustments

CONSEQUENCES

This section analyses the consequences of protecting the natural resources of the Fanno Creek Watershed, and the consequences of allowing these resources to be diminished or destroyed. The State Goal 5 Administrative Rule requires the City to look at these two extreme possible futures. This does not mean that either the City or the State prefers an all preservation or all development future. Many developments can occur with little or no harm to the environment, and mitigation can many natural values lost to careful development. The prescribed analytical method requires an assumptions that development will be does as carelessly as can be allowed under existing city land use regulations and in all significant natural resource areas that are not protected by existing land use regulations. This "worst case" analysis is, required before the City can go to the last section of this plan, decisions that balance reasonably expected conflicts between good development and good natural resource protection.

Method

This plan analyzes the following four types of consequences: economic, social, environmental and energy. These analyses consider both the effects on the resources of allowing conflicting uses, and the effects on the conflicting uses of protecting the resources. These effects can be either on-site or off-site. Other applicable Statewide Planning Goals are also considered in the analyses of these effects. An analysis is adequate for purposes of meeting the Goal 5 Rule²⁷ if it provides a jurisdiction with reasons why decisions are made for protecting specific resources.

Site Specific Consequences

The following pages include analyses for each resource site.

²⁷*Oregon Administrative Rules*, Chapter 660, Division 16.

Resource Site 124

Location: Fanno Creek Tributaries North of S.W. Hamilton Road and East of S.W. Dosch Road

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.²⁸ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion without protected natural resources.²⁹ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place worth living in or visiting.

²⁸The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

²⁹Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 571 acres of single-dwelling residential property in Resource Site 124. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 124 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Present high land values, absence of sidewalks, and limited transit service already discourage group living.³⁰ Comprehensive plan designations provide for new development on 7,000 and 10,000 square foot lots without regard to topographic or service limitations. The northwest portion of Resource Site 124 that is zoned R20 and cannot be developed to either its base zone or comprehensive plan density of R10 because of the absence of sanitary sewers and inability of the native silt and clay soils to support drain fields on lots smaller than about an acre. Property values in Resource Site 124 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 124 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.³¹

³⁰Transit Service is limited to Tri-Met Route 51 on S.W. Dosch and Route 55 on S.W. Hamilton.

³¹Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper presented at the 1991 Country in the City Conference (Portland, Oregon).

- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.³²
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.³³
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.³⁴
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.³⁵

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.³⁶ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.³⁷ Issuance of building permits in

³²T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

³³Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, May 1978.

³⁴John D. Cooper, Director of Parks, Boise, Idaho 1989.

³⁵"Cluster Builders' New Enticement: Adjacent Woods." *New York Times*, May 8, 1987.

³⁶See, for example, *Fanno Creek Streambank Restoration and Water Quality Plan*, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

³⁷Maps of landslide potential are part of the State record justifying acknowledgment of the Portland Comprehensive Plan for compliance with Statewide Goal 7.

floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 124. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.³⁸ The Metropolitan Service District projects that 75% of residential land constrained by slopes, 20% of residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.³⁹ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 124 are on steep slopes, along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations limiting residential development would impose more costs. These include

³⁸See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

³⁹Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 124 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 124 could provide 90% of the housing of provided unregulated alternative.⁴⁰ Since the Portland Metropolitan Region has an "under build" factor of 10%, approved development averages only 90% of the density allowed by comprehensive plans. This means that all housing opportunities lost to environmental protection in Resource Site 124 could be fully replaced by strict application of full comprehensive plan density requirements in unprotected areas.

Economic Consequences on Conflicting Commercial Uses

There is no commercial property in Resource Site 124.

⁴⁰Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres} / \text{Total Residential Acres})]$.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in the Fanno Creek Watershed.

Economic Consequences on Conflicting Open Space Uses

There are eight acres of open space property in Resource Site 124. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

In the absence of new regulations park land could be converted completely to lawns, parking lots, or agriculture; or to some conditional commercial uses. Economic benefits would accrue to the extent that free public recreation was replaced by commercial activities, but the value of adjoining residential property would be diminished by the off site effects of noise and traffic, and by the loss of the amenities that natural resources provide.

Regulations prohibiting the development of open space could also provide economic value. Flood, earthquake, and landslide hazards can be reduced through the protection of natural resources. Resource protection can reduce public health and safety hazards caused by flooding and landslides. Storm drainage infrastructure costs can be minimized by allowing wetlands in open spaces to provide flood retention and detention, aquifer recharge, sediment trapping, and water purification. Landslides can be prevented by preserving native forests on steep slopes.

Prohibitions would reduce the theoretical profitability of open space by prohibiting conditional uses like retail sales and service, commercial outdoor recreation, mining, and radio and TV broadcast facilities. Theoretical farm and forest uses would be eliminated. No land in Resource Site 124 is being managed for commercial forestry, but timber is often sold as forested land is converted to urban uses. Steep slopes and small parcel sizes in Resource Site 124 make agriculture impractical, but some sites could support the grazing of a few llamas or goats. These uses would also be lost by resource protection. Sufficient retail sales and services are provided along Beaverton-Hillsdale Highway, which is less than half a mile away from Resource Site 124. There are no known mineral and aggregate resources in resource Site 124 to be affected by prohibitions. Resource Site 124 is a mile-and-a-half away from the Healy Heights antenna farm. The seven existing towers have sufficient space for several new broadcast antennas, and existing regulations require tower sharing. There is no need for new towers in Resource Site 124, but prohibitions would preclude this theoretical opportunity.

Regulations limiting conflicting uses could be applied to about a quarter of Hamilton Park, the only open space in Resource Site 124. These regulations would protect a native forest next to Bridlemile School, and thus provide an excellent educational resource. The regulations would allow the use of a stream, riparian area, and wetland as a stormwater detention, but prohibit structures. These regulations would preserve most natural resource values, preserve free public recreation, and the economic benefits of preserved public safety would far outweigh the theoretical benefits of conditional commercial uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES

Social Consequences of Resource Protection

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 124 contains Hamilton Park. This park provides public greenspaces where visitors can recreate and enjoy natural amenities.

Protection of forest, riparian, and wetland resources in Hamilton Park will retain and increase the recreational and educational values. Ecological management will ensure that most of the "nature park" resources will remain undisturbed and its forests allowed to mature into an condition which will enhance the urban wilderness experience of park users. Retention and increase in abundance and diversity of native wildlife will mean greater aesthetic pleasure and educational benefits for area residents, and can interest and entice citizens to do things to enrich the environment. Recreational and educational values will continue and perhaps increase over time and will be preserved for the enjoyment of future generations.

Social Consequences on Aesthetic Values

Resource Site 124 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within Resource Site 124 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Site 124. Bridlemile School is the only school in Resource Site 124. There are no significant resources on school property, so educational opportunities would not be reduced by resource protection.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for

replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 124 will result in generally positive benefits in terms of continued and enhanced recreation and environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is

removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.

- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.
- Increases in peak runoffs. Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- Increases in creek temperature. Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60's and 70's can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- Increases in water pollution. Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the

Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;
- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and

groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property.

Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations. Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 124.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R20	20,000	25	none
R10	10,000	30	none
R7	7,000	35	none

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion.

Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species.

The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as

stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same traffic effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area unless it is being dedicated for preservation. If these procedures go unchecked the City will be placed in the position of allowing new development that is certain to destroy irreplaceable natural resources, or defending claims of regulatory taking.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.⁴¹

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can makes the water muddy. Grains of silt in muddy water can form an abrasive that can causes even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

⁴¹Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES**Energy Consequences of Resource Protection**

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings.

Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES**General Summary of all Consequences**

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a custom market. This change would be partially due to new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 124 provides spawning sites for fish swimming up through Resource Site 125, portions of the Fanno Creek Watershed west of the Portland City Limits, and portion of the Tualatin River Watershed downstream from the conjunction of Fanno Creek with the Tualatin River

Resource Site 125

Location: Fanno Creek Mainstream and Tributary Junctions

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.⁴² Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion without protected natural resources.⁴³ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place worth living in or visiting.

⁴²The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

⁴³Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 1049 acres of single-dwelling and 185 acres of multi-dwelling residential property in Resource Site 125. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 125 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Transit service and pedestrian amenities are sufficient to support group living.⁴⁴ High property values tend to discourage group living facilities, but Multnomah County has donated at least one tax forfeited single-dwelling property in Resource Site 125 for a group living facility. Comprehensive plan designations provide for new single-dwelling development on 5,000 to 10,000 square foot lots without regard to topographic or service limitations. Other designations provide for multi-dwelling development along Beaverton-Hillsdale Highway, but much of this land is in floodways. Property values in Resource Site 125 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 125 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.⁴⁵

⁴⁴Transit Service includes Tri-Met Route 51 on S.W. Dosch, 55 on S.W. Hamilton and Sunset, and 54, 56, and 92 on Beaverton-Hillsdale Highway.

⁴⁵Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper

- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.⁴⁶
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.⁴⁷
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.⁴⁸
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.⁴⁹

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.⁵⁰ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.⁵¹ Issuance of building permits in

presented at the 1991 Country in the City Conference (Portland, Oregon).

⁴⁶T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

⁴⁷Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, May 1978.

⁴⁸John D. Cooper, Director of Parks, Boise, Idaho 1989.

⁴⁹"Cluster Builders' New Enticement: Adjacent Woods." *New York Times*, May 8, 1987.

⁵⁰See, for example, *Fanno Creek Streambank Restoration and Water Quality Plan*, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

⁵¹Maps of landslide potential are part of the State record justifying acknowledgment of the

floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 125. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.⁵² The Metropolitan Service District projects that 75% of single-dwelling residential land constrained by slopes, 25% of multi-dwelling residential land constrained by slopes, 20% of land all residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.⁵³ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 125 are on steep slopes, along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations

Portland Comprehensive Plan for compliance with Statewide Goal 7.

⁵²See the Metropolitan Housing Rule which was adopted by LCDRC to carry out Statewide Planning Goal 10.

⁵³Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

limiting residential development would impose more costs. These include the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 125 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 125 could provide 95% of the housing of provided by the unregulated alternative.⁵⁴ The same program could provide nearly as much multi-family housing as the unregulated alternative.⁵⁵ This is less to the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities lost to environmental protection could be more than replaced by strict application of full comprehensive plan density requirements in unprotected areas.

⁵⁴Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Single-Dwelling Residential Acres} / \text{Total Single-Dwelling Residential Acres})]$.

⁵⁵Formula used is $100 - [\text{Under Build Factor of } 0.20 \times (\text{Protected Multi-Dwelling Residential Acres} / \text{Total Multi-Dwelling Residential Acres})]$.

Economic Consequences on Conflicting Commercial Uses

There are 44 acres of commercial property in Resource Site 125. The principle conflicting uses of commercial property are retail sales and service, office, quick vehicle servicing, vehicle repair, commercial parking, self-service storage, commercial outdoor recreation, and major event entertainment. Other conflicting uses include manufacturing and production, warehouse and freight movement, wholesale sales, industrial service, basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

Left unregulated commercial development would provide additional retail sales and service opportunities along Beaverton-Hillsdale Highway (current vacancy rate of 5%). Present and significant future demand for office space is met by the downtown (current vacancy rate of 16%) and the Lloyd Center areas (current vacancy rate of 4%). Beaverton-Hillsdale Highway serves as a neighborhood shopping district with several shops generally organized around a supermarket. Available land provides for a slight expansion of these retail activities, but cannot accommodate new or campus type conflicting uses theoretically allowed by the code. Retail expansions would provide some additional employment that would benefit the economy and tax base. These expansions would also require the filling of wetlands, construction in floodways, and building on steep slopes. The type of effects on natural resources would be the same as those described for residential development, but more pronounced, because commercial development tends to completely cover sites with parking lots and structures.

Loss of natural resource amenities would have adverse economic effects on commercial property. According to corporate real estate executives, "quality of life" issues are now as important as cost when choosing new office or factory locations.⁵⁶ A location which will help attract and retain key personnel was cited as the most important factor in choosing new office locations and the fifth most important in choosing manufacturing locations.⁵⁷ The Joint Economic Committee of the United States Congress reports that a city's quality of life is more important than purely business-related factors when it comes to attracting new businesses, particularly in the high-tech and service industries.⁵⁸ Recently, Portland was ranked the third-best city in the United States to locate a business by the 1990 *Cushman & Wakefield Monitor*, an annual nationwide survey of 400 chief executive

⁵⁶San Francisco Chronicle, June 8, 1989.

⁵⁷*Ibid.*

⁵⁸Fact Sheet: Sign Control and Economic Development, Scenic America, Washington, D.C. November-December 1987.

officers on economic and business-related issues. According to Thomas Usher, Cushman and Wakefield's Senior Vice President, quality of life was a key factor in Portland's high popularity.

The filling and piping of Fanno Creek would have some adverse economic effects due to the loss of regional or national conference business. Environment-related conferences often use Portland because of easily-accessed natural resources within the city limits. The 1990 Country-in-the-City Symposium, attracting international participants, used Fanno Creek as a field site for conference sessions. Conferences such as County-in-the-City draw participants and speakers from the metropolitan area and around the country. Tourism might be diminished. Dollar expenditures on tourism and convention-type activities are difficult to identify. However, in 1988, Defenders of Wildlife conducted a survey of Oregon households on the economic impact of nongame wildlife and concluded that an average annual household expenditure of about \$348 was attributed to travel and over \$600 to photography and optical equipment directly related to wildlife enjoyment.⁵⁹

The loss of natural resources could also have a souring effect on local retail sales and service. According to a 1988 survey conducted for the Defenders of Wildlife, Oregon households spent an average of over \$8,600 on recreation activities related to nongame wildlife. Of these annual expenditures, over \$2,300 (photographic and optical equipment, bird seed, clothing, magazines and books, landscaping for wildlife, boats, etc.) could be used on wildlife-related activities in Portland. Similar studies have also illustrated a positive economic impact on local businesses as a result of expenditures on recreation activities. The disaster, regulatory, insurance, and legal costs destroying all natural resources would be the same as those described for residential development.

Regulations prohibiting new commercial development would preserve natural values and public safety, particularly fish passage and flood conveyance. These same regulations would also prohibit the expansion of retail sales and service. Expansion opportunities are limited, but these prohibitions could have some dampening effect on employment and tax base. Maximum theoretical employment loss in Resource Site 125 would be 72 jobs.⁶⁰

Regulations limiting commercial uses could preserve most resource values and most employment opportunities. Commercial land north of Beaverton-Hillsdale Highway is constrained by floodways and wetlands, and commercial land north of Beaverton-Hillsdale Highway is constrained by slopes. By

⁵⁹"Nongame Wildlife Assessment Survey." Defenders of Wildlife, 1988.

⁶⁰Formula is Metro projected employment growth per acre x conserved acres of commercial property.

limiting conserved areas to land with physical constraints, theoretical employment loss over the next 50 years in the retail sales and service sector could be limited to 14 jobs.⁶¹

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in Resource Site 125.

Economic Consequences on Conflicting Open Space Uses

There are 59 acres of open space property in Resource Site 125. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

In the absence of new regulations park land could be converted completely to lawns, parking lots, or agriculture; or to some conditional commercial uses. Economic benefits would accrue to the extent that free public recreation was replaced by commercial activities, but the value of adjoining residential property would be diminished by the off site effects of noise and traffic, and by the loss of the amenities that natural resources provide.

Regulations prohibiting the development of open space could also provide economic value. Flood, earthquake, and landslide hazards can be reduced through the protection of natural resources. Resource protection can reduce public health and safety hazards caused by flooding and landslides. Storm drainage infrastructure costs can be minimized by allowing wetlands in open spaces to provide flood retention and detention, aquifer recharge, sediment trapping, and water purification. Landslides can be prevented by preserving native forests on steep slopes.

Prohibitions would reduce the theoretical profitability of open space by prohibiting conditional uses like retail sales and service, commercial outdoor recreation, mining, and radio and TV broadcast facilities. Theoretical farm and forest uses would be eliminated. No land in Resource Site 125 is being managed for commercial forestry, but timber is often sold as forested land is converted to urban uses. Steep slopes and small parcel sizes in Resource Site 125 make agriculture impractical, but some sites could support the grazing of a few llamas or goats. These uses would also be lost by resource protection. Sufficient retail sales and services are provided along Beaverton-Hillsdale Highway, which is part of Resource Site 125. There are no known mineral and aggregate resources in resource Site 125 to be affected by prohibitions. Resource Site 125 is adjacent to the Healy Heights antenna farm. The seven

⁶¹Formula is acres of conserved commercial property x Metro under build factor of 0.20.

existing towers have sufficient space for several new broadcast antennas, and existing regulations require tower sharing. There is no need for new towers in Resource Site 125, but prohibitions would preclude this theoretical opportunity.

Regulations limiting conflicting uses could be applied to Council Crest, Albert Kelly and Hillsdale Parks, the only designated open space in Resource Site 125. These regulations would protect a native forests. These regulations would preserve most natural resource values, preserve free public recreation, and the economic benefits of preserved public safety would far outweigh the theoretical benefits of conditional commercial uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES

Social Consequences of Resource Protection

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 125 contains several city parks. The parks provide public greenspaces where visitors can recreate and enjoy the natural amenities of the Pacific Northwest.

Protection of Fanno Creek Watershed forest and open space resources will retain and increase the recreational and educational values of parks. Ecological management will ensure that most of the "nature park" resources will remain undisturbed and its forests allowed to mature into an condition which will enhance the urban wilderness experience of park users. Retention and increase in abundance and diversity of native wildlife will mean greater aesthetic pleasure and educational benefits for area residents, and can interest and entice citizens to do things to enrich the environment. Recreational and educational values will continue and perhaps increase over time and will be preserved for the enjoyment of future generations.

Social Consequences on Aesthetic Values

The Fanno Creek Watershed provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within the Fanno Creek Watershed form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

The residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. Protected natural resources in public park land would be near Robert Gray and Wilson Schools, and thus convenient for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 125.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the

abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats.

As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Green spaces such as those in the Fanno Creek Watershed provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in the Fanno Creek Watershed will result in generally positive benefits in terms of continued and enhanced recreation and environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.
- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.
- Increases in peak runoffs. Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- Increases in creek temperature. Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60°s and 70°s can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- Increases in water pollution. Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;

- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property. Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 125.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none
R5	5,000	45	none
R2.5	2,500	50	none
Multi-Dwelling Zones			
R2	4,000	50	30

Environmental Consequences of Commercial Uses

Removal of forest cover is allowed in commercial zones and generally has the same effects as described under agriculture above. Residential use is allowed in commercial zones at multifamily densities. Commercial use has all the landscape and residential effects described above, but increased lot coverage allowances compound the problem of impermeable surfaces. Commercial categories also generate more traffic than household living, and diminish or destroy open space, scenic values and recreational opportunities.

The following chart describes the commercial zones present in Resource Site 125.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Commercial Zones			
CN2	none	65	15
CO1	none	50	15
CO2	none	65	15
CG	none	85	15

Commercial zoning is dominant along Beaverton-Hillsdale Highway west of SW 45th Avenue. The main stem of Fanno Creek flows along the north side of this section of the highway. The general commercial zone allows manufacturing and production. This use can cause "industrial type" pollution of water and air.

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian

sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species.

The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and

minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.⁶²

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can makes the water muddy. Grains of silt in muddy water can form an abrasive that can causes even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

⁶²Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES**Energy Consequences of Resource Protection**

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings.

Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES**General Summary of all Consequences**

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 125 provides rearing and feeding sites for fish spawned in Resource Site 124 and rearing, feeding, and spawning sites for fish swimming up through portions of the Fanno Creek Watershed west of the Portland City Limits and portions of the Tualatin River Watershed downstream from the conjunction of Fanno Creek with the Tualatin River. The deeper pools, often created by beavers, in this site are especially important during low flows. Site 125 provides wildlife connections to Site 126 through the Southern Pacific rail right-of-way. This connection continues west of the City Limits through the Tualatin Valley Parks and Recreation District's rails-to-trails program.

Resource Site 126

Location: Pendelton Tributary of Fanno Creek

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.⁶³ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion furthest from the protected natural resource.⁶⁴ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place perceived as worth living in or visiting.

⁶³The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

⁶⁴Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 239 acres of single-dwelling residential property in Resource Site 126. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 126 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Transit service and pedestrian amenities are limited in Resource Site 126, and these limitations tend to discourage group living.⁶⁵ Nevertheless, there is one retirement home within this site. Comprehensive plan designations provide for new development on 7,000 and 10,000 square foot lots without regard to topographic or service limitations. Property values in Resource Site 126 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 126 is only part of part of the Fanno Creek Watershed without significant hills. It has views of the West Hills and enjoys many of the same amenities keep property values in Southwest Portland higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.⁶⁶

⁶⁵Transit Service is limited to Tri-Met Route 1 on S.W. Cameron and Shattock.

⁶⁶Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper presented at the 1991 Country in the City Conference (Portland, Oregon).

- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.⁶⁷
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.⁶⁸
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.⁶⁹
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.⁷⁰

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.⁷¹ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.⁷² Issuance of building permits in

⁶⁷T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

⁶⁸Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, May 1978.

⁶⁹John D. Cooper, Director of Parks, Boise, Idaho 1989.

⁷⁰"Cluster Builders' New Enticement: Adjacent Woods." *New York Times*, May 8, 1987.

⁷¹See, for example, *Fanno Creek Streambank Restoration and Water Quality Plan*, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

⁷²Maps of landslide potential are part of the State record justifying acknowledgment of the Portland Comprehensive Plan for compliance with Statewide Goal 7.

floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 126. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.⁷³ The Metropolitan Service District projects that 75% of residential land constrained by slopes, 20% of residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.⁷⁴ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 126 are upland forests, or along drainageways and the abandoned Southern Pacific right-of-way, or in wetlands. Even in the complete absence of regulation, development in wetlands and drainageways involves spending more time and money than development dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations limiting residential

⁷³See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

⁷⁴Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

development would impose more costs. These include the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 126 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 126 could provide 96% of the single-dwelling housing of provided by the unregulated alternative.⁷⁵ This is less than the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities lost to environmental protection could be more than replaced by strict application of full comprehensive plan density requirements in unprotected areas.

Economic Consequences on Conflicting Commercial Uses

There is no commercial property in Resource Site 126.

⁷⁵Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres} / \text{Total Residential Acres})]$.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in Resource Site 126 but industrial activities do continue as nonconforming uses in a residential zone on a dairy property on the extreme western end of the site. Significant Resource Site 126 values on the dairy property are limited to an abandoned railroad right-of-way on the northern edge. Conservation of native vegetation along this strip will not interfere with dairy expansion, or the conversion of the site to residences. This is the only site in the Fanno Creek Watershed, not presently used as a school, park, or church, with enough site area for a new school, college, medical center, or other campus type commercial use. The conservation of the abandoned right-of-way would not interfere with the conversion of the dairy site to these uses.

Economic Consequences on Conflicting Open Space Uses

There are seven acres of open space property in Resource Site 126. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

Less than one acre of native vegetation along the northern edge of Pendelton Park along the abandoned Southern and Pacific railroad was identified as significant natural resource. Conservation of this vegetation is critical for the maintenance of a wildlife corridor, and will have no economic consequences for open space uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES**Social Consequences of Resource Protection**

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 126 contains Pendelton Park. Although this park is adjacent to Hayhurst School and provides significant recreational opportunities, the natural resources along the northern edge of this park are not particularly suited for environmental education.

Social Consequences on Aesthetic Values

Resource Site 126 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

Forested areas within Resource Site 126 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 126. Hayhurst School is in Resource Site 126. There are no significant resources on school property, so educational opportunities would not be reduced by resource protection.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 126 will result in generally positive benefits in terms of continued and enhanced recreation and environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES**Environmental Consequences of Resource Protection**

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.
- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.
- Increases in peak runoffs. Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- Increases in creek temperature. Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60's and 70's can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- Increases in water pollution. Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;

- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property. Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 126.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species. The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space.
Institutional structures have the same effects as commercial development.
The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.⁷⁶

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

⁷⁶Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can make the water muddy. Grains of silt in muddy water can form an abrasive that can cause even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES**Energy Consequences of Resource Protection**

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings.

Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES

General Summary of all Consequences

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences

are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 126 provides water necessary to support rearing and feeding sites for fish using the Fanno Creek Watershed west of the Portland City Limits. Site 126 provides wildlife connections to Site 125 through the Southern Pacific rail right-of-way.

Resource Site 127

Location: Vermont Tributary of Fanno Creek

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.⁷⁷ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion furthest from the protected natural resource.⁷⁸ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place perceived as worth living in or visiting.

⁷⁷The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

⁷⁸Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 512 acres of single-dwelling residential and 32 acres of multi-dwelling residential property in Resource Site 127. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 127 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Transit service is sufficient to support group living but pedestrian amenities are poor.⁷⁹ Comprehensive plan designations provide for new single-dwelling attached housing on 2,500 square foot lots, new single-dwelling detached housing on 5,000 and 7,000 square foot lots without regard to topographic or service limitations. Comprehensive Plan designations provide new multi-dwelling housing along S.W. Multnomah, Garden Home and Canby between S.W. 45th and Capitol Highway. Some of this multi-dwelling land along S.W. Multnomah is severely constrained by steep slopes, flooded areas, and wetlands. Property values in Resource Site 127 would, in the absence of new regulations, increase to the extent that land and services could support new residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 127 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.⁸⁰

⁷⁹Transit Service includes Tri-Met Route 1 on S.W. Vermont and 45th, 41 on S.W. Capitol Highway, and 45 on S.W. Garden Home.

⁸⁰Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper

- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.⁸¹
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.⁸²
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.⁸³
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.⁸⁴

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.⁸⁵ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.⁸⁶ Issuance of building permits in

presented at the 1991 Country in the City Conference (Portland, Oregon).

⁸¹T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

⁸²Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, May 1978.

⁸³John D. Cooper, Director of Parks, Boise, Idaho 1989.

⁸⁴"Cluster Builders' New Enticement: Adjacent Woods." *New York Times*, May 8, 1987.

⁸⁵See, for example, *Fanno Creek Streambank Restoration and Water Quality Plan*, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

⁸⁶Maps of landslide potential are part of the State record justifying acknowledgment of the

floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 127. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.⁸⁷ The Metropolitan Service District projects that 75% of single-dwelling residential land and 25% of the multi-dwelling residential land constrained by slopes, 20% of all residential land constrained by floodplains, and none of the residential land constrained by wetlands will be developed over the next 50 years.⁸⁸ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 127 are on steep slopes, along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations

Portland Comprehensive Plan for compliance with Statewide Goal 7.

⁸⁷See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

⁸⁸Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

limiting residential development would impose more costs. These include the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 127 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 127 could provide 95% of the single-dwelling housing of provided by the unregulated alternative.⁸⁹ The same program could achieve 87% of the multi-dwelling housing provided by the unregulated alternative.⁹⁰ Considering both figures together, the expected reduction in housing is close to the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities lost to environmental protection could be more than replaced

⁸⁹Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres}/\text{Total Residential Acres})]$.

⁹⁰Formula used is $100 - [\text{Under Build Factor of } 0.20 \times (\text{Protected Multi-Dwelling Residential Acres}/\text{Total Multi-Dwelling Residential Acres})]$.

by strict application of full comprehensive plan density requirements in unprotected areas.

Economic Consequences on Conflicting Commercial Uses

There are 15 acres of commercial property in Resource Site 127. The principle conflicting uses of commercial property are retail sales and service, office, quick vehicle servicing, vehicle repair, commercial parking, self-service storage, commercial outdoor recreation, and major event entertainment. Other conflicting uses include manufacturing and production, warehouse and freight movement, wholesale sales, industrial service, basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

There is less than one acre of significant natural resources identified on commercial property on resource site 127⁹¹. These areas include a few square feet riparian area and wetland behind a delicatessen on S.W. Vermont; a steep slope, riparian area and wetland behind the parking lot of the offices of a pizza take-out store near the intersection of S.W. 45th and Multnomah, and a steep slope, drainageway, and wetland west of the Post Office off S.W. Multnomah. The harm to employment and other economic benefits from protecting these resources is too small to analyze in any meaningful way. Any development in these areas would involve the filling of wetlands, construction in floodways, and building on steep slopes. The type of effects on natural resources would be the same as those described for residential development, but more pronounced, because commercial development tends to completely cover sites with parking lots and structures. Public safety and compliance with Clean Water Act obligations would be severely compromised by this development. The type of commercial activities needed in Resource Site 127, convenience groceries, delicatessens, pizza take-out, and video rentals, are already met. The identified areas are critical for wildlife connections and other values. Protection of these values clearly outweighs theoretical commercial expansions.

⁹¹For the purpose of report summaries fractions of acres are rounded to the nearest whole, unless the nearest whole number is zero, in which case the fraction is rounded to one.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in Resource Site 127 but industrial activities do continue as nonconforming uses in a residential zone on a dairy property on the extreme western end of the site. Significant Resource Site 127 values on the dairy property are limited to a stream, riparian area, and wetlands near the southern edge of this property. Protection of these resources would not interfere with dairy expansion, or the conversion of the site to residences. This is the only site in the Fanno Creek Watershed, not presently used as a school, park, or church, with enough site area for a new school, college, medical center, or other campus type commercial use. The protection of natural resources along the southern edge of the dairy property would not prevent the conversion of the dairy site to these uses.

Economic Consequences on Conflicting Open Space Uses

There are 82 acres of open space property in Resource Site 127. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

In the absence of new regulations park land could be converted completely to lawns, parking lots, or agriculture; or to some conditional commercial uses. Economic benefits would accrue to the extent that free public recreation was replaced by commercial activities, but the value of adjoining residential property would be diminished by the off site effects of noise and traffic, and by the loss of the amenities that natural resources provide.

Regulations prohibiting the development of open space could also provide economic value. Flood, earthquake, and landslide hazards can be reduced through the protection of natural resources. Resource protection can reduce public health and safety hazards caused by flooding and landslides. Storm drainage infrastructure costs can be minimized by allowing wetlands in open spaces to provide flood retention and detention, aquifer recharge, sediment trapping, and water purification. Landslides can be prevented by preserving native forests on steep slopes.

Prohibitions would reduce the theoretical profitability of open space by prohibiting conditional uses like retail sales and service, commercial outdoor recreation, mining, and radio and TV broadcast facilities. Theoretical farm and forest uses would be eliminated. No land in Resource Site 127 is being managed for commercial forestry, but timber is often sold as forested land is converted to urban uses. Small parcel sizes make in Resource Site 127 make agriculture impractical, but some sites could support the grazing of small mammals, of the growing of fresh market vegetables. These uses would also

be lost by resource protection. Sufficient retail sales and services are provided along Beaverton-Hillsdale Highway, which is part of Resource Site 125. There are no known mineral and aggregate resources in resource Site 127 to be affected by prohibitions. Resource Site 127 is too low for an antenna farm.

Regulations limiting conflicting uses could be applied to part of Gabriel Park, the only designated open space in Resource Site 127. These regulations would protect a native forests, streams and wetlands. These regulations would preserve most natural resource values, preserve free public recreation, and the economic benefits of preserved public safety would far outweigh the theoretical benefits of conditional commercial uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES

Social Consequences of Resource Protection

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 127 contains Gabriel Park. This park provides public greenspaces where visitors can recreate and enjoy natural amenities.

Protection forest, riparian, and wetland resources in Gabriel Park will retain and increase the recreational and educational values. Ecological management will ensure that most of the "nature park" resources will remain undisturbed and its forests allowed to mature into an condition which will enhance the urban wilderness experience of park users. Retention and increase in abundance and diversity of native wildlife will mean greater aesthetic pleasure and educational benefits for area residents, and can interest and entice citizens to do things to enrich the environment. Recreational and educational values will continue and perhaps increase over time and will be preserved for the enjoyment of future generations.

Social Consequences on Aesthetic Values

Resource Site 127 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within Resource Site 127 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 127. There are no schools in Resource Site 127, so educational opportunities would not be reduced by resource protection. Gabriel Park is a regional resource which has served as a field site for state and national conferences on urban watersheds and wetland restoration. It is an excellent educational resource.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and

subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 127 will result in generally positive benefits in terms of continued and enhanced recreation and environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly

susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.

- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.
- Increases in peak runoffs. Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- Increases in creek temperature. Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60°s and 70°s can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- Increases in water pollution. Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the

food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;
- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and

groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property.

Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects. Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat. Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to

local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 127.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none
R2.5	2,500	50	none
Multi-Dwelling Zones			
R2	4,000	50	30
R1	10,000	60	20

Environmental Consequences of Commercial Uses

Removal of forest cover is allowed in commercial zones and generally has the same effects as described under agriculture above. Residential use is allowed in commercial zones at multifamily densities. Commercial use has all the landscape and residential effects described above, but increased lot coverage allowances compound the problem of impermeable surfaces. Commercial categories also generate more traffic than household living, and diminish or destroy open space, scenic values and recreational opportunities.

The following chart describes the commercial zones present in Resource Site 127.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Commercial Zones			
CN2	none	65	15
CS	none	50	none
CG	none	85	15

Commercial zoning in Resource Site 127 is present at the intersection of SW Multnomah Boulevard and SW 45th Avenue. It should be noted that the

general commercial zone allows manufacturing and production. This use can cause "industrial type" pollution of water and air.

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade

streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species.

The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.⁹²

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can makes the water muddy. Grains of silt in muddy water can form an abrasive that can causes even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES**Energy Consequences of Resource Protection**

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

⁹²Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings.

Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES**General Summary of all Consequences**

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a

custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 127 provides water necessary to support rearing and feeding sites for fish using the Fanno Creek Watershed west of the Portland City Limits. Site 127 provides wildlife connections to Site 128 through the Oregon Electric rail right-of-way.

Resource Site 128

Location: Woods (Multnomah) Tributary of Fanno Creek

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.⁹³ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion furthest from the protected natural resource.⁹⁴ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place perceived as worth living in or visiting.

⁹³The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

⁹⁴Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 504 acres of single-dwelling and 29 acres of multi-dwelling residential property in Resource Site 128. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 128 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Limited transit service and pedestrian amenities already discourage group living.⁹⁵ Group living facilities do, however, exist on the north side of Multnomah Boulevard, demonstrating that residents who are confined during a course of treatment, do not require these amenities. Transit and sidewalks may, however, be very important to visitors. Comprehensive plan designations provide for new development on 5,000 and 7,000 square foot lots without regard to topographic or service limitations. There is a small amount of multi-dwelling property on the S.W. Corner of the intersection of S.W. Multnomah and 45th. Property values in Resource Site 128 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 128 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

⁹⁵Transit Service is limited to Tri-Met Route 45 on S.W. Spring Garden and Route 41 on S.W. Capitol highway.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.⁹⁶
- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.⁹⁷
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.⁹⁸
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.⁹⁹
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.¹⁰⁰

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.¹⁰¹ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the

⁹⁶Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper presented at the 1991 Country in the City Conference (Portland, Oregon).

⁹⁷T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

⁹⁸Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." Land Economics, May 1978.

⁹⁹John D. Cooper, Director of Parks, Boise, Idaho 1989.

¹⁰⁰"Cluster Builders' New Enticement: Adjacent Woods." New York Times, May 8, 1987.

¹⁰¹See, for example, Fanno Creek Streambank Restoration and Water Quality Plan, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.¹⁰² Issuance of building permits in floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 128. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.¹⁰³ The Metropolitan Service District projects that 75% of residential land constrained by slopes, 20% of residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.¹⁰⁴ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 128 are on steep slopes,

¹⁰²Maps of landslide potential are part of the State record justifying acknowledgment of the Portland Comprehensive Plan for compliance with Statewide Goal 7.

¹⁰³See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

¹⁰⁴Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations limiting residential development would impose more costs. These include the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 128 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 128 could provide 95% of the single-dwelling housing of provided by the unregulated alternative.¹⁰⁵ The same program could achieve all of the multi-dwelling housing provided by the unregulated alternative.¹⁰⁶

¹⁰⁵Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres} / \text{Total Residential Acres})]$.

¹⁰⁶There is less than an acre of multi-family zoning in Resource Site 128 with significant values. The values are primarily scenic, and were identified in the City-wide inventory of scenic resources. Most of this area is in a right-of-rather than lots. The economic effects of

Expected housing is within the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities theoretically lost to environmental protection could be more than replaced by strict application of full comprehensive plan density requirements in unprotected areas.

Economic Consequences on Conflicting Commercial Uses

There are 21 acres of commercial property in Resource Site 128. The principle conflicting uses of commercial property are retail sales and service, office, quick vehicle servicing, vehicle repair, commercial parking, self-service storage, commercial outdoor recreation, and major event entertainment. Other conflicting uses include manufacturing and production, warehouse and freight movement, wholesale sales, industrial service, basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

There is less than one acre of significant natural resources identified on commercial property on resource site 128¹⁰⁷. This property is a nearly vertical slope between S.W. Taylors Ferry and Interstate-5. There is a drainageway and wetland at the bottom of the slope; and the few square feet of resources identified provide flood conveyance, erosion control, and slope stability values. The adverse economic effects of protecting this area are too small to calculate.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in the Fanno Creek Watershed.

Economic Consequences on Conflicting Open Space Uses

There are 42 acres of open space property in Resource Site 128. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

conserving this area are too small to calculate.

¹⁰⁷For the purpose of report summaries fractions of acres are rounded to the nearest whole, unless the nearest whole number is zero, in which case the fraction is rounded to one.

In the absence of new regulations park land could be converted completely to lawns, parking lots, or agriculture; or to some conditional commercial uses. Economic benefits would accrue to the extent that free public recreation was replaced by commercial activities, but the value of adjoining residential property would be diminished by the off site effects of noise and traffic, and by the loss of the amenities that natural resources provide.

Regulations prohibiting the development of open space could also provide economic value. Flood, earthquake, and landslide hazards can be reduced through the protection of natural resources. Resource protection can reduce public health and safety hazards caused by flooding and landslides. Storm drainage infrastructure costs can be minimized by allowing wetlands in open spaces to provide flood retention and detention, aquifer recharge, sediment trapping, and water purification. Landslides can be prevented by preserving native forests on steep slopes.

Prohibitions would reduce the theoretical profitability of open space by prohibiting conditional uses like retail sales and service, commercial outdoor recreation, mining, and radio and TV broadcast facilities. Theoretical farm and forest uses would be eliminated. No land in Resource Site 128 is being managed for commercial forestry, but timber is often sold as forested land is converted to urban uses. Steep slopes and small parcel sizes in Resource Site 128 make agriculture impractical, but some sites could support grazing or truck gardens. These uses would also be lost by resource protection. Sufficient retail sales and services are provided along Barbur Boulevard and Capitol Highway, which are both within a half mile of Resource Site 128. There are no known mineral and aggregate resources in resource Site 128 to be affected by prohibitions. Resource Site 128 is too low for an antenna farm.

Regulations limiting conflicting uses could be applied to April Hill and Woods Parks, the only designated open space in Resource Site 128. These regulations would protect native forests, streams, wetlands, and riparian areas. These regulations would preserve most natural resource values, preserve free public recreation, and the economic benefits of preserved public safety would far outweigh the theoretical benefits of conditional commercial uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES

Social Consequences of Resource Protection

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 128 contains April Hill and Woods Parks. These parks provides public greenspaces where visitors can recreate and enjoy natural amenities.

Protection forest, riparian, and wetland resources these parks will retain and increase the recreational and educational values. Ecological management will ensure that most of the "nature park" resources will remain undisturbed and its forests allowed to mature into an condition which will enhance the urban wilderness experience of park users. Retention and increase in abundance and diversity of native wildlife will mean greater aesthetic pleasure and educational benefits for area residents, and can interest and entice citizens to do things to enrich the environment. Recreational and educational values will continue and perhaps increase over time and will be preserved for the enjoyment of future generations.

Social Consequences on Aesthetic Values

Resource Site 128 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within Resource Site 128 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 128. Maplewood School is in Resource Site 128. There are no significant resources on school property, so educational opportunities would not be reduced by resource protection. Maplewood School is, however, very close to April Hill Park. There is a Greenspaces grant to restore, enhance, and interpret natural values in this park. These values will aid elementary education.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 128 will result in generally positive benefits in terms of continued and enhanced recreation and

environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.
- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.

- **Increases in peak runoffs.** Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- **Increases in creek temperature.** Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60's and 70's can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- **Increases in water pollution.** Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;
- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the

natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property.

Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental

impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional

forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential

construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 128.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none
Multi-Dwelling Zones			
R2	4,000	50	30

Environmental Consequences of Commercial Uses

Removal of forest cover is allowed in commercial zones and generally has the same effects as described under agriculture above. Residential use is allowed in commercial zones at multifamily densities. Commercial use has all the landscape and residential effects described above, but increased lot coverage allowances compound the problem of impermeable surfaces. Commercial categories also generate more traffic than household living, and diminish or destroy open space, scenic values and recreational opportunities.

The following chart describes the commercial zones present in Resource Site 128.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Commercial Zones			
CN2	none	65	15
CO1	none	50	15
CO2	none	65	15
CG	none	85	15

There is less than one acre of commercial zoning on significant resources within resource site 128.

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species. The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.¹⁰⁸

¹⁰⁸Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can make the water muddy. Grains of silt in muddy water can form an abrasive that can cause even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES**Energy Consequences of Resource Protection**

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of

buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings. Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno

Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES

General Summary of all Consequences

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and

energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 128 provides rearing, feeding and spawning sites for fish for fish swimming up through portions of the Fanno Creek Watershed west of the Portland City Limits and portions of the Tualatin River Watershed downstream from the conjunction of Fanno Creek with the Tualatin River. Site 128 provides wildlife connections to Site 127 through the Oregon Electric rail right-of-way.

Resource Site 129

Location: North Fork Ash Creek Tributary of Fanno Creek

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.¹⁰⁹ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion furthest from the protected natural resource.¹¹⁰ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place perceived as worth living in or visiting.

¹⁰⁹The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

¹¹⁰Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 340 acres of single-dwelling residential property in Resource Site 129. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 129 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Limited transit service and a general absence of sidewalks already discourage group living.¹¹¹

Comprehensive plan designations provide for new development on 5,000 and 7,000 square foot lots without regard to topographic or service limitations. There is no multi-dwelling residential property in resource site 129. Property values in Resource Site 129 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 129 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.¹¹²

¹¹¹Transit Service is limited to Tri-Met Route 43 on S.W. Taylors Ferry.

¹¹²Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper presented at the 1991 Country in the City Conference (Portland, Oregon).

- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.¹¹³
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.¹¹⁴
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.¹¹⁵
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.¹¹⁶

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.¹¹⁷ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.¹¹⁸ Issuance of building permits in

¹¹³T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

¹¹⁴Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, May 1978.

¹¹⁵John D. Cooper, Director of Parks, Boise, Idaho 1989.

¹¹⁶"Cluster Builders' New Enticement: Adjacent Woods." *New York Times*, May 8, 1987.

¹¹⁷See, for example, *Fanno Creek Streambank Restoration and Water Quality Plan*, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

¹¹⁸Maps of landslide potential are part of the State record justifying acknowledgment of the Portland Comprehensive Plan for compliance with Statewide Goal 7.

floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 129. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.¹¹⁹ The Metropolitan Service District projects that 75% of residential land constrained by slopes, 20% of residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.¹²⁰ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 129 are on steep slopes, along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations limiting residential development would impose more costs. These include

¹¹⁹See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

¹²⁰Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 129 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 129 could provide 94% of the single-dwelling housing of provided by the unregulated alternative.¹²¹ This level of housing is within the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities lost to environmental protection could be more than replaced by strict application of full comprehensive plan density requirements in unprotected areas.

¹²¹Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres} / \text{Total Residential Acres})]$.

Economic Consequences on Conflicting Commercial Uses

There is less than one acre of commercial property in Resource Site 129. No significant natural resources have been identified on this property, so no commercial analysis is necessary.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in the Fanno Creek Watershed.

Economic Consequences on Conflicting Open Space Uses

There is no open space property in Resource Site 129.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES**Social Consequences of Resource Protection**

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

There are no parks in Resource Site 129. Undeveloped slopes and riparian areas serve as de facto open space, but these lands are not available for public recreation or environmental education.

Social Consequences on Aesthetic Values

Resource Site 129 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and streams, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within Resource Site 129 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 129. Smith School is in Resource Site 129. There are no significant resources on school property, so educational opportunities would not be reduced by resource protection.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno

Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 129 will result in generally positive benefits in terms of aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.
- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local

source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.

- **Increases in peak runoffs.** Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- **Increases in creek temperature.** Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60's and 70's can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- **Increases in water pollution.** Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks

lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;
- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property.

Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places

for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive

plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 129.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none
R5	5,000	45	none

Environmental Consequences of Commercial Uses

Removal of forest cover is allowed in commercial zones and generally has the same effects as described under agriculture above. Residential use is allowed in commercial zones at multifamily densities. Commercial use has all the landscape and residential effects described above, but increased lot coverage allowances compound the problem of impermeable surfaces. Commercial categories also generate more traffic than household living, and diminish or destroy open space, scenic values and recreational opportunities.

The following chart describes the commercial zones present in Resource Site 129.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Commercial Zones			
CN2	none	65	15

None of the commercially zoned land in resource site 129 in areas identified as significant natural resources.

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species.

The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the

synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.¹²²

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in

¹²²Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can make the water muddy. Grains of silt in muddy water can form an abrasive that can cause even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES

Energy Consequences of Resource Protection

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings.

Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight

and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to

employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES

General Summary of all Consequences

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 129 provides water necessary to support rearing and feeding sites for fish using the Fanno Creek Watershed west of the Portland City Limits.

Resource Site 130

Location: South Fork Ash Creek Tributary of Fanno Creek

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.¹²³ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion furthest from the protected natural resource.¹²⁴ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place perceived as worth living in or visiting.

¹²³The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

¹²⁴Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

The economic consequences of allowing residential uses in Resource Site 130 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Limited transit service and poor pedestrian amenities already discourage group living.¹²⁵ Comprehensive plan designations provide for new development on 7,000 and 10,000 square foot lots without regard to topographic or service limitations.

Comprehensive plan designations provide for new multi-dwelling housing along Interstate 5, Barbur Boulevard, and Capitol Highway. Property values in Resource Site 130 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 130 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.¹²⁶
- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.¹²⁷

¹²⁵Transit Service is limited to Tri-Met Route 43 on S.W. Taylors Ferry.

¹²⁶Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper presented at the 1991 Country in the City Conference (Portland, Oregon).

¹²⁷T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.¹²⁸
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.¹²⁹
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.¹³⁰

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.¹³¹ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.¹³² Issuance of building permits in floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

¹²⁸Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." Land Economics, May 1978.

¹²⁹John D. Cooper, Director of Parks, Boise, Idaho 1989.

¹³⁰"Cluster Builders' New Enticement: Adjacent Woods." New York Times, May 8, 1987.

¹³¹See, for example, Fanno Creek Streambank Restoration and Water Quality Plan, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

¹³²Maps of landslide potential are part of the State record justifying acknowledgment of the Portland Comprehensive Plan for compliance with Statewide Goal 7.

Another alternative is new land use regulations stopping all new residential development in Resource Area 130. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.¹³³ The Metropolitan Service District projects that 75% of residential land constrained by slopes, 20% of residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.¹³⁴ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 130 are on steep slopes, along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations limiting residential development would impose more costs. These include the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being

¹³³See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

¹³⁴Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 130 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 130 could provide 97% of the single-dwelling housing of provided by the unregulated alternative.¹³⁵ The same program could achieve all of the multi-dwelling housing provided by the unregulated alternative, because no significant resources were identified on multi-dwelling property in Resource Site 130. This amount of housing is within the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities lost to environmental protection could be more than replaced by strict application of full comprehensive plan density requirements in unprotected areas.

Economic Consequences on Conflicting Commercial Uses

There are 63 acres of commercial property in Resource Site 130. None of the significant natural resources identified in Resource Site 130 are on these commercial properties, so an analysis is not necessary.

¹³⁵Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres} / \text{Total Residential Acres})]$.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in the Fanno Creek Watershed.

Economic Consequences on Conflicting Open Space Uses

There are 18 acres of open space property in Resource Site 130. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The designated open space in Resource Site 130 is the "Dickinson Site." This is an undeveloped school district property which serves as a *de facto* park. In the absence of new regulations this site could be converted completely to lawns, parking lots, or agriculture; or to some conditional commercial uses. Economic benefits would accrue to the extent that free public recreation was replaced by commercial activities, but the value of adjoining residential property would be diminished by the off site effects of noise and traffic, and by the loss of the amenities that natural resources provide.

Regulations prohibiting the development of open space could also provide economic value. Flood, earthquake, and landslide hazards can be reduced through the protection of natural resources. Resource protection can reduce public health and safety hazards caused by flooding and landslides. Storm drainage infrastructure costs can be minimized by allowing wetlands in open spaces to provide flood retention and detention, aquifer recharge, sediment trapping, and water purification. Landslides can be prevented by preserving native forests on steep slopes.

Prohibitions would reduce the theoretical profitability of open space by prohibiting conditional uses like retail sales and service, commercial outdoor recreation, mining, and radio and TV broadcast facilities. Theoretical farm and forest uses would be eliminated. No land in Resource Site 130 is being managed for commercial forestry, but timber is often sold as forested land is converted to urban uses. Steep slopes and small parcel sizes in Resource Site 130 make agriculture impractical, but some sites could support the grazing of a few llamas or goats. These uses would also be lost by resource protection. Sufficient retail sales and services are provided along Barbur Boulevard and Capitol Highway. There are no known mineral and aggregate resources in resource Site 130 to be affected by prohibitions. Resource Site 130 is too low for an antenna farm.

Regulations limiting conflicting uses could be applied to the "Dickinson Site," the only designated open space in Resource Site 130. These regulations would protect a native forest, a stream, and a riparian area. These regulations would preserve most natural resource values, preserve free public recreation, and the economic benefits of preserved public safety would far outweigh the theoretical benefits of conditional commercial uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES

Social Consequences of Resource Protection

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 130 contains the "Dickinson Site". This site provides public greenspaces where visitors can recreate and enjoy natural amenities.

Protection forest, riparian, and wetland resources in the "Dickinson Site" will retain and increase the recreational and educational values. Ecological management will ensure that most of the "nature park" resources will remain undisturbed and its forests allowed to mature into an condition which will enhance the urban wilderness experience of park users. Retention and increase in abundance and diversity of native wildlife will mean greater aesthetic pleasure and educational benefits for area residents, and can interest and entice citizens to do things to enrich the environment. Recreational and educational values will continue and perhaps increase over time and will be preserved for the enjoyment of future generations.

Social Consequences on Aesthetic Values

Resource Site 130 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development

which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within Resource Site 130 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 130. The "Dickinson Site" is school district property. Preserving the stream and riparian area on the south part of the property and the forest on the northern side of the property would still leave ten acres of unregulated open space in the center of the site. This is large enough for a new school or for an environmental education center, and still provide sufficient space for public recreation.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area

grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 130 will result in generally positive benefits in terms of continued and enhanced recreation and environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade

wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.

- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.
- Increases in peak runoffs. Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- Increases in creek temperature. Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60°s and 70°s can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- Increases in water pollution. Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons,

kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;
- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected.

Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property.

Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 130.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none
Multi-Dwelling Zones			
R2	4,000	50	30

Environmental Consequences of Commercial Uses

Removal of forest cover is allowed in commercial zones and generally has the same effects as described under agriculture above. Residential use is allowed in commercial zones at multifamily densities. Commercial use has all the landscape and residential effects described above, but increased lot coverage allowances compound the problem of impermeable surfaces. Commercial categories also generate more traffic than household living, and diminish or destroy open space, scenic values and recreational opportunities.

The following chart describes the commercial zones present in Resource Site 130.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Commercial Zones			
CN2	none	65	15
CO2	none	65	15
CG	none	85	15

None of the commercially zoned land in Resource Site 130 is in areas identified as significant natural resources.

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and

degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species.

The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed

wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change

they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.¹³⁶

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can makes the water muddy. Grains of silt in muddy water can form an abrasive that can causes even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES

Energy Consequences of Resource Protection

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on

¹³⁶Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

the heating and cooling of structures and impacts on transportation and infrastructure costs.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings. Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes,

energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES**General Summary of all Consequences**

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed

for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 130 provides water necessary to support rearing and feeding sites for fish using the Fanno Creek Watershed west of the Portland City Limits.

Resource Site 131

Location: Far Southwest Tributary of Fanno Creek East of I-5

ECONOMIC CONSEQUENCES**Economic Consequences of Resource Protection on Conflicting Uses**

Regulations can reduce the supply of properties possessing attributes needed for development. The following attributes factor in decisions to buy property: the uses allowed by regulation; location and size; available services and infrastructure; and the amenities or nuisances contributed by surrounding properties. The supply of properties possessing similar combinations of needed attributes may either exceed or fall short of demand.

Land use regulations that prohibit all conflicting uses can provide maximum natural resource protection, but can also deprive property of economic value whenever complete prohibitions apply to entire ownerships.¹³⁷ Land use regulations that limit the time, manner, or place of conflicting uses; prohibit some but not all conflicting uses; or prohibit all conflicting uses on portions of ownerships can provide substantial natural resource protection and still maintain high property values. Land use regulations that allow all conflicting uses, or the absence of any land use regulations, can provide maximum property values, but can also allow the complete destruction of all natural resources.

Examples of land use regulations include development seasons, construction management, and setbacks. Regulations can reduce property values whenever they prevent entire ownerships from being devoted to conflicting uses. Developers often avoid these value reductions by placing all the development allowed on a property on the portion furthest from the protected natural resource.¹³⁸ Application fees, review time, and other regulatory requirements add to the costs of development. Developers generally pass these costs on in the prices of developed properties. The amenity values provided by protected natural resources often offset added development costs. The economic benefits of land use regulations include the following: the efficiency of providing services to clustered development patterns; the costs avoided by not developing known hazard areas; a clean and healthy environment; and the value of a place perceived as worth living in or visiting.

¹³⁷The Portland City Code is written so that this cannot happen. See 33.575.030 and 33.805.040 (F), (G), and (H).

¹³⁸Clustering, planned unit developments, and density transfers are ways to avoid value reductions.

Economic Consequences on Conflicting Residential Uses

There are 420 acres of single-dwelling and 54 acres of single-dwelling residential property in Resource Site 131. The principle conflicting uses of residential property are household and group living. Other conflicting uses include basic utilities, community service, essential service providers, parks and open areas, schools, colleges, medical centers, religious institutions, daycare, agriculture, aviation and surface passenger terminals, detention facilities, radio and TV broadcast facilities, railroad lines and utility corridors, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

The economic consequences of allowing residential uses in Resource Site 131 would be to increase household living on all land not constrained by slope or flood hazards, or by the absence of services. Limited transit service and pedestrian amenities already discourage group living.¹³⁹ Comprehensive plan designations provide for new single-dwelling development on 7,000 and 10,000 square foot lots without regard to topographic or service limitations. Comprehensive plan designations provide for new multi-dwelling development along Capitol Highway. Property values in Resource Site 131 would, in the absence of new regulations, increase to the extent that land and services could support new single dwelling residential units. Local government, school district, and special district tax receipts would increase proportionally with property values.

Property values would diminish to the extent that new residential development destroyed amenities. Natural resource are amenities. Household living areas acknowledged as desirable, and commanding higher than average prices, all have natural resource amenities. Resource Site 131 is part of Portland's West Hills. West Hills amenities keep property values higher than the City average. The principle amenities contributing to these higher values are views, water bodies, and forests. Residential lots next to natural resources in new clustered subdivisions and planned unit developments are usually the first lots to sell. Numerous studies illustrate that proximity to natural resources increases property values. The following are summaries of study findings.

- Economic Research Associates of San Francisco found that inclusion of greenspaces in new developments increased land values of surrounding properties and accelerated lot sales.¹⁴⁰

¹³⁹Transit Service is limited to Tri-Met Route 41 on S.W. Capitol Highway, but Resource Site 131 is within a mile of the transit center on Barbur Boulevard.

¹⁴⁰Steven E. Spickard, Economic Research Associates The Economic of Greenways Paper presented at the 1991 Country in the City Conference (Portland, Oregon).

- In Philadelphia property values were shown to decrease by distance from open space: proximity to open space accounted for 33 percent of property value at a 40-foot distance, nine percent of the value at 1,000 feet and only four percent at 2,500 feet.¹⁴¹
- Property values near greenbelts in Boulder, Colorado showed an average decline of \$4.20 for each foot a house was located away from a greenbelt. The study concluded that, other factors held constant, the average value of property adjacent to a greenbelt would be 32 percent higher than those 3,200 feet away.¹⁴²
- The Boise River Greenbelt in Idaho was shown to be directly responsible for property improvements which raised the appraised value of properties within the Greenbelt to over \$200 million. Property values of undeveloped land were \$26,000 to \$34,000 per acre near the Greenbelt versus \$10,000 to \$17,000 elsewhere.¹⁴³
- Properties adjacent to protected forests sell quicker. The test case was a 142-unit cluster development set which set aside 97 acres of forest as protected common open space. Care was taken to preserve the rural character of the open space and to encourage a herd of deer and hundreds of birds to remain. Homes closer to the protected woods sold quicker than those further away.¹⁴⁴

The absence of new regulations would allow continued loss of forest cover. This cover stabilizes steep slopes, prevents erosion, and maintains clean water. The maintenance of riparian vegetation is an important component in the City's agreement with the Oregon Department of Environmental Quality to meet its Federal Clean Water Act obligations.¹⁴⁵ The Tualatin River, into which Fanno Creek and its tributaries flow, does not comply with Clean Water Act standards. If the continued loss of riparian vegetation could be linked to continued violation of Tualatin water quality standards the following might happen: administrative fines, citizen suites, and as a worst case, a court imposed development moratorium. Liability might also arise if the City issued building permits in areas of known landslide potential without requiring appropriate safeguards.¹⁴⁶ Issuance of building permits in

¹⁴¹T. R. Hammer, et al. "The effect of a Large Urban Park on Real Estate Values," *Journal of American Planning Association* 40 (1974): pp. 274-277.

¹⁴²Mark Correll et al. "The Effects of Greenbelts on Residential Property Values: Some Findings on the Political Economy of Open Space." *Land Economics*, May 1978.

¹⁴³John D. Cooper, Director of Parks, Boise, Idaho 1989.

¹⁴⁴"Cluster Builders' New Enticement: Adjacent Woods." *New York Times*, May 8, 1987.

¹⁴⁵See, for example, *Fanno Creek Streambank Restoration and Water Quality Plan*, two volumes, HARZA Northwest for Portland Bureau of Environmental Services, October 28, 1993.

¹⁴⁶Maps of landslide potential are part of the State record justifying acknowledgment of the Portland Comprehensive Plan for compliance with Statewide Goal 7.

floodways could jeopardize the City's eligibility to participate in the National Flood Insurance Program. Since there is no alternative to the federal program, commercial lending for new residential, commercial, and industrial development (particularly along the Columbia and Willamette Rivers, the Columbia Slough, and Johnson Creek) could come to a halt.

Another alternative is new land use regulations stopping all new residential development in Resource Area 131. These regulations would protect significant natural resources, but would prohibit needed and other housing. Land on slopes less than 30%, outside floodplains, and designated for residential development by comprehensive plans are "needed" for housing according to state definitions.¹⁴⁷ The Metropolitan Service District projects that 75% of residential land constrained by slopes, 20% of residential land constrained by floodplains, and none of the land constrained by wetlands will be developed over the next 50 years.¹⁴⁸ This housing is not "needed" but is desired whenever public safety and most resource values could be preserved by development carefully matched to individual site conditions. Even careful development would be precluded by prohibitions.

Regulatory prohibition of new residential development would also subject the City to claims that private property was taken for public purposes without the compensation required by the federal and state constitutions. These claims would probably succeed whenever it could be shown that there was no reasonable economic use remaining on regulated property and that the development of this property would not constitute a nuisance, or threaten public health, safety, or welfare. Even if these regulations did not work a complete taking, recent amendments to the Oregon Constitution tie the tax bases of school districts and local governments to the market value of real property. As market values fluctuate, property taxes vary in direct proportion. Regulations that lowered property value would also lower government tax receipts. Persons paying taxes on property that they could not develop would probably apply for, and receive, lower assessments or qualifications for the open space tax deferral program.

A third alternative is to limit, but not prohibit, new residential development. Most significant natural resources in Resource Area 131 are on steep slopes, along drainageways, or in wetlands. Even in the complete absence of regulation, development in these areas involves spending more time and money than development on flatter or dryer land. Developers incur extra costs by building on unstable slopes or in flood prone areas. New regulations limiting residential development would impose more costs. These include

¹⁴⁷See the Metropolitan Housing Rule which was adopted by LCDC to carry out Statewide Planning Goal 10.

¹⁴⁸Regional Forecast, Allocation and Transportation Model: Base Case II Summary, METRO, Planning Department, June 28, 1993.

the cost of preparing an application and paying application fees; the costs of any required impact avoidance, mitigation, and construction management measures; and the costs of waiting for a staff, hearings officer, or city council decision on an application. These costs may also include fees paid to consulting architects, engineers, or ecologists. Land costs in southwest Portland already prevent new single-dwelling detached housing from being affordable to households earning less than the mean metropolitan area income. Special site constraints and new regulations will add to the costs of already unaffordable housing. Regional forecasts demonstrate that market demand Resource Site 131 is such that these costs can be absorbed in higher prices. Selling prices will determine market value, and higher values will translate into increased government revenue.

Regulations limiting new residential development would control the time, manner, and place of new residential development. In some cases development on portions of ownerships would be prohibited. The regulatory scheme would first require that unnecessary harm to resources be avoided, and that any unavoidable harm be corrected by mitigation. This program would ensure that resource values, if not the same amount of resource area, would be maintained over time. The qualification "over time" is an important one. Mitigation is not always successful, and even when it is, it may take many years to reestablish lost values. Stream and marsh values can be reestablished over a few years. Some values provided by older forests may take hundreds of years to reestablish. Environmentally sensitive construction methods and mitigation activities can be expensive, and as discussed above, these costs are added to the price of new housing.

The additional costs of environmentally sensitive development are offset by amenity values. The same type of techniques used to avoid harm to protected natural resources can also yield savings. For example, clustered development lowers infrastructure expenditures by decreasing the area which needs to be served by roads and utilities. These savings are especially apparent in areas steep terrain or near floodways. The regulations proposed by this plan in Resource Site 131 could provide 99% of the single-dwelling housing of provided by the unregulated alternative.¹⁴⁹ The same program could achieve 98% of the multi-dwelling housing provided by the unregulated alternative. This is within the natural "under build" factor in metropolitan region, and more than enough to fulfill state "needed housing" obligations. Housing opportunities lost to environmental protection could be more than replaced by strict application of full comprehensive plan density requirements in unprotected areas.

¹⁴⁹Formula used is $100 - [\text{Under Build Factor of } 0.75 \times (\text{Protected Residential Acres} / \text{Total Residential Acres})]$.

Economic Consequences on Conflicting Commercial Uses

There are 31 acres of commercial property in Resource Site 131. No significant natural resources were identifying on this property, so no analysis is necessary.

Economic Consequences on Conflicting Industrial Uses

There are no industrial properties in the Fanno Creek Watershed.

Economic Consequences on Conflicting Open Space Uses

There are ten acres of open space property in Resource Site 131. The principle conflicting uses of open space property are parks and open areas, and agriculture. Other conflicting uses include retail sales and service, commercial outdoor recreation, basic utilities, community service, schools, daycare, mining, radio and TV broadcast facilities, rail lines and utility corridors, infrastructure, infrastructure, temporary and revocable uses; and land divisions, partitions, and property line adjustments.

In the absence of new regulations park land could be converted completely to lawns, parking lots, or agriculture; or to some conditional commercial uses. Economic benefits would accrue to the extent that free public recreation was replaced by commercial activities, but the value of adjoining residential property would be diminished by the off site effects of noise and traffic, and by the loss of the amenities that natural resources provide.

Regulations prohibiting the development of open space could also provide economic value. Flood, earthquake, and landslide hazards can be reduced through the protection of natural resources. Resource protection can reduce public health and safety hazards caused by flooding and landslides. Storm drainage infrastructure costs can be minimized by allowing wetlands in open spaces to provide flood retention and detention, aquifer recharge, sediment trapping, and water purification. Landslides can be prevented by preserving native forests on steep slopes.

Prohibitions would reduce the theoretical profitability of open space by prohibiting conditional uses like retail sales and service, commercial outdoor recreation, mining, and radio and TV broadcast facilities. Theoretical farm and forest uses would be eliminated. No land in Resource Site 131 is being managed for commercial forestry, but timber is often sold as forested land is converted to urban uses. Steep slopes and small parcel sizes in Resource Site 131 make agriculture impractical, but some sites could support the grazing of a few llamas or goats. These uses would also be lost by resource protection. Sufficient retail sales and services are provided along Barbur Boulevard and Capitol Highway. There are no known mineral and aggregate resources in resource Site 131 to be affected by prohibitions. Resource Site 131 is too low for an antenna farm.

Regulations limiting conflicting uses could be applied to a small wetland in Lesser Park, the only designated open space in Resource Site 131. These regulations would preserve wetland values, preserve free public recreation, and the economic benefits of preserved public safety would far outweigh the theoretical benefits of conditional commercial uses.

Summary of Economic Consequences

Protection of natural resources will have both positive and negative economic impacts. Positive impacts include retention and increase of natural amenities. These amenities, in turn, increase property values; accelerate the sale of real estate; bolster the tax bases; attract tourists, conferences, and businesses; result in more efficient use of public services and utilities; and increase recreation opportunities and expenditures.

SOCIAL CONSEQUENCES

Social Consequences of Resource Protection

Social consequences considered in this analysis include impacts on recreation and environmental education opportunities; impacts on historic, cultural and aesthetic values; regional identity and local landscape character; impacts on incompatible land uses; impacts on housing and education; and impacts on public health, safety and welfare.

Social Consequences on Recreation and Environmental Education

Resource Site 131 contains Lesser Park. This park provides public greenspaces where visitors can recreate and enjoy natural amenities.

Protection of wetland resources in Lesser Park will retain and increase the recreational and educational values. Ecological management will ensure that most of the "nature park" resources will remain undisturbed and its forests allowed to mature into an condition which will enhance the urban wilderness experience of park users. Retention and increase in abundance and diversity of native wildlife will mean greater aesthetic pleasure and educational benefits for area residents, and can interest and entice citizens to do things to enrich the environment. Recreational and educational values will continue and perhaps increase over time and will be preserved for the enjoyment of future generations.

Social Consequences on Aesthetic Values

Resource Site 131 provides many aesthetic values. Many residents have chosen to live in the area because of the presence of resources such as forest and open space, the numerous birds and other wildlife, and the country-in-the-city atmosphere provided by these resources. Without resource protection these aesthetic values would be diminished or lost. Development which degrades or destroys natural resources of the Fanno Creek Watershed would reduce the intrinsic value of the area.

Social Consequences on Regional Identity

The forested hillsides within Resource Site 131 form a backdrop separating the Tualatin Valley from the Central City. Continuation and enhancement of natural resources will add to the image of Southwest Portland neighborhoods and the identity of the Portland region, while their destruction would result in loss of identity, and therefore uniqueness, character and value.

Social Consequences on Screening and Buffering of Incompatible Uses

Natural resources act as an edge between different land uses, separating and buffering them from each other both visually and physically. Protection of natural resources allows for incompatible land uses to locate more closely with less potential for conflicts. Forest cover or native vegetation can be used as a natural buffer between land uses so extra landscaping will not be needed to buffer incompatible uses.

Social Consequences on Housing and Education

Needed residential development potential under present zoning and Comprehensive Plan designations will not be changed by environmental regulation. School districts would also benefit from the protection of natural areas for field trips. Protection of natural resources could have negative effects on housing and education if development is prohibited or cannot be redistributed elsewhere on site through such mechanisms as clustering or planned unit development. Clustering of development can also reduce police and fire response times. Only where entire properties are precluded from development, or where residential densities are reduced through zone changes, would resource protection have significant adverse impacts on housing and education, but this is not the case in Resource Area 131. Markham School and the Portland Community College Sylvania Campus are in Resource Site 131. There are no significant resources on school property, so educational opportunities would not be reduced by resource protection. There is a significant upland forest on the western slope of the college property. Preservation of this area is part of the college master plan, and will not interfere with needed expansions.

Social Consequences on Public Health, Safety, and Welfare

Protection of natural resources located on steeply-sloped hillsides will protect the general public from landslides and earthquakes. Protection of floodways and drainage reserves will protect the public from flooding. This protection reduces potential demand on disaster relief agencies and bureaus (and subsequent demand on tax dollars), as well as individual expenses for replacement of destroyed property and treatment for injury. Retention of the abundance and diversity of native wildlife will also control and reduce populations of disease-carrying pests such as rats. As the metropolitan area grows over the next decade, the preservation and maintenance of the area's green spaces will be crucial to maintaining the population's health. Natural resources on public park lands provide people with opportunities for

recreation and exercise. People can also go to these spaces to escape the stresses of urban life. The parks, trails and natural open spaces of the Fanno Creek Watershed provide such amenities for keeping a growing population physically and psychologically healthy.

Summary of Social Consequences

Protection of natural resources in Resource Site 131 will result in generally positive benefits in terms of continued and enhanced recreation and environmental education opportunities; preserved historic, cultural and aesthetic qualities; enhanced sense of place, uniqueness and character; increased protection from incompatible land uses; protection from disasters, and reduced disaster relief costs.

ENVIRONMENTAL CONSEQUENCES

Environmental Consequences of Resource Protection

The environmental consequences of protecting natural resources are positive. Forest vegetation, wetlands, creeks and drainageways act as filters, cleansing water and maintaining water quality within the watershed. Soils, humus and organic matter on the forest floor filter and absorb surface water runoff, which recharges groundwater reservoirs and reduces erosion caused by surface runoff. Groundwater discharge, in the form of springs and seeps, supplies water to creeks and wetlands and helps sustain surface waters during low flow periods. Wetlands, water bodies and adjacent flood plains provide flood storage and desynchronization, reducing overall flood levels. Vegetation traps sediment from surface runoff, provides soil anchoring, and absorbs certain hazardous chemicals and heavy metals, thereby reducing water pollution and turbidity. Vegetation also dissipates erosive forces of surface runoff, allowing deposition of suspended solids and increasing bank stabilization, which both increase water quality. Protection of these resources maintains the physical, chemical and biological integrity of the Fanno Creek Watershed forest and watershed ecosystem.

The construction of buildings and impervious surfaces and other human activities which disturb or remove natural resources such as forest vegetation and soils can affect watershed resources in the following ways:

- Increases in erosion, sedimentation and landslides. The unstable soils and steep slopes of the Fanno Creek Watershed can become highly susceptible to erosion, slumping, and failure when forest cover is removed or when cuts and fills are made for roads and buildings. These activities can result in public safety hazards and can degrade wildlife habitat and increase sediment transport, creek bed siltation and degradation or loss of fish spawning grounds.

- Decreases in creek flows during dry months. Reduced forest cover and increased impervious surfaces reduce groundwater recharge and lower the volume of water in creeks contributed by groundwater during low flow periods. This may alter stream characteristics by causing portions of affected creeks to dry up earlier in the season, removing a local source of water and moisture essential to the survival of fish, amphibians and aquatic organisms, and preventing salmonids from reaching spawning grounds.
- Increases in peak runoffs. Increased impervious surfaces can increase surface runoff, reduce vegetative detention functions, and compact soils, and all this can result in increased peak flows. Increased peak flows increase erosion, bank undercutting, creekside landslides, sediment transport, siltation of spawning beds and flooding.
- Increases in creek temperature. Heated runoff from roads, roofs and compacted soils combined with reduced vegetative cover raise summer water temperatures. Water temperatures in the high 60's and 70's can be lethal to salmonids and are likely to reduce fish runs (ideal temperatures for salmonids are between 56°F and 62°F); high water temperatures can also degrade habitat for amphibians and other aquatic organisms.
- Increases in water pollution. Septic drain fields can contaminate ground and surface waters. Pesticides, herbicides and fertilizers applied to agricultural crops or landscaped areas can pollute groundwater and nearby creeks. Contaminants from commercial, industrial and other urban uses can degrade surface and groundwater quality. Leaks (oil, gas, tar, antifreeze, etc.) from autos and farm equipment, heating and cooling systems, and roofs also degrade water quality. Dirt and mud eroded from cultivated land or deposited from autos and farm equipment can drain into nearby creeks and contribute to sedimentation.

Environmental Consequences Plants and Animals

Plants provide food and cover for fish and wildlife. Their roots, bark, foliage, nuts and fruits provide food for a variety of wildlife species. Twigs, leaves and bark are used for nest building and insulation. Large trees, especially snags, are prime perch sites for hawks and owls which feed on small mammals on the ground below. Although plants are at the bottom of the food chain, they are a crucial element of the entire system. Algae in the Fanno Creek and its tributaries is eaten by tiny macro-invertebrates, which are in turn eaten by fish and amphibians, which may be eaten by herons, kingfishers or other birds. On land crickets, beetles and small mammals feed on vegetation, and in turn provide food for raptors and larger mammals.

When vegetation begins to die and decay, it becomes home and food to mites, earthworms, fungi and millipedes which aid in the decomposition process. Older forests have complex structure with multi-layered canopies, dead and downed logs, large trees and snags. Hollow trees laying on the ground provide cover for rabbits and voles, salamanders and snakes. Tree trunks lying partially submerged in a creek or pond provide cover and shading for fish, attachment sites for aquatic insects, sunning areas for western pond turtles, snakes and dragonflies.

The vegetative cover and waterways provide travel corridors for the fish and animals. Safe access to and along the waterways is crucial. Habitat diversity and connectivity between the habitats is the key to a healthy ecosystem. Interspersion of Fanno Creek Watershed natural areas with surrounding forests and natural areas is critical to its continued viability as habitat for wildlife. Interspersion provides opportunities for migration and recruitment of wildlife which sustains the flow of genetic material and reduces vulnerability to disease, predation and local extinction.

The following environmental changes and human activities degrade natural resources of forest ecosystems:

- Loss of vegetation;
- Replacement of native vegetation with invasive species or lawns;
- Escape and encroachment of exotic plants (e.g., ivy, holly) into forest;
- Replacement of vegetation with ecologically barren buildings, fences, driveways, parking lots, other impervious surfaces, etc.;
- Reduced groundwater recharge through impervious surfaces;
- Reduction of the structural diversity of forest plant communities;
- Removal of dead vegetation in all strata (creek, ground, tree canopy);
- Erosion and deterioration of stream banks;
- Litter and garbage in water courses and along trails;
- Presence of domestic cats, dogs and destructive human activity;
- Increasing human population density and noise;
- Leaching of toxic materials, deposition of sewage, leaching of herbicides, pesticides and fertilizers from cultivated landscapes;
- Fences and streets which limit wildlife access and passage; and
- Noise, light and other development impacts which disturb the breeding and predator instincts of terrestrial animals.

Resource protection would have a positive effect on ecologically significant forests, fish and wildlife habitat, riparian areas, streams, wetlands and groundwater resources. Flood storage, desynchronization functions and groundwater recharge and discharge functions would be enhanced. Hazard areas would be avoided and natural heritage values would be protected. Minimum and maximum stream flows would be maintained within suitable ranges. Nutrient trapping and removal functions would be maintained and enhanced. Open space, recreation opportunities and scenic values would be

retained. The erosive forces of flooding would also be dissipated and sediment trapping functions would be enhanced. Water purity and water quantity would be maintained and eventually increased.

Conflicting uses alter stream erosion processes, sedimentation patterns, nutrient flows and water quality. They also create changes to drainage patterns, soil chemistry, plant and animal communities. If these uses actually occurred at the intensities allowed by city land use regulations, without mitigating measures to protect resources, they would diminish or destroy the natural resources in the Fanno Creek Watershed. The following are analyses of conflicting uses.

Environmental Consequences of Agriculture

Clearing of vegetation, plowing of fields, exposing bare soils and other farm practices cause erosion which degrades water quality and can adversely impact aquatic habitat for fish and amphibians.

The conversion of forest to farm land replaces diverse forest plant communities with only a few cultivated species. Forest cover is needed to prevent the synchronization of flood events, to prevent bank erosion and to prevent silting of stream beds. Forest cover is also needed to reduce maximum and increase minimum stream flows to maintain proper levels. Forest leaf mass and decaying organic matter on the forest floor function as a sponge, trapping and absorbing rainwater during wet periods and releasing stored water during drier periods. Cover removal may also precipitate landslides which pose hazards to people and property.

Preparing land for planting or grazing often includes filling of wetland areas and removal of riparian vegetation from stream banks. This increases stormwater runoff and eliminates the purifying effects of vegetation. Vegetation is particularly valuable on farmland where herbicides, fertilizers and pesticides are used because it acts as a filter, cleansing runoff which can degrade habitat and harm aquatic wildlife. These chemicals may also contaminate groundwater reserves. Animal fecal contamination occurs as a result of pasture use and has similar environmental effects.

Agriculture also takes irrigation water from streams and wells. Extensive use of groundwater can result in draw down of the water table, which in turn can reduce creek flows. Adequate water flow levels are needed to support fish, amphibians and aquatic organisms. Reduced water flows can also reduce or eliminate sources of water for terrestrial animals.

Farm use normally does not diminish open space, but can degrade scenic areas and reduce recreational opportunities by limiting access. Removal of forest cover destroys native vegetation. Removal of forest cover and planting of agricultural crops provides opportunities for non-native and intrusive plants to become established in adjacent forest.

Removal of forest cover also denudes or eliminates habitat for many native animals. Lost habitat includes feeding, nesting, perching and roosting places for birds. Forest clearing removes plants which produce edible seeds, berries, nuts, bark, leaves, stems and roots for animals. Forest clearing also removes important structural features of the forest such as multiple layered canopies, dead and downed logs, large trees and snags. These important habitat components are removed when the forest is cleared. Other detrimental impacts include poisoning of wildlife caused by chemicals used on plants and in the soil in agricultural processes, and lights, loud noises and other farm activities which disturb the breeding and predator instincts of animals.

Forest fragmentation caused by the clearing of vegetation for agricultural uses increases the isolation of one habitat area from another. This can impede or form barriers to wildlife migration and can limit the flow of genetic material. As the range of habitat for indigenous wildlife becomes restricted and isolated, opportunities for recruitment from other areas are limited and wildlife populations become vulnerable to disease, predation and local extinction. Clearing can also result in reduction or local extinction of forest interior species which required larger forested tracts or habitat.

Environmental Consequences of Forestry

Forestry is in the same use category as agriculture. Because forestry is generally feasible on steeper slopes than farming, harvest practices can cause more erosion than farming. The erosion and sedimentation effects of tree harvesting can be at least as detrimental to water-related resources as the farm practices described above.

Forestry can replace multi-functional forest ecosystems with more simple systems or monoculture tree plantations. Cultured forests and tree plantations often are less structurally diverse and have less leaf mass than the natural forests they replace. Tree plantations have less ability to prevent the synchronization of flood events, bank erosion and the siltation of stream beds than do natural forests. Stream temperatures and flows can also be more variable in tree plantations.

Monoculture plantations are also more vulnerable to forest diseases and pests than natural forests. The loss of natural forests have the same effects on wildlife and flooding as described in the analysis of agriculture above.

Forestry also involves the use of herbicides, fertilizers and pesticides which may contaminate ground and surface waters. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Forestry does not diminish open space, but degrades scenic values and diminishes recreational opportunities by limiting or eliminating access. The harvest of trees also fragments, degrades or destroys wildlife habitat. Tree cutting and planting provide opportunities for non-native and intrusive plants to become established in adjacent natural forest. Tree cutting and the storing and transport of logs destroys forest plants. Timber harvest has the same effects on native plants, fish and wildlife as the clearing activities described in the analysis for agriculture. The establishment of tree plantations can provide habitat for species which prefer early successional forests, or benefit from the forests fringes around clearings. However, tree plantations rarely have the plant diversity found in early successional natural forests; hence, the diversity of food and cover resources is limited. Noises and lights caused by forestry activities can further degrade habitat values as described in reference to farm practices.

Environmental Consequences of Landscaping

Landscaping is accessory to all open space, single-dwelling residential, multi-dwelling residential, and commercial uses. The clearing of forests, whether for homes, businesses, or parks and open areas has the same effects as clearing done for agriculture or forestry. Like farming and forestry, the maintenance of landscaping often requires the use of irrigation water. The erosion, sedimentation, flooding and water withdrawal effects of clearing forests to establish landscapes are similar to those of the farm and forest practices described above. The impacts of the loss of structural diversity, leaf mass and related habitat components are also analyzed above.

Landscaping does not diminish open space, but can degrade scenic areas and diminish recreational opportunities. The effects of landscaping on fish and wildlife habitat is similar to the effects of forestry described above. Landscape trees, shrubs and ground cover often invade adjoining native forests. English ivy, holly, laurel, and clematis are commonly used in landscaped areas and are particular problems in the Fanno Creek Watershed.

Some animals benefit from the proximity of landscaping to forests. These species feed on seeds and berries produced by landscape plants, and while they are not feeding they find protective cover in the forest. This feeding pattern is, however, responsible for the spread of exotic seeds to the forest and the resulting degradation of natural forest habitat.

Urban landscaping rarely involves the re-establishment of multiple layered canopies, dead and downed logs, large trees and snags found in mature native

forests. The loss of older forests have the same effects on wildlife and flooding as described for agriculture and forestry above.

The maintenance of landscapes also involves the use of herbicides, fertilizers and pesticides which may contaminate groundwater. Contaminated surface runoff can degrade wildlife habitat and harm aquatic life in nearby creeks.

Environmental Consequences of Household Living

Housing living is the predominant land use of the Fanno Creek Watershed. Residential uses can have all the landscape effects described above. They also have aggravating effects on stormwater detention and retention, erosion and sedimentation. These effects are most pronounced during construction, but continue afterward. Unstable soils, steep slopes and a shallow, perched water table in the Fanno Creek Watershed are very susceptible to residential construction activities. Excavation and fill for roads or buildings can precipitate landslides and cause erosion. Landslides and erosion can damage or destroy downstream watershed resources and property.

Some areas of the Fanno Creek Watershed where residential uses are allowed are not served by public sewers. Septic drain fields can pollute both ground and surface waters. In other areas homes are served by sewers, but by pumping rather than gravity flow. There are both public and private pumping stations. Some homes have their own pumps. While pumping can, in special circumstances, be a cost-effective and environmentally sensitive service option, pumps occasionally fail. Power outages and mechanical problems are common causes of failures. When pumps fail, surface waters and soils are contaminated by raw sewage.

Impervious surfaces such as streets, sidewalks and roof tops raise runoff time-of-concentration, reduce vegetative detention functions, and compact soils. This increases surface water runoff and peak flows. Increased peak flows, in turn, increase erosion, landslides, sediment transport, creek bed siltation and flooding.

Impervious surfaces permit less rainfall to infiltrate the soil, reducing groundwater recharge and lowering volume of water in creeks contributed by groundwater. This may cause neighboring creeks to dry up early in the season, which can damage or destroy habitat for resident fish, amphibians and invertebrates, and eliminate a source of water for terrestrial animals. Heated runoff from impervious surfaces and reduced vegetative cover can raise water temperatures in nearby creeks and degrade aquatic habitat. Runoff can also carry pollutants into these creeks. Impervious surfaces also interfere with the transfer of air and gases.

Residential development can impair travel routes for terrestrial vertebrates. By creating inhospitable environments, these developments, particularly

when in conjunction with large subdivisions, can isolate wildlife or cut off some species from a significant portion of their range. This limits or cuts off the flow of genetic material for these species, and in some cases may lead to local extinction. Roads, traffic and fences can also form barriers to wildlife migration. Household pets can kill and harass native wildlife. Lighting and evening activities can also disturb wildlife.

Many of the adverse environmental consequences of residential uses in the Fanno Creek Watershed arise from increases in impervious surfaces. There are no limits on these surfaces in single dwelling zones, but as a practical matter significant portions of single dwelling lot are usually landscaped. The following chart describes building coverage and landscaping requirements for zones present in Resource Site 131.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Single Dwelling Zones			
R10	10,000	30	none
R7	7,000	35	none
Multi-Dwelling Zones			
R2	4,000	50	30

Environmental Consequences of Commercial Uses

Removal of forest cover is allowed in commercial zones and generally has the same effects as described under agriculture above. Residential use is allowed in commercial zones at multifamily densities. Commercial use has all the landscape and residential effects described above, but increased lot coverage allowances compound the problem of impermeable surfaces. Commercial categories also generate more traffic than household living, and diminish or destroy open space, scenic values and recreational opportunities.

The following chart describes the commercial zones present in Resource Site 131.

Zone Symbol	Minimum Lot Size in Square Feet	Maximum Percent Building Coverage	Required Percent Landscaped Area
Commercial Zones			
CN2	none	65	15
CO2	none	65	15
CG	none	85	15

None of the commercially zoned land in Resource Site 131 is in areas identified as significant natural resources.

Environmental Consequences of Industrial Uses

Industrial uses are allowed with special limitations, or as conditional uses, in commercial-zoned areas. The allowed uses include manufacturing and production, warehouse and freight movement and wholesale sales. Industrial use has all the landscape and residential effects described above. Increased lot coverage allowances compound the problem of impermeable surfaces (e.g., reduced water penetration and supply of nutrients to the soil, lower groundwater levels and interference with the transfer of air and gases).

Environmental Consequences of Open Space Uses

Under the new city zoning code effective January 1, 1991, the new Open Space (OS) base zone was applied to land that had an OS Comprehensive Plan designation. Large areas within the Fanno Creek Watershed have OS designations. In the Fanno creek Watershed this zone has only been applied to city parks and school yards. Developed open space, such as lawns and planted landscape beds, have the same effects described for landscaping. Park uses also generate traffic which can pose hazards to wildlife.

The Open Space zone allows activities such as the clearing of vegetation, the creation of impervious surfaces such as parking lots and the building of certain structures for retail sales and service, or for major event entertainment. The potential environmental consequences of Open Space uses are similar to but not as significant as those described for Household Living uses above.

Open space trail construction and maintenance practices on steep slopes or near creeks can cause erosion and disturb vegetation. Recreational use of natural areas can degrade wildlife habitat values. Unleashed pets can kill and harass wildlife. Intensive recreation such as cycling, motoring and equestrian sports occur on trails designed for hiking, where they often cause erosion. Camping in public parks, although not allowed by park rules, does occur and degrades natural, recreational and scenic values. Particularly dangerous is the use of camp fires during dry seasons. Illegal trash dumping and littering also occurs in parks. Trash degrades natural, recreational and scenic values. Trash can also pollute water, harm wildlife and provide a seed source for non-native intrusive plants.

Environmental Consequences of Infrastructure and Utility Corridors

Construction and maintenance practices for roads, stormwater control structures, sewers, water lines and reservoirs, gas and utility lines can have a variety of detrimental effects. These activities can create cleared corridors which increase wind and light penetration into the forest, and can degrade natural plant and animal communities. Careless practices can degrade

streams and wetlands and block fish passage. Careful practices can cause some erosion and provide opportunities for the establishment of non-native plant species by disturbing soil or by removing perennial plant species.

The establishment and maintenance of roads and utilities can fragment wildlife habitat in the same way as described under agricultural impacts above. These activities can also increase stormwater runoff; pollute water and reduce forest cover needed to maintain adequate stream flows, clarity and temperature for aquatic life. Maintenance can remove important structural components from forests and can reduce the amount of vegetative cover. This cover can help prevent bank erosion, stream bed siltation, and the synchronization of flood events, and can also help maintain adequate stream flows.

Some chemical deicers used to keep roads clear of snow and ice, and some herbicides used to control roadside vegetation can contaminate soils, degrade the health of plants and the animals which feed on them, and degrade the quality of ground and surface waters.

Environmental Consequences of Basic Utilities

Although operation of existing basic utilities have few adverse environmental effects, construction and maintenance practices for new basic utilities have a variety of adverse effects. These activities can cause erosion and provide opportunities for the establishment of non-native plant species by disturbing soil and destroying perennial plant species. These practices degrade streams and wetlands and block fish passage. Construction often fragments wildlife habitat, increases storm water run-off and erosion, and reduces forest cover needed to support full-year beneficial use of streams by affecting flows, clarity, and temperature. Maintenance of existing facilities can remove important structural components from forests and reduce vegetative cover. This cover is needed to prevent the synchronization of flood events, bank erosion, and the silting of stream beds, and to maintain maximum and minimum stream flows at proper levels. Some types of basic utilities, such as stormwater detention areas, retention areas, sediment traps, and constructed wetland pollution treatment facilities have beneficial environmental effects by restoring functional values degraded by upstream development.

Environmental Consequences of Community Service

This use has the same effects as commercial development.

Environmental Consequences of Essential Service Providers

This use has the same effects as commercial development.

Environmental Consequences of Schools

School grounds have the same effects as parks and open space. School structures have the same effects as commercial development.

Environmental Consequences of Colleges

College grounds have the same effects as parks and open space. College structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Medical Centers

Medical Center grounds have the same effects as parks and open space. Medical Center structures have the same effects as commercial development. Traffic impacts are high.

Environmental Consequences of Religious Institutions

Institutional grounds have the same effects as parks and open space. Institutional structures have the same effects as commercial development. The majority of traffic effects are limited to one day per week.

Environmental Consequences of Daycare

Daycare has the same effects as any auto-oriented commercial use. Traffic effects are high at drop-off and pick-up times, and slight during other times.

Environmental Consequences of Aviation and Surface Passenger Terminals

The environmental effects of terminal are similar to those described for warehouse and freight movement, but toxic materials are not usually handled.

Environmental Consequences of Detention Facilities

The effects of jails and prisons on natural resources are no more intensive than commercial zoning.

Environmental Consequences of Mining

Mining completely destroys natural resources, but there are no known mineral and aggregate sites in the Fanno Creek Watershed

Environmental Consequences of Radio and Television Broadcast Facilities

Towers have adverse visual effects, and some electro-magnetic emissions can cause health problems.

Environmental Consequences of Temporary Uses

The City Zoning Code allows several uses for up to one year as "Temporary Uses". Most of these uses are commercial uses that occur on developed property. Construction staging areas are also listed in the temporary use category, and staging can occur on undeveloped property. The storage of equipment, materials, and spoils can destroy or degrade natural resources. On

the other hand, the staging areas can be for projects that, when finished, can benefit the environment.

Environmental Consequences of Revocable Uses

There are a few outstanding permits for office and retail and service uses in residential zones. These permits have the same effects as commercial uses. These permits will expire soon, and will cease to be conflicting uses.

Environmental Consequences of Nonconforming Uses

Manufacturing, production, and warehousing exists in residential zones. Existing conditions of approval limit off-site effects and truck traffic. The effects are the same as commercial uses.

Environmental Consequences of Land Divisions, Partitions, and Property Line Adjustments

These procedures can place new lots either in, or outside, protected natural resources. They usually increase the number, if not the kind, of conflicting uses. It is particularly important that every new lot have a usable building area outside a protected area, and that no new lot be completely within a protected area.

Summary of Environmental Consequences

If the conflicting uses described above occurred at the intensities allowed by existing city zoning and land use regulations, they would have significant detrimental impacts on natural resources. The following is a review of the expected harm.

Environmental Consequence of Microclimatic Change

During the growing season, the centers of native forests are cooler, damper, and dimmer than forest edges or urban landscapes. This microclimate is fully established in forests wider than 600 meters, and partially established in narrower forests. In the winter these native forests are warmer than forest edges or landscapes. Urban landscapes can substitute for many of the values provided by forest edges, but there is no substitute for native forest centers. Many native plant and animal species are adapted for live at certain temperatures, humidities, and light intensities. If these conditions change they will be displaced by exotic and opportunistic species. Examples of this problem include vines choking out trees along clear cuts, and the displacement of song birds by crows, sparrows, starlings, and pigeons.

Environmental Consequence on Dispersion Blocks

It is essential that species progeny in habitat at carrying capacity be able to travel to suitable underutilized habitat. If this is not possible either the parents or young will die. Urban stream corridors and drainageways provide necessary dispersion habitat for many species. If dispersion is blocked, gene pools become simplified, leaving remaining populations less able to respond to environmental stress. This process cause the local extrication of species and can contribute to the extinction of entire species such as the Pileated woodpecker.¹⁵⁰

Environmental Consequence of Noise and Glare

Machinery, reflective surfaces, and artificial lighting cause some species to avoid developed areas.

Environmental Consequence of Stormwater Run Off and Flooding

Stormwater run-off and flooding usually increases in proportion to the level of urban development. This phenomenon is caused by an increase in impervious surfaces. Examples of these surfaces include roof tops, streets, parking lots, driveway, etc.

Environmental Consequence of Erosion and Turbidity

Increases in run-off and flooding can be accompanied by increases in water velocity. This increased velocity can erode stream beds and banks and can makes the water muddy. Grains of silt in muddy water can form an abrasive that can causes even more erosion down stream. This process is aggravated if stream side vegetation has been removed. Some Fanno Creek stream banks are incising several inches per year. Beds which should be only 18 inches deep are now several feet deep, too deep for high water to hop over the bank into the floodway. This increases velocity further compounding the problem.

Environmental Consequence of Domestic, Exotic, and Feral Species

Domestic cats and dogs hunting wildlife is a major problem, but plant species can also be bad. Ivy and blackberry are major problems in Fanno Creek Watershed.

ENERGY CONSEQUENCES**Energy Consequences of Resource Protection**

This section provides a general analysis of the energy consequences of resource protection. Energy consequences analyzed below include impacts on the heating and cooling of structures and impacts on transportation and infrastructure costs.

¹⁵⁰Sensitive Vertebrates of Oregon, ODFW, DBM 2/20/92, two pages.

Energy Consequences on the Heating and Cooling of Structures

Resource protection may alter energy consumption for heating and cooling of structures. If resource sites were protected from development, then development would have to occur elsewhere. To do this, urban boundaries could be expanded and the same building density and form could be built. This would have no net change on energy consumption for heating and cooling of structures. However, this may result in negative consequences if development occurs outside the urban growth boundary. Energy consumed for transportation would increase due to longer automobile trips.

If it were desirable or necessary to locate the development on or near the same site as the resource, structures could be located closer together outside of the resource area. This could be accomplished through clustering of buildings, which could result in more common wall construction and reduced surface area for a given volume. Heat transfer between indoors and outdoors would be reduced, resulting in energy savings.

Vegetation provides a tempering effect on climate and reduces energy needs for heating and cooling structures. Trees shade nearby buildings in the summer, reducing energy demands for cooling. Plants also absorb sunlight and transpire during growing seasons, reducing ambient air temperatures. Trees and shrubs also act as a wind break during winter. By slowing or diverting winter winds around and over buildings, heat loss from convection is reduced, resulting in lower energy needs.

In summary, resource protection would result in overall positive consequences. Energy needs for heating and cooling structures would be reduced. A positive impact would result from clustering. Energy savings would be realized as a result of the ameliorating effects of resource vegetation on the local climate. The extent of energy savings will depend on many factors, including type of resource protected, proximity of resource to development, structure type, heating source, construction materials, design and activities.

Energy Consequences on Transportation

Energy expenditures for transportation are related primarily to distance of travel between origin and destination and mode of transportation available. These variable can be affected by natural resource protection.

Public transportation is available throughout the study area. The Tri-County Metropolitan Transportation District (TRI-MET) provides public bus service along several regional transit ways. If new residential development was located away from resource areas and along or closer to public transit routes, energy needs for transportation could be reduced. Residents would have access to public transportation.

If resource protection limited or precluded future residential development in the Fanno Creek Watershed, and it were not replaced with increased densities nearby, impacts on energy consumption for transportation would depend on where the displaced housing would be located and whether residents would need to travel greater distances between home and employment or shopping. If development were allowed to expand beyond the urban growth boundary (UGB), development outside of the UGB would continue and energy consumption for transportation would increase.

The location of the Fanno Creek Watershed allows easy access to large populations for recreation, wildlife observation and educational purposes. Because this resource is closer to users, less transportation energy is required and a greater range of transportation modes, including bicycling and walking, can be used. Designated bicycle, equestrian and pedestrian trails within Fanno Creek Watershed make these alternative, non-consumptive forms of transportation more attractive.

Resource protection impacts on transportation energy costs depend upon where needed and potentially displaced housing will relocate. If potential housing units can be located nearby protected resource areas, located closer to employment centers and/or located closer to public transit routes, a net positive benefit from protection would result. If urban boundaries were expanded in areas far from employment, commercial and recreation destinations to compensate for lost needed development opportunities, more energy would be required for commuting and other automobile travel. Protection of urban natural areas of high recreational value will also reduce energy costs and encourage energy-efficient modes of transportation.

Energy Consequences on Infrastructure

Clustering of development outside of natural resource areas in an efficient manner will result in less infrastructure needed to serve sewer, water, transportation and other needs. Less energy will be lost in electrical transmission. It can also result in faster fire and police response times and reduce energy costs associated with these services.

Maintaining permeable soils and forest cover reduces peak flood levels and the potential for landslides. Resource protection would therefore reduce associated energy costs if development occurs away from flood and landslide hazard areas, fewer hazard control structures would be needed. Energy savings from reduced infrastructure materials and maintenance needs would result.

Energy Consequences on Firewood

The protection of forests will reduce the amount of available firewood. Although important for some people, firewood is not a major heating method in the Metropolitan area.

Summary of Energy Consequences

Considerable savings of energy can be achieved through natural resource protection, particularly in terms of infrastructure provision and structure heating and cooling. Transportation savings can also be substantial if needed development were located near destination points and public transit routes and energy-efficient travel modes were integrated into the natural resource protection plan.

ALL CONSEQUENCES**General Summary of all Consequences**

Protection of natural resources will have both positive and negative consequences. In general, the positive economic, social, environmental and energy consequences of resource protection outweigh the potential negative consequences. Housing faces the highest potential economic consequences in the form of reduced development potential. However, these consequences are partially offset by the economic benefits which result from resource protection.

COMPLIANCE WITH OTHER STATEWIDE PLANNING GOALS

The Statewide Goal 5 analyses above also demonstrates compliance with other statewide other Statewide Planning Goals. Particularly relevant are Goals 6, 7, 10, and 11.

Statewide Planning Goal 6 - Air, Water, and Land Resource Quality

This plan will help meet State and Federal water quality standards. It is a component of the City's DEQ approved compliance schedule for the Tualatin Watershed. This scheduled was prepared to comply with a decree of the Federal District Court.

Statewide Planning Goal 7 - Areas Subject to Natural Disasters and Hazards

This plan identifies public safety as a value to be protected. Development will either be directed away from hazards, or mitigation and construction management techniques will provide the necessary safeguards.

Statewide Planning Goal 10 - Housing

The State's Metropolitan Housing Administrative Rule requires that lands in floodplains, on slopes greater than 25%, and needed for the protection of significant natural resources and open space be removed from the City's buildable lands inventory. Although this land is, by definition, not needed for housing, it does provide some in-fill opportunities. To the extent housing density can be increased, urban services can be provided in a more cost effective manner. The overall housing effect of this plan would be that up 23% of the Fanno Creek Watershed would change from a speculation to a

custom market. This added cost of housing could be avoided in the absence of new regulations.

Statewide Planning Goal 11 - Public Facilities and Services

This plan will provide for orderly and efficient delivery of urban services by clustering development in areas of steep topography. Without this clustering, many parts of the Fanno Creek Watershed would be difficult or impossible to serve.

Off-site Effects: Resource Site 131 is the only site blocked to fish migration, but it still provides water necessary to support rearing and feeding sites for fish using the Fanno Creek Watershed west of the Portland City Limits.

DECISIONS

Goal 5 Decisions

Programs carrying-out Statewide Planning Goal 5 are combinations of the following three decisions.

1. Allowing all conflicting uses.

This decision is made when a conflicting use, notwithstanding its harm to a resource, is so important that it should be allowed without restrictions. This decision is carried-out by leaving all, or part of, a base zoning alone, even though the entire base zone may contain natural resources known to be significant.

2. Allowing some conflicting uses.

This decision is made when both the resource and the conflicting uses are important relative to each other, and some restrictions are placed on conflicting uses. These restrictions would protect some resource values while at the same time allowing some conflicting uses. This decision is carried-out by placing an environmental conservation zone over a base zone. The environmental conservation zone is generally placed on resources that, while not as important as those receiving environmental protection zones, are of significant value to overall ecosystems, and warrant conservation. In rare occasions, the conservation zone is also placed on very important resources, but only when the base zone allows very important conflicting uses. The conservation zone allows base zone development whenever the harmful aspects of development are minimized, controlled, and mitigated.

3. Prohibiting all conflicting uses.

This decision is made when a resource, relative a conflicting use, is so important that the resource should be protected and all conflicting uses should be prohibited. This decision is carried out by placing an environmental protection zone over a base zone. Most protected resources are irreplaceable. They have high functional values. Examples of these resources include wetlands, ponds and creeks, and high quality uplands. These areas generally support fish and wildlife and may contain sensitive, threatened or (locally) rare species. Vegetation in these areas usually serves critical soil and slope stabilization functions. Especially important are those riparian areas which provide shade, stabilize creek banks and adjacent slopes, or provide organic material to a water body. The environmental protection zone insures the protection of resources, functional values, fish and wildlife habitat, and the preservation of the integrity and viability ecosystems as a whole. The environmental protection zone also protects existing and future development from natural hazards such as landslides, earthquakes, and flooding.

Decisions to allow all conflicting uses are "no action" alternatives. In short, they are decisions to let everything which can happen, to happen. No additional regulations are needed to let conflicting uses happen. Goal 5 does, however, require new land use regulations for decisions to limit or prohibit conflicting uses. These decisions are carried out by the proposed environmental regulations and the zoning maps. It is important to note that none of these land use regulations authorize public use of regulated property.

General Decisions

A general decision was made to exempt activities which have no, or no significant, adverse environmental consequences from regulation. In certain cases these exemptions have clear and objective qualifying situations to ensure no significant harm to significant natural resources. A general decision was also made to replace transition area quasi-judicial reviews to ministerial review by clear and objective standards. The transition areas, by definition, have no significant resources, but development in transition areas must be done carefully to avoid harm to nearby significant resources. These two decisions apply city-wide.

A special transition area is also provided for Fanno Creek Watershed residences. This is a decision to not protect known significant resources. This decision does not apply to riparian areas, and does not apply city-wide.

Site Specific Decisions

The following charts describe the decisions made for each resource site. All eight resource sites have a mixture of protection, conservation, and no overlay decisions. These decisions are carried out by the proposed environmental regulations and zoning maps. The area affected by each zone is given in the chart for each resource site.

Resource Site 124

The decision for Resource Site 124 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 124 Fanno Creek Tributaries North of S.W. Hamilton Road and East of S.W. Dosch Road					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	0	79	0	0	79
Conservation Overlay Zone	2	40	0	0	40
No Overlay Zone	6	452	0	0	452
Total	8	571	0	0	579

Resource Site 124 contains steep headwater tributaries of Fanno Creek. These streams flow in ravines from the north to the south and southwest. Topography becomes progressively flatter as streams reach S.W. Hamilton Road. Some of the steeper ravines contain native forests in advanced succession. Most drainageways, streams, ponds, and riparian areas listed on page 38 of this volume and depicted in Volume 2 of the Fanno creek Plan are recommended for environmental protection zones. (The identified scrub-shrub wetland is under the jurisdiction of Multnomah County.) The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations volume 3 of this plan, and other supporting documents provide sufficient

information to justify prohibiting the conflicting uses listed on page 71 of this volume in order to protect the resources listed on page 38 of this volume.

A stream and riparian area north of the intersection of S.W. 58th and Hamilton was placed in a conservation zone because of stream channel modifications, and because the riparian area was largely composed of non-native Cottonwood trees. This area still provides significant resource values, but habitat values are reduced by the partial removal of plants providing food and cover for wildlife. This area is, however, of critical importance as part of an east to west connection between parallel riparian areas on either side of the Hamilton Woods subdivision. Another riparian area west of S.W. 44th and Downsview Court was placed in a conservation because of the removal of native plants providing food and cover for wildlife. This area remains significant as a north to south corridor for wildlife which connects with a more valuable area under the jurisdiction of Multnomah County which flows back into the city where it is recommended for an environmental protection zone. The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 71 of this volume in order to conserve the resources listed on page 38 of this volume.

Hamilton Road functions as dam on its north side. Palustrine marsh wetlands listed on page 38 of this volume have established themselves in saturated soils are recommended for environmental protection zones. The ESEE analysis for Resource Site 124 provides sufficient information that resource values and conflicting uses are both important in these areas. The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 71 of this volume in order to conserve the resources listed on page 38 of this volume.

Forests are listed on page 38 of this volume and depicted in Volume 2 of the Fanno Creek Plan. Only those upland forests adjoining riparian areas were recommended for environmental zones. Forests dominated by native conifers are, with some exceptions, recommended for protection zones. The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 71 of this volume in order to protect the resources listed on page 38 of this volume.

Upland forests dominated by alder and maple, and not adjoining riparian areas, are recommended for conservation zones. The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations in Volume 3 of

this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 71 of this volume in order to conserve the resources listed on page 38 of this volume. An exception to the general rule includes a conifer plantation adjoining a riparian area south of SW Hewett. It was originally planted for holiday trees and, through time and neglect, has begun to assume the character of a forest. This area is recommended for a conservation zone because trees all of the same age class do not provide the same cover values to wildlife as mixed-age forests. The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 71 of this volume in order to conserve the resources listed on page 38 of this volume.

The environmental zone maps include less upland forested area than the resource inventory maps. These reductions are at the edges rather than the centers of these forests. Forest loss at edges does not significantly degrade resource values provided that functioning centers remain. The analysis for Resource Site 124 beginning on page 81 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify allowing the conflicting uses (almost entirely from single-dwelling residential) listed on page 71 of this volume in areas with significant upland forest resources.

The chart summarizes decisions for Resource Site 124. Most of the land recommended by conservation or protection is zoned for single dwelling residential development. A portion of the open space zone which includes Hamilton Park is also affected by environmental zones. No commercial or multi-dwelling zones are affected by the decisions for Resource Site 124.

Resource Site 125

The decision for Resource Site 125 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 125 Fanno Creek Mainstream and Tributary Junctions					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	23	63	6	0	92
Conservation Overlay Zone	6	200	21	4	231
No Overlay Zone	30	786	158	44	1018
Total	59	1049	185	48	1341

Resource Site 125 contains the mainstream of Fanno Creek and tributaries south of S.W. Hamilton and north of Beaverton-Hillsdale Highway; east of S.W. Dosch and north of Beaverton-Hillsdale Highway; and south of Beaverton-Hillsdale Highway, north of S.W. Vermont, and east of S.W. 45th Avenue.

Riparian areas south of S.W. Hamilton Road and west of S.W. 45th Avenue are recommended for environmental conservation zones. Food and cover values are somewhat degraded by the loss of native vegetation, but this area remains important as wildlife habitat (particularly as a corridor) and the other values listed on page 40. These conservation zones affect the north sides of

commercial and multi-dwelling residential property along Beaverton-Hillsdale Highway, and some single dwelling residential property south of S.W. Hamilton Road. Zone configurations are such that no conflicting use is completely eliminated by environmental zoning. There are two culverts under an office building at the west end (down stream) of the recommended conservation environmental zone that are too small to pass a 100-year flood. Federal Emergency Management Agency designated floodways are included within the recommended conservation zone. Along some segments fish habitat (particularly fish passage) and public safety are the principle values that would be conserved by environmental zoning. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 72 of this volume in order to conserve the resources listed on page 40 of this volume.

The extent and quality of native plant cover improves east of S.W. 45th Avenue and north of Beaverton Hillsdale Highway. Streams, riparian areas, and adjoining upland forests with better food and cover components (these forests are usually in steep ravines) are recommended for environmental protection zoning. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 72 of this volume in order to protect the resources listed on page 40 of this volume.

Other streams, riparian areas, upland forests west of S.W. 45th Avenue with less food and cover are recommended for conservation zoning. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 72 of this volume in order to conserve the resources listed on page 40 of this volume.

The northeastern edge of Resource Site 125 is a ridge which includes Council Crest Park and S.W. Fairmount Boulevard. Later succession upland forest, riparian areas, and streams are recommended for environmental protection zones. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 72 of this volume in order to conserve the resources listed on page 40 of this volume.

Other upland forests in a less advanced state of succession along the northeastern edge of Resource Site 125, and the Fairmount Boulevard scenic area, are recommended for environmental conservation zones. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient

information to justify limiting the conflicting uses listed on page 72 of this volume in order to conserve the resources listed on page 40 of this volume.

The section of Resource area 125 that is south of Beaverton-Hillsdale Highway includes the abandoned S. P. "Red Electric" railroad right-of-way. This right of way includes a forested embankment that has seasonal ponds at the toe of the slope. This abandoned right of way, and adjoining upland forest, is very important as a connection to the Resource Site 126 and is recommended for an environmental conservation zone. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 72 of this volume in order to conserve the resources listed on page 40 of this volume.

Four north-flowing, unnamed tributaries, south of Beaverton-Hillsdale Highway have well developed native forests and these tributaries and riparian areas are recommended for environmental protection zones. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 72 of this volume in order to protect the resources listed on page 40 of this volume.

Upland forests adjacent to these four tributaries are recommended for conservation zones. The analysis for Resource Site 125 beginning on page 105 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 72 of this volume in order to conserve the resources listed on page 40 of this volume.

The chart for Resource Site 125 provides a summary of these decisions. Most of the land recommended for protection or conservation is in single-dwelling zones. No commercial areas would be protected, protected multi-dwelling areas are flood and landslide prone, or very significant habitat.

Resource Site 126

The decision for Resource Site 126 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 126 Pendelton Tributary of Fanno Creek					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	0	7	0	0	7
Conservation Overlay Zone	1	42	0	0	43
No Overlay Zone	6	190	0	0	196
Total	7	239	0	0	246

Resource Site 126 includes the Pendelton Tributary of Fanno Creek. The portion of this creek east of S.W. 55th avenue has limited cover and is recommended for a conservation zone. The analysis for Resource Site 126 beginning on page 132 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 73 of this volume in order to conserve the resources listed on page 42 of this volume.

Riparian cover improves west of S.W. 55th Avenue and is recommended for a protection zone. The analysis for Resource Site 126 beginning on page 132 of this volume, the evaluations in Volume 3 of this plan, and other supporting

documents provide sufficient information to justify prohibiting the conflicting uses listed on page 73 of this volume in order to protect the stream, marsh, and riparian forest resources listed on page 42 of this volume.

The abandoned Southern and Pacific railroad right-of-way is an important wildlife corridor from Resource Site 125 through Resource Site 126. The upland forest between this right-of-way and Pendelton creek is also a critical connection. The analysis for Resource Site 126 beginning on page 132 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 73 of this volume in order to conserve the resources listed on page 42 of this volume.

The upland forest north of the Pendelton Creek riparian area is in an advanced state of succession, but its separation from other forest of similar character limits its value as wildlife habitat. This forest is recommended for a conservation zone. The analysis for Resource Site 126 beginning on page 132 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 73 of this volume in order to conserve the resources listed on page 42 of this volume.

The chart for Resource Site 126 provides a summary of these decisions. All but one acre of the land recommended for protection or conservation is in single-dwelling zones.

Resource Site 127

The decision for Resource Site 127 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 127 Vermont Tributary of Fanno Creek					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	17	25	4	1	47
Conservation Overlay Zone	2	51	1	1	55
No Overlay Zone	63	436	27	13	539
Total	82	512	32	15	641

Resource Site 127 includes the Vermont Tributary of Fanno Creek. Most of this creek, riparian area, and adjoining late succession upland forest are recommended for protection zones. The analysis for Resource Site 127 beginning on page 155 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 74 of this volume in order to protect the resources listed on page 44 of this volume.

Two degraded headwaters stream segments in and near Gabriel Park are recommended for conservation zones. The analysis for Resource Site 127 beginning on page 155 of this volume, the evaluations in Volume 3 of this

plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 74 of this volume in order to conserve the resources listed on page 44 of this volume.

Younger upland forests near condominium developments south and west of Gabriel Park and west S.W. Shattock Road are recommended for conservation zones. The forest between Gabriel Park and S.W. Maplewood Drive, part of the abandoned Oregon Electric railroad right-of-way, is especially important as a wildlife connection between Resource Sites 127 and 128. These forests are recommended for conservation zones. The analysis for Resource Site 127 beginning on page 155 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 74 of this volume in order to conserve the resources listed on page 44 of this volume.

The chart describes the decisions for Resource Site 127. Most of the land recommended for conservation or protection is zoned for open space or single dwelling residential development.

Resource Site 128

The decision for Resource Site 128 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 128 Woods (Multnomah) Tributary of Fanno Creek					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	21	26	0	0	47
Conservation Overlay Zone	17	170	1	1	189
No Overlay Zone	4	308	28	20	360
Total	42	504	29	21	596

Resource Site 128 contains the Woods Creek tributary of Fanno Creek. All of this creek and riparian area, and older adjoining upland forests are recommended for protection zones. The analysis for Resource Site 128 beginning on page 181 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 75 of this volume in order to protect the resources listed on page 46 of this volume.

Younger upland forest and the Multnomah Boulevard scenic area are recommended for conservation zones. S.W. Multnomah and Maplewood are part of the abandoned Oregon electric railroad right-of-way and are important

for wildlife habitat connections between Resource Sites 128 and 129. The analysis for Resource Site 128 beginning on page 181 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 75 of this volume in order to conserve the resources listed on page 46 of this volume.

The chart describes the decisions for resource Site 128. Most of the land recommended for protection or conservation is zoned for single-dwelling residential use, but several acres of open space are also recommended. This open space is in Woods and April Hill Parks.

Resource Site 129

The decision for Resource Site 129 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 129 North Fork Ash Creek Tributary of Fanno Creek					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	0	19	0	0	19
Conservation Overlay Zone	0	47	0	0	47
No Overlay Zone	0	274	0	1	275
Total	0	340	0	1	341

Resource Site 129 includes the north fork of Ash Creek. This creek and its riparian area are recommended for environmental protection zones. The analysis for Resource Site 129 beginning on page 207 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 76 of this volume in order to protect the resources listed on page 48 of this volume.

Upland forests are recommended for conservation zones. This forest provides an important habitat connection between Resource Site 128 and Resource Site 129. The analysis for Resource Site 129 beginning on page 207 of

this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 76 of this volume in order to conserve the resources listed on page 48 of this volume.

The decisions for Resource Site 129 are described in the chart. All of the land recommended for protection or conservation is zoned for single dwelling residential development.

Resource Site 130

The decision for Resource Site 130 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 130 South Fork Ash Creek Tributary of Fanno Creek					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	1	9	0	0	10
Conservation Overlay Zone	7	45	0	0	52
No Overlay Zone	10	237	25	63	335
Total	18	291	25	63	397

Resource Site 130 includes the south fork of Ash Creek. This creek, its riparian area, a scrub shrub wetland, and a forest at the west end of the site, and one upland forest at the east end of the site are recommended for environmental protection zones. The forest at the east end is especially important for slope stability and buffering impacts from Interstate 5 on adjoining residential property. The analysis for Resource Site 130 beginning on page 230 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 77 of this volume in order to protect the resources listed on page 50 of this volume.

Other upland forests are recommended for conservation zones. The analysis for Resource Site 130 beginning on page 230 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 77 of this volume in order to conserve the resources listed on page 50 of this volume.

The decisions for Resource Site 130 are described in the chart. Most of the land recommended for protection or conservation is zoned for single dwelling residential development, but some open space land is also recommended. All of this open space is in the "Dickenson Site."

Resource Site 131

The decision for Resource Site 131 is to prohibit conflicting uses in some places, limit them in other places, but to allow them in most places. Prohibitions are applied when resources are more important than the conflicting uses. The importance of a resource is gauged by the values it provides, its scarcity, how easily it could be replaced over the short term, and its "connectivity" or the contribution of its location toward maintaining a functioning ecological unit. Critical "links in a chain" are given high importance when they connect streams or forests. Limitations on conflicting uses are applied when the value of resources is comparable to the need for conflicting uses. When the need for conflicting uses outweighs the importance of resources, no prohibitions or limitations are applied. These decisions are carried out by the proposed zoning maps. The areas affected by each kind of decision are given in the chart below.

Resource Site 131 Far Southwest Tributary of Fanno Creek East of I-5					
	Open Space Acres	Single- Dwelling Acres	Multi- Dwelling Acres	Commercial Acres	Total Acres
Protection Overlay Zone	0	5	0	0	5
Conservation Overlay Zone	0	93	1	0	94
No Overlay Zone	10	322	53	31	416
Total	10	420	54	31	515

Resource Site 131 includes far southwest portion of the Fanno Creek Watershed. It includes one intermittent unnamed tributary. This tributary and its riparian area are recommended for environmental protection zones. The forest at the east end is especially important for slope stability and buffering impacts from Interstate 5 on adjoining residential property. The analysis for Resource Site 131 beginning on page 254 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify prohibiting the conflicting uses listed on page 78 of this volume in order to protect the resources listed on page 52 of this volume.

All upland forests and one marsh wetland are recommended for conservation zones. The analysis for Resource Site 131 beginning on page 254 of this volume, the evaluations in Volume 3 of this plan, and other supporting documents provide sufficient information to justify limiting the conflicting uses listed on page 78 of this volume in order to conserve the resources listed on page 52 of this volume.

The decisions for Resource Site 130 are described in the chart. All land recommended for protection or conservation is zoned for single dwelling residential development, except for a small wetland in Lesser Park.

REGULATIONS

The following are the measures needed to carry out the purposes of the *Fanno Creek and Tributaries Conservation Plan*.

1. Amend Two Goal 8 Comprehensive Plan Policies (8.10 and 8.11).
2. Amend Two Chapters of the City Zoning Code (complete replacement Environmental Zone Chapter and add two new definitions to the definitions chapter).
3. Amend the City Zoning Maps by adding Environmental Conservation zones and Environmental Protection overlay zones, and by removing stream feature and scenic designations.

NEW COMPREHENSIVE PLAN POLICIES

8.10 Drainageways

Regulate development within identified drainageways for the following multiple objectives.

Objectives:

A. Stormwater runoff

Conserve and enhance drainageways for the purpose of containing and regulating stormwater runoff.

B. Water quality and quantity

Protect, enhance, and extend vegetation along drainageways to maintain and improve the quality and quantity of water.

B.—C. Wildlife

Conserve and enhance the use of drainageways where appropriate as wildlife corridors which allow the passage of wildlife between natural areas and throughout the city, as well as providing wildlife habitat characteristics including food, water, cover, breeding, nesting, resting, or wintering areas.

8.11 Special Areas

Recognize unique land qualities and adopt specific planning objectives for special areas.

A. Willamette River Greenway

Protect and preserve the natural and economic qualities of lands along the Willamette River through implementation of the city's Willamette River Greenway Plan.

B. Balch Creek Watershed

Protect and preserve fishery, wildlife, flood control, and other natural resource values of the Balch Creek Watershed through the application of special development standards and approval criteria in the environmental overlay zones.

C. Johnson Creek Basin

Protect and preserve the scenic, recreation, fishery, wildlife, flood control, water quality, and other natural resource values of the Johnson Creek basin through application of environmental overlay zones and implementation of the Johnson Creek Basin Protection Plan.

D. Northwest Hills

Protect and preserve forest, wildlife and watershed resources through implementation of the Northwest Hills Natural Areas Protection Plan.

E. Southwest Hills

Protect and preserve fish and wildlife, forest, and water resources through implementation of the Southwest Hills Resource Protection Plan.

F. East Buttes and Terraces

Conserve wildlife, forest and water resource values and the unique geology of the East Buttes and Terraces through implementation of the East Buttes and Terraces Conservation Plan.

G. Fanno Creek Watershed

Conserve fishery, wildlife, flood control, and water quantity and quality values of the Fanno Creek Watershed through implementation of the Fanno Creek and Tributaries Conservation Plan.

NEW ENVIRONMENTAL REGULATIONS

CHAPTER 33.430
ENVIRONMENTAL ZONES
(Amended by Ord. No. _____, effective January 19, 1994)

Sections:

General

- 33.430.010 Purpose
- 33.430.020 Overlay Zones
- 33.430.030 Map Symbols
- 33.430.040 Subareas of Environmental Zones
- 33.430.050 Where These Regulations Apply
- 33.430.060 When These Regulations Apply
- 33.430.070 Items Exempt From These Regulations
- 33.430.080 Prohibitions
- 33.430.090 Relationship To Other Regulations

Natural Resources and Values

- 33.430.110 Purpose
- 33.430.120 Environmental Reports
- 33.430.130 Natural Resources and Values

Development Standards For Transition Areas

- 33.430.210 Purpose
- 33.430.220 Procedure
- 33.430.230 Development Standards

Development Standards For Resource Areas

- 33.430.250 Purpose
- 33.430.260 Procedure
- 33.430.270 Development Standards

Environmental Review

- 33.430.310 Purpose
- 33.430.320 Procedure
- 33.430.330 Application Requirements
- 33.430.340 Approval Criteria
- 33.430.350 Modification of Base Zone Development Standards

Natural Resource Management Plans

- 33.430.410 Purpose
- 33.430.420 Scope
- 33.430.430 Detail
- 33.430.440 Provisions
- 33.430.450 Adoption

Modifying Environmental Zone Boundaries

- 33.430.510 Purpose
- 33.430.520 Procedure

General

33.430.010 Purpose

The purpose of the environmental zones is to:

- Protect and conserve natural resources and resource values;
- Carry out Comprehensive Plan policies and objectives; and
- Encourage coordination between city, county, special district, regional, state, and federal agencies.

33.430.020 Overlay Zones

There are two environmental overlay zones.

- A. The Environmental Protection overlay zone is applied whenever the City determines that even careful development would harm an irreplaceable resource. The regulations of the Environmental Protection zone are stringent, and are designed to protect natural resources.
- B. The Environmental Conservation overlay zone is applied whenever the City determines that careful development could conserve most of the values provided by a natural resource. The regulations of the Environmental Conservation zone are intended to conserve resource values by first avoiding significant detrimental environmental impacts and then mitigating the unavoidable impacts of development.

33.430.030 Map Symbols

The environmental overlay zones are shown on the Official Zoning Maps with the following symbols:

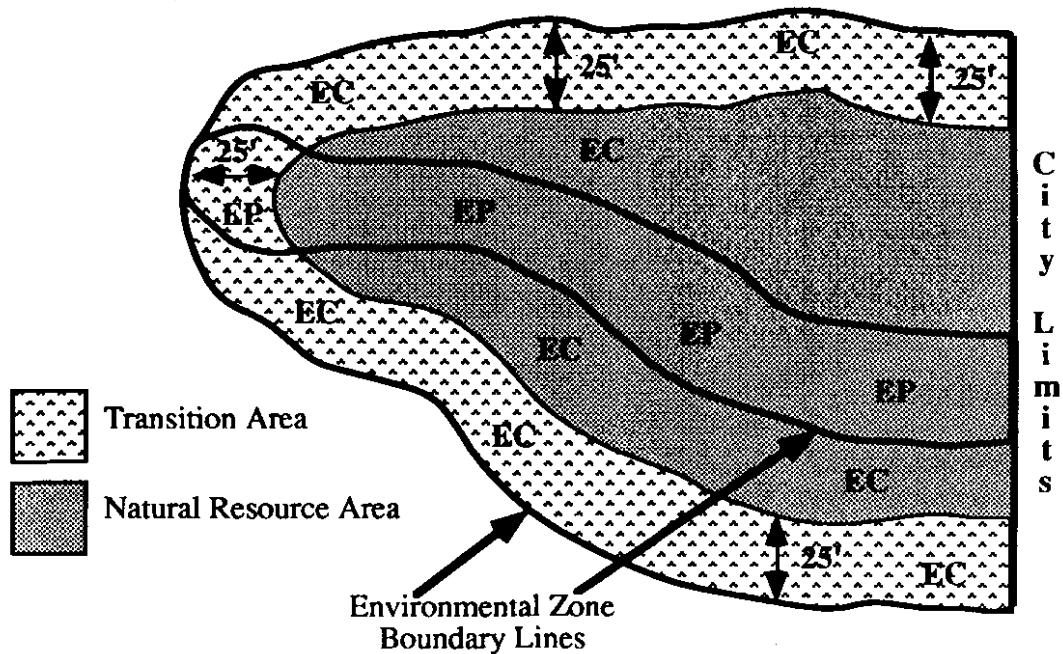
<u>Full Name</u>	<u>Map Symbol</u>
Environmental Conservation	c
Environmental Protection	p

33.430.040 Subareas of Environmental Zones

Environmental overlay zones contain natural resource areas and transition areas. Natural resource areas contain significant natural resources. Transition areas surround natural resource areas. Natural resources within transition areas are not significant, but they provide a buffer between significant resources and adjacent development. The rules for determining subareas are:

- A. **General rule.** The general rule for determining subareas is to measure 25 feet inward from the edge of an environmental zone boundary. This 25-foot area is the transition area. The remaining area is the natural resource area. See Figure 430-1. The general rule is modified in the following situations:
 - 1. Where part of an environmental zone boundary is also the City Limits, a transition area is not measured from the City Limits.
 - 2. Where environmental zone boundaries abut other environmental zone boundaries, transition areas are only measured from the combined outer-most boundaries of all abutting zones.
 - 3. Where environmental zone boundaries are contained within other environmental zone boundaries, a transition area is not measured from any contained boundary.
- B. **Special rules for the Fanno Creek Watershed.** Subsection A, above, also applies to the Fanno Creek Watershed except:
 - 1. **Residences.** Residences in Environmental Conservation zones are always in transition areas. For the purpose of this subsection "residence" means the building coverage of any residential structure and its attached accessory structures. If this total building coverage is less than 5,000 square feet, the transition area is extended into adjacent uncovered area. See Figure 430-2. The following are prohibited:

**Figure 430-1
Environmental Zone Subareas**



- a. Extensions greater than 5,000 square feet;
 - b. Extensions more than 25 feet from a residence;
 - c. Extensions into any resource area of any Environmental Protection zone;
and
 - d. Extensions into any riparian areas.
2. **Riparian Areas.** All riparian areas in environmental zones, including areas within 25 feet of environmental zone boundaries, are in resource areas. For the purpose of this section "riparian area" means all area within 20 feet of the top of bank of a water body, and all area between the top of banks of a water body.

33.430.050 Where These Regulations Apply

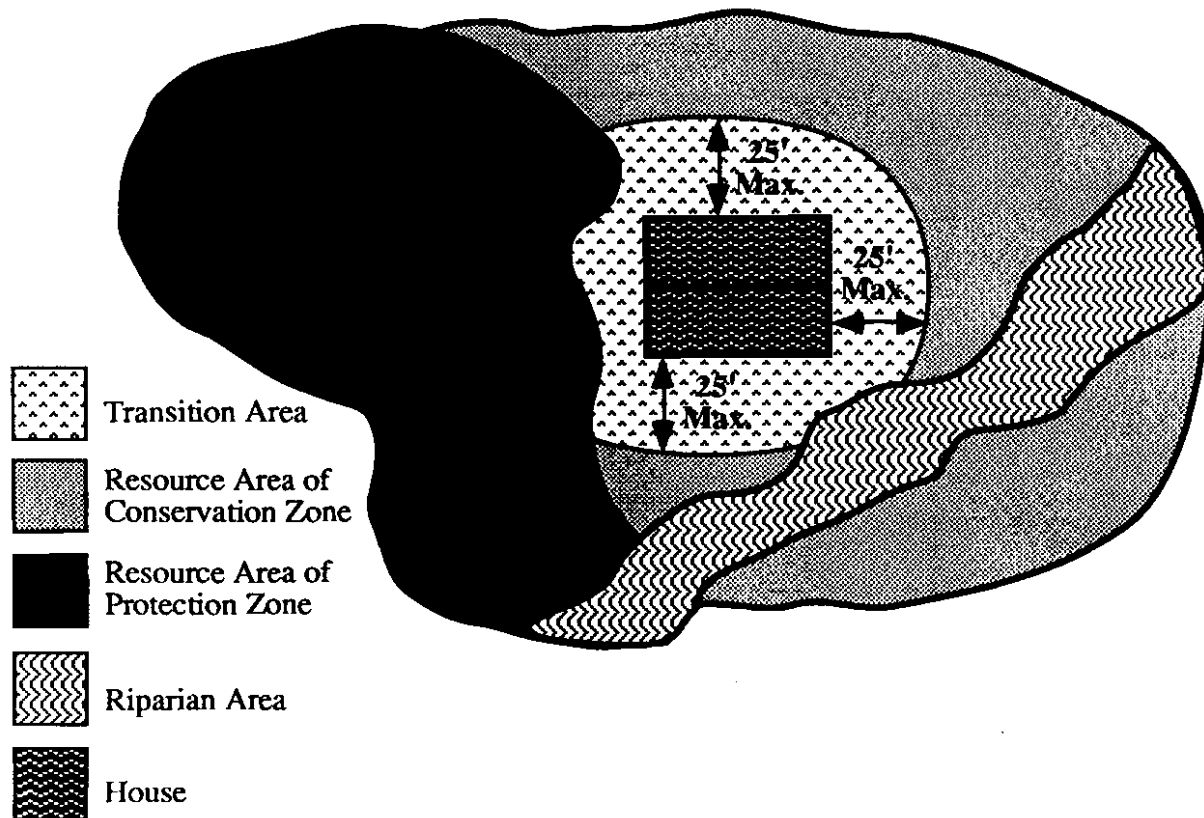
These regulations apply to all environmental zones, except those in the Columbia South Shore Plan District that are south of NE Marine Drive. See Chapter 33.515, Columbia South Shore Plan District.

33.430.060 When These Regulations Apply

Unless exempted by Section 33.430.070, below, the regulations of this chapter apply to the following:

- A. Development;
- B. Land divisions, partitions, and property line adjustments;

Figure 430-2
Special Residential Transition Area in the Fanno Creek Watershed



- C. Removing, cutting, mowing, clearing, burning, or poisoning native vegetation;
- D. Changing topography, clearing, grading, excavating, and filling;
- E. Resource enhancement; and
- F. Dedication and expansions of rights-of-way.

33.430.070 Items Exempt From These Regulations

The following items, unless prohibited by Section 33.430.080, below, are exempt from the regulations of this chapter:

- A. Change of ownership.
- B. Temporary emergency procedures necessary for the protection of life, health, safety, or property. See Chapter 33.296, Temporary Activities.
- C. Existing development and improvements, including the following activities:
 - 1. Maintenance, repair, and replacement of structures, exterior improvements, roads, and utilities. Replacement is not exempt whenever coverage, size, capacity, or height is increased.

2. Maintenance of gardens, pastures, lawns, and landscape perimeters; including the installation of new irrigation and drainage facilities and new erosion control features.
3. Alterations of buildings which do not change building coverage or height.
4. Operation, maintenance, and repair of the following: irrigation systems; drainage and stormwater detention areas; water and sewage pumping stations; erosion control and soil stabilization features; and pollution reduction facilities. This exemption applies only if all spoils are placed outside environmental zones.
5. Cutting hazardous portions of existing trees. Hazardous portions are those overhanging or within striking distance of a structure or a developed right-of-way. Cutting these portions is exempt only if all sections of wood greater than 12 inches in diameter remain, or are placed, in the resource area of the same ownership on which they are cut.

D. The following new development and improvements:

1. Federal or federally-supported projects described as the preferred alternative in a Final Environmental Impact Statement, or a Final Supplemental Environmental Impact Statement, found by Order-in-Council to comply with all applicable policies and objectives of Goal 8 of the Comprehensive Plan.
2. Activities which the City is directed to perform by judgments entered by courts of competent jurisdiction.
3. Activities specifically exempted by state or federal law from compliance with local comprehensive plans and land use regulations.
4. Public street and sidewalk improvements meeting all of the following: Improvements must be within an existing public right-of-way used by truck or automobile traffic. Local service streets must not exceed the minimum curb-to-curb widths described in Title 34, Subdivision and Partitioning Regulations. Other streets must not exceed curb-to-curb widths of 70 feet. Sidewalks must not exceed an edge-to-edge width of six feet.
5. Pedestrian accessed water quality monitoring stations constructed to the standards of the Bureau of Environmental Services and pedestrian accessed groundwater monitoring wells constructed to the standards of the Bureau of Water Works.
6. Utilities installed above or below developed portions of public rights-of-way.
7. Single utility poles providing service to a single ownership or monitoring station.
8. Boundary and topographic surveys leaving no cut scars greater than one inch in diameter on live parts of native plants.
9. Soil tests performed with hand-held equipment, provided that excavations do not exceed a depth of five feet, combined diameters of all excavations do not exceed five feet, and all excavations are refilled with native soil.

10. Trails conforming to all of the following: Trails must be confined to a single residential ownership. Construction must take place between May 1 and October 30 with hand held equipment. Widths must not exceed 30 inches. Switch backs must be used on slopes exceeding 20 percent. There must be no scars greater than three inches in diameter left on live parts of native plants. Trails must not be placed between the top-of-banks of water bodies.
11. Land divisions, partitions, and property line adjustments with tentative plans, final plans, and recorded plats showing all of the following for every lot created or adjusted:
 - a. Building sites no closer than five feet to any resource area. For the purpose of this subsection, "building site" means an area of any shape in which a square 40 feet by 40 feet will fit;
 - b. Public and private utilities (including water lines, sewer lines or drain fields, and stormwater disposal facilities) where none of these utilities are in a resource area; and
 - c. Streets, driveways, and parking areas where no pavement is within ten feet of a resource area.
12. Any use, development, or other activity in the Columbia South Shore Plan District south of NE Marine Drive.

33.430.080 Prohibitions

Prohibitions apply to both transition areas and resource areas.

- A. **General prohibitions.** The following items are prohibited in all environmental zones:
 1. Bulk plant, bulk use, or package use of hazardous substances. Transportation of hazardous substances through environmental zones by rail or on designated truck routes is allowed. Use of consumer quantities of hazardous substances within environmental zones is allowed subject to the regulations of this chapter. See 33.140.120 for descriptions of hazardous material quantities.
 2. The planting or propagation of any plant identified as a nuisance plant or prohibited plant on the Portland Plant List.
 3. Exterior work activities, unless in conjunction with a river-related or river-dependent use, See Chapter 33.440, Greenway Zones.
 4. Outdoor storage of unconfined solid or liquid waste, and outdoor storage of waste containers with cumulative volumes exceeding 90 gallons within any ownership. For the purpose of this chapter "waste" does not include residential trash cans, sorted recyclable materials, and landscape debris awaiting scheduled pick-up.
- B. **Special prohibitions.** The following items are prohibited only in environmental zones within the Northwest Hills or the Balch Creek Watershed.
 1. Development season. In environmental zones designated by the Balch Creek Watershed Protection Plan and the Northwest Hills Natural Areas Protection

Plan any activity which exposes soil to direct contact with stormwater between October 1 and April 30 is prohibited. An exception to this prohibition allows emergency repair of existing structures during any time of year.

2. Commercial sanctuary. In environmental zones designated by the Balch Creek Watershed Protection Plan, residential development is prohibited in commercial zones.

33.430.090 Relationship To Other Regulations

This chapter contains only the City's environmental regulations. Items which the City regulates through this chapter may also be regulated by other agencies. In cases of overlapping City, Special District, Regional, State, or Federal regulations, the more stringent regulations will control. City approval does not imply approval by these other agencies.

Natural Resources and Values

33.430.110 Purpose

The protection of natural resources preserves resource values. Unavoidable losses of natural resources can be mitigated by the restoration, creation, or enhancement of other resources. The adequacy of mitigation is judged by the comparison of lost values to new values.

33.430.120 Environmental Reports

The City has adopted the following environmental study reports:

- Balch Creek Watershed Protection Plan
- Columbia Corridor Industrial and Environmental Mapping Project
- Columbia South Shore Natural Resources Management Plan
- East Buttes, Terraces and Wetlands Conservation Plan
- East Columbia Neighborhood Natural Resources Management Plan
- Fanno Creek and Tributaries Conservation Plan
- Johnson Creek Basin Protection Plan
- Northwest Hills Natural Areas Protection Plan
- Smith and Bybee Lakes Natural Resources Management Plan
- Southwest Hills Resource Protection Plan

These reports identify natural resources and describe values at resource sites. The City's management objectives for study areas are also described in these reports.

33.430.130 Natural Resources and Values

All natural resources identified in the inventories of the reports listed in Section 33.430.120 are significant. Resource values are the benefits provided by natural resources. The values for each resource site are in the analysis section of these reports.

Development Standards For Transition Areas

33.430.210 Purpose

The purpose of these standards is to control development within transition areas. These standards are needed to prevent significant detrimental environmental impacts on adjoining resource areas. These standards also serve as models for construction management plans required for environmental review.

33.430.220 Procedure

Uses and development within transition areas must conform to the standards of this chapter. Adjustment of these standards is prohibited. Uses and development which do not meet these development standards require approval through environmental review process set out in Sections 33.430.310 to 33.430.350, below.

33.430.230 Development Standards

The development standards of this section apply to all transition areas.

- A. Building setbacks.** These regulations allow construction access, stormwater handling, and erosion control to take place between natural resource areas and structures. In some cases these regulations may also preserve solar access for natural resources. Structures must be set back from all resource areas by the distances stated in Table 430-1. Public safety facilities are exempt from this standard.

Table 430-1 Required Setbacks From Resource Areas	
Height of Structure in Feet	Required Setback in Feet
25 or Less	5
More than 25 but less than 30	10
More than or equal to 30 but less than 35	15
More than or equal to 35 but less than 50	20
More than 50	25

- B. Parking and truck areas.** These regulations maintain the scenic value of natural resources. They also buffer the noise, fumes, lights, and motion of vehicular traffic.
1. **Auto and light truck areas.** Parking areas for autos and light trucks must be set back at least 10 feet from natural resource area boundaries. The setback must be landscaped to at least the L2 standard, as stated in Chapter 33.248, Landscaping and Screening.
 2. **Medium and heavy truck areas.** Parking, loading, and maneuvering areas for medium and heavy trucks must be set back at least 10 feet from natural resource area boundaries. The setback must be landscaped to at least the L3 standard, as stated in Chapter 33.248, Landscaping and Screening.
- C. Exterior storage and display.** Exterior storage and display areas must be set back at least 10 feet from resource area boundaries. The setback must be landscaped to at least the L3 standard, as stated in Chapter 33.248, Landscaping and Screening.
- D. Drainage.** Stormwater facilities must be approved by the Bureau of Environmental Services.
- E. Vegetation.** Vegetation used for required landscaping must be native. Rye and fescue grasses need not be native.
- F. Exterior lighting.** Exterior lights must not be spaced closer than one light every 25 feet. Incandescent lights exceeding 200 watts (or other light types exceeding the brightness of a 200 watt incandescent light) must be placed so that they do not shine directly into natural resource areas.

- G. Noise.** Nonresidential buildings must be placed and constructed to meet the Title 18 noise standards for nonresidential development adjacent to residential zones. For the purpose of this standard natural resource area boundaries shall be treated as residential property lines.
- H. Erosion control.** Erosion control must conform to Chapter 24.70, Clearing, Grading, and Erosion Control; the Erosion Control Technical Guidance Handbook, City of Portland, Bureau of Environmental Services, January, 1991; and the following standards.
1. **Wet weather.** All development between November 1 and April 30 of any year, which disturbs more than 500 square feet of ground, requires wet weather measures described in the Erosion Control Technical Guidance Handbook.
 2. **Self inspection.** Areas of ground disturbance must be inspected by or under the direction of the owner according to the following schedule: at least once every seven calendar days, within 12 hours of any storm event greater than one-half inch of rain in any 24-hour period, and once every 24 hours when runoff is occurring.
 3. **Minimum record keeping.** Records must be kept of all self inspections. Instances of visible measurable erosion must be recorded with a brief explanation of corrective measures taken. This record must be made available to the City upon request and retained until final inspection.
 4. **Maintenance and removal.** Erosion control measures must be maintained until 90 percent of all disturbed ground is covered by vegetation. Ninety percent cover means that on any 100 foot line, live vegetation must be found on nine of eleven equal distant points measured at ten foot intervals.

Development Standards For Resource Areas

33.430.250 Purpose

The purpose of these standards is to provide clear planting and erosion control requirements within resource areas. These standards are needed to help prevent significant detrimental environmental impacts on resource values within natural resource areas.

33.430.260 Procedure

Uses and development within resource areas must conform to the standards of this chapter. Uses and development within resource areas must also conform to the applicable approval criteria set out in Section 33.430.340, below.

33.430.270 Development Standards

The development standards of this section apply to all resource areas.

- A. Erosion control.** Erosion control must conform to Chapter 24.70, Clearing, Grading, and Erosion Control; the Erosion Control Technical Guidance Handbook, City of Portland, Bureau of Environmental Services, January, 1991; and the following standards.
1. **Wet weather.** All development between November 1 and April 30 of any year, which disturbs more than 500 square feet of ground, requires wet weather measures described in the Erosion Control Technical Guidance Handbook.

2. Self inspection. Areas of ground disturbance must be inspected by or under the direction of the owner according to the following schedule: at least once every seven calendar days, within 12 hours of any storm event greater than one-half inch of rain in any 24-hour period, and once every 24 hours when runoff is occurring.
 3. Minimum record keeping. Records must be kept of all self inspections. Instances of visible measurable erosion must be recorded with a brief explanation of corrective measures taken. This record must be made available to the City upon request and retained until final inspection.
 4. Maintenance and removal. Erosion control measures must be maintained until 90 percent of all disturbed ground is covered by vegetation. Ninety percent cover means that on any 100 foot line, live vegetation must be found on nine of eleven equal distant points measured at ten foot intervals.
- B. Landscape materials.** All landscaping, whether required or optional, must be of plant species native to the Portland Metropolitan Area and contained on the Portland Plant List. Where this requirement conflicts with plant lists identified in other sections of the code, this requirement will take precedence.

Environmental Review

33.430.310 Purpose

The purpose of environmental review is to prevent unnecessary harm to the environment, compensate for unavoidable harm, and ensure the success of mitigation and enhancement activities. The review provides for flexibility and reasonable development opportunities in the environmental conservation zone.

33.430.320 Procedure

Environmental reviews for all uses and development not listed under a special procedure are processed under the general procedures.

- A. General procedures.** The following are the general procedures:
1. Uses and development in natural resource areas of Environmental Conservation zones are processed through the Type II procedure.
 2. Uses and development in natural resource areas of Environmental Protection zones are processed through the Type III procedure.
 3. Uses and development in natural resource areas of both environmental zones are processed in a single review through the Type III procedure.
- B. Special procedures.** Uses and development in transition areas which do not conform to the development standards of this chapter are processed through the Type II procedure. The following uses in resource area of environmental protection zones and environmental conservation zones are also processed through a Type II procedure:
1. Roads and access drives, and buried connections to existing sewer and water lines in the Southwest Hills Resource Protection Plan area and the Fanno Creek and Tributaries Conservation Plan area;

2. Public recreational trails and signs; and
3. Resource enhancement activities.

- C. Pre-application conference required.** A pre-application conference is required for each Type II and III Review processed under the general procedures. Type II reviews processed under the special procedures do not require pre-application conferences.

33.430.330 Application Requirements

In addition to the standard application requirements of Section 33.730.060, the following information is required for an environmental review application:

- A. Supplemental site plan requirements.** One copy of each site plan must be at a scale of at least one inch to 100 feet. Site plans are required for existing conditions and construction management. A mitigation site plan is also required whenever significant detrimental environmental impact on identified natural resources and values cannot be avoided. The following must be included:
1. An existing conditions site plan including:
 - a. For the entire site:
 - 100-year floodplain and floodway boundaries;
 - Boundaries of the natural resource area and the transition area. These boundaries may be scaled in relation to property lines from the Official City Zoning Maps; and
 - Drainage patterns.
 - b. In areas of the site to be disturbed:
 - Distribution outline of shrubs and ground covers, indicating most abundant species;
 - Topography shown by contour lines at two foot vertical contours in areas of slopes less than ten percent and at five foot vertical contours in areas of slopes ten percent or greater;
 - Trees greater than six inches in diameter, measured five feet above the ground, identified by species;
 - United States Soil Conservation Service's Classification of soil types; and
 - Wetlands identified and delineated in accord with the January, 10, 1989, Federal Manual for Identifying and Delineating Jurisdictional Wetlands.
 - c. In areas of the site to be left undisturbed:
 - Crown cover outline, species composition, and successional stage of trees.
 2. A construction management site plan including:
 - Areas where existing topography and vegetation is to be left undisturbed;
 - Excavations and fills, including types of fill material; and
 - Site contouring, including existing and proposed grades.

3. A mitigation site plan including:

- Dams, weirs, or other in-water structures;
- Distribution outline, species composition, and percent cover of ground covers to be seeded or planted;
- Distribution outline, species composition, size, and spacing of shrubs to be planted;
- Location, species, and size of each tree to be planted;
- Stormwater management features, including retention, infiltration, detention, discharges, and outfalls;
- Water bodies to be created, including depth; and
- Water sources to be used, including volumes.
- Information showing compliance with Section 33.248.090, Mitigation and Restoration Plantings.

B. Supplemental narrative. The following is required:

1. Impact evaluation. Resources and values identified as significant for an environmental study area as a whole and for the affected resource sites must be addressed. The following must be evaluated:
 - a. Natural resources;
 - b. The values provided by these resources; and
 - c. The significant detrimental environmental impacts of the proposed use or development.
2. Construction management. Include construction timetables and describe how areas designated to be left undisturbed will be protected:
3. Mitigation. Describe a program to rectify, repair, or compensate for unavoidable significant detrimental environmental impacts. Mitigation must not be proposed as a substitute for avoidable impacts. Mitigation programs must be comprehensive and long term.
 - a. Location of mitigation measures. Mitigation must be done within the Portland city limits and within the same watershed as the proposed use or development.
 - b. Responsibility. The applicant must own the mitigation site; possess a legal instrument (such as an easement or deed restriction) sufficient to carry out and ensure the success of the mitigation program; or demonstrate legal authority to acquire property through eminent domain.
 - c. Elements of a mitigation plan. A mitigation plan must contain the following elements:
 - Comparison of the natural resource and values on the development site to those on the mitigation site;
 - Resource values to be restored, created, or enhanced on the mitigation site;
 - Documentation of coordination with concerned local, regional, special district, state, and federal regulatory agency;

- Construction timetables;
- Operations and maintenance practices;
- Monitoring and evaluation procedures; and
- Remedial actions for unsuccessful mitigation.
- Information showing compliance with Section 33.248.090, Mitigation and Restoration Plantings.

d. Assurances of performance. The Planning Director may require assurances that mitigation will be successfully carried out. See Section 33.700.050, Performance Guarantees.

C. Special evaluation by a trained professional. The Planning Director may hire a professional to evaluate proposals and make recommendations upon finding that additional expertise is warranted due to exceptional circumstances. The professional may have expertise in the applicable natural resource or expertise in the potential adverse impacts on the natural resource. A fee for these services will be charged to the applicant in addition to the application fee.

33.430.340 Approval Criteria

An environmental review application will be approved if the review body finds that the applicant has shown that all of the applicable approval criteria are met. There are three categories of approval criteria: general, special, and supplemental.

A. General approval criteria. General criteria apply to all uses and development not addressed by special criteria. These criteria are:

1. Transition areas. There will be no significant detrimental environmental impact on natural resource areas.
2. Resource areas in Environmental Conservation zones. There are no practicable locations, within the same ownership as the proposed use or development, on lands outside environmental zones or within transition areas.
3. Resource areas in Environmental Protection zones. All of the following must be met:
 - a. All sites within the Portland city limits, in which the proposed use or development is possible, are also in the resource areas of Environmental Protection zones;
 - b. Of these sites, the proposed site contains the least significant natural resources;
 - c. There is a public need for the proposed use or development; and
 - d. The public benefits of the proposed use or development outweigh all significant detrimental environmental impacts.

B. Special approval criteria. Special criteria apply to specified uses and development instead of the general criteria. These criteria are:

1. Public recreational trails. The public benefits of the proposed trails, rest points, view points, and interpretative facilities outweigh all significant detrimental environmental impacts.

2. **Public safety facilities.** The public benefit of the proposed facility outweighs all significant detrimental environmental impacts.
 3. **Resource enhancement projects.** There will be no loss of total resource area, no loss of any type of natural resource, no significant detrimental environmental impact on any resource value; and a significant improvement of at least one resource value.
 4. **Land divisions, partitions, and property line adjustments.** All resource areas of Environmental Protection zones in Planned Unit Developments and Cluster Subdivisions must be in common open space tracts. All lots, tracts, and parcels not in common ownership, and containing resource areas, must designate building sites, vehicular access, and utility service. All proposed uses and development must be outside the resource area of the environmental protection zone or must qualify for, and meet the criterion in Subparagraph 4, below.
 5. **Roads, driveways, walkways, stormwater disposal, and buried connections to existing sewer and water lines in the Southwest Hills Resource Protection Plan area and the Fanno Creek and Tributaries Conservation Plan area.** The applicant's impact evaluation demonstrates all of the following:
 - a. A Portland area 25-year, 24-hour storm described in the Soil Conservation Service's charts, will either not be detained or be detained for the periods required by the Bureau of Environmental Services;
 - b. Fill volumes are the minimum necessary to meet public facility design standards;
 - c. Road and driveway widths are the minimum necessary to meet public facility design standards;
 - d. There will be no significant detrimental environmental impact on water bodies for the migration, rearing, feeding, or spawning of fish; and
 - e. Water bodies are crossed only when there are no practicable alternatives; and no fill is placed between tops of banks.
- C. Supplemental approval criteria.** Supplemental criteria apply in addition to the applicable general or special criteria. These criteria are:
1. **Impact avoidance.** Proposed locations, designs, and construction methods are less detrimental to identified resource values than other practicable alternatives.
 2. **Construction management.** There will be no significant detrimental environmental impact on areas designated to be left undisturbed, and no trespass on adjacent ownerships.
 3. **Mitigation.** There will be no net loss of resource values.

4. Development in the Balch Creek Watershed. The following approval criteria apply within resource areas and transition areas designated by the Balch Creek Watershed Protection Plan.
 - a. Fish. Balch Creek cutthroat trout must be maintained in a range at least as extensive as their range in 1987 and at population of at least 2,000. Opportunities for stream enhancement must also be maintained.
 - b. Wildlife. The location, quantity, and quality of forest and contiguous forest cover must be sufficient to provide habitat for deer and elk and to provide for the passage of deer and elk between Forest Park and Pittock Acres Park.
 - c. Stormwater runoff. The frequency and severity of flooding in Macleay Park and the Northwest industrial area must not increase. Post-development flows must not exceed pre-development flows. Flow calculations must be based on a typical Portland area 25-year, 24-hour storm and be made in accord with the methods described in the United States Department of Agriculture, Soil Conservation Service's, Technical Release 55, Urban Hydrology for Small Watersheds. Private stormwater control facilities must have an operation and maintenance plan.
 - d. Soil erosion. Site clearing must be limited to the minimum necessary for construction. All cleared areas which are not within a building foundation or a graveled entrance way must be covered with mulch, matting, or other effective erosion control features within fifteen days of the initial clearing. Temporary erosion control features must be removed by October first of the same year the development was begun. All permanent vegetation must be seeded or planted by October 1 of the same year the development was begun, and all soil not covered by buildings or other impervious surfaces must be completely vegetated by December 1 of the same year the development was begun.
 - e. Forest cover. Ninety percent of the portion of development sites in environmental zones must be retained or established in closed canopy forest. An exception to this standard allows 3,000 square feet of unforested area for sites less than 30,000 square feet in total area. Planned unit developments, subdivisions, and clustered subdivisions must include required forested areas in common open space. The planting of trees and shrubs for forest restoration, forest establishment, or landscaping must be done with native plants, but not with red alder or big-leaf maple. This standard allows the granting of adjustments to allow more than ninety percent of total area to remain unforested for designated park and cemetery, agriculture, or forestry activities provided that all other applicable approval criteria are met.
4. Development in the Northwest Hills. The following approval criteria apply within resource areas and transition areas designated by the Northwest Hills Natural Areas Protection Plan.
 - a. Wildlife. The location, quantity, quality and structural characteristics of forest vegetation must be sufficient to provide habitat and maintain travel corridors for the following indicator species: pileated woodpecker, sharp-shinned hawk, Roosevelt elk, white-footed vole, and red-legged frog. Standards to meet this criteria are provided in the applicable Habitat

Evaluation Procedure developed by the United States Fish and Wildlife Service.

- b. **Parks and Open Space.** Overall scenic, recreational, educational and open space values of Forest Park must not be diminished as a result of development activities. Public safety facilities are exempt from this criterion.
- c. **Miller Creek Watershed.** In the Miller Creek Watershed, development activities must not degrade natural water quality, quantity, and seasonal flow conditions, and must not increase water temperatures above 68°F. In addition, development activities must not decrease opportunities for fish and amphibian passage.

33.430.350 Modification of Base Zone Development Standards

Building heights may be increased and building setbacks may be decreased through environmental review. These modifications cannot be approved unless they are necessary to avoid or minimize significant detrimental environmental impacts. Modifications approved through environmental review do not require adjustments.

Natural Resource Management Plans

33.430.410 Purpose

Natural resource management plans provide an alternative to case-by-case environmental reviews. These plans provide the means to evaluate the cumulative effects of development and mitigation proposed at different times and in different places within the same large ecosystem. These plans are of particular value in areas of multiple ownership. These plans also provide opportunities for coordination with, or joint adoption by, other local governments; special districts; and regional state, and federal agencies.

33.430.420 Scope

Natural resource management plans must cover large ecosystems such as a forests, creeks, sloughs, or watersheds. These plans must address all natural resources and values conserved and protected by environmental zones within the plan boundaries. The plan must also address all significant detrimental environmental impacts of uses allowed by the plan.

33.430.430 Detail

At least one set of all required maps must be at the linear scale of one inch representing 200 feet. Plan document maps may be reduced and simplified for report purposes.

33.430.440 Provisions

Whenever natural resource management plan provisions conflict with the provisions of this chapter, plan provisions supersede. Non-conflicting provisions supplement the provisions of this chapter. The following contents are required for all natural resource management plans:

- A. Management objectives to maintain or enhance natural resources and values;
- B. Lists of allowed and prohibited uses;
- C. Maps of areas where these uses are allowed and prohibited;
- D. Types of mitigation or enhancement required;

- E. Maps of areas reserved for these mitigation or enhancement actions;
- F. Timetables for development, mitigation, and enhancement; and
- G. Procedures and criteria for approving allowed uses.

33.430.450 Adoption

Adoption and amendment of natural resource management plans is processed through a legislative procedure, See Chapter 33.740, as a plan district or a plan district amendment, See Chapter 33.500. A natural resource management plan, or an amendment to a natural resource management plan, will be approved if it meets both of the following approval criteria:

- A. Compliance with the purpose scope, detail, and contents required by Sections 33.430.410 to 33.430.440; and
- B. Compliance with the Statewide Planning Goals and the Goals and Objectives of the Portland Comprehensive Plan.

Modifying Environmental Zone Boundaries

33.430.510 Purpose

The location and quality of natural resources change naturally over time. The Official Zoning Maps will be updated to reflect these natural changes through periodic review and legislative procedures. Requests for environmental zone boundary changes are processed as a change of an overlay zone, as stated in Chapter 33.855, Zoning Map Amendments, but a special quasi-judicial procedure applies to permitted changes. This procedure does not apply to changes caused by violations of this Title.

33.430.520 Procedure

The City Council, Planning Commission, or Planning Director may initiate quasi-judicial environmental zone boundary amendments to reflect permitted changes in the location or quality of natural resources. The boundaries may be modified through a Type II procedure, and may be concurrent for corresponding mitigation and development sites. A Type II environmental zone boundary amendment may be made upon finding that either of the following situations exist:

- A. **Successful mitigation.** An approved mitigation plan has been successful and a new, restored, or enhanced resource exists which, depending on its degree of significance, should be included in either the resource area of an Environmental Conservation zone or the resource area of an Environmental Protection zone.
- B. **Approved loss of resource.** All of the following must be found:
 - 1. An approved development in a natural resource area has been completed;
 - 2. All mitigation required of this development has been successful;
 - 3. Natural resources at the developed site no longer exist, or have been subject to a significant detrimental environmental impact; and
 - 4. Depending on the degree of impact, the developed site should be placed in the resource area of an Environmental Conservation zone, in a transition area, or be excluded from environmental zone boundaries.

NEW DEFINITIONS

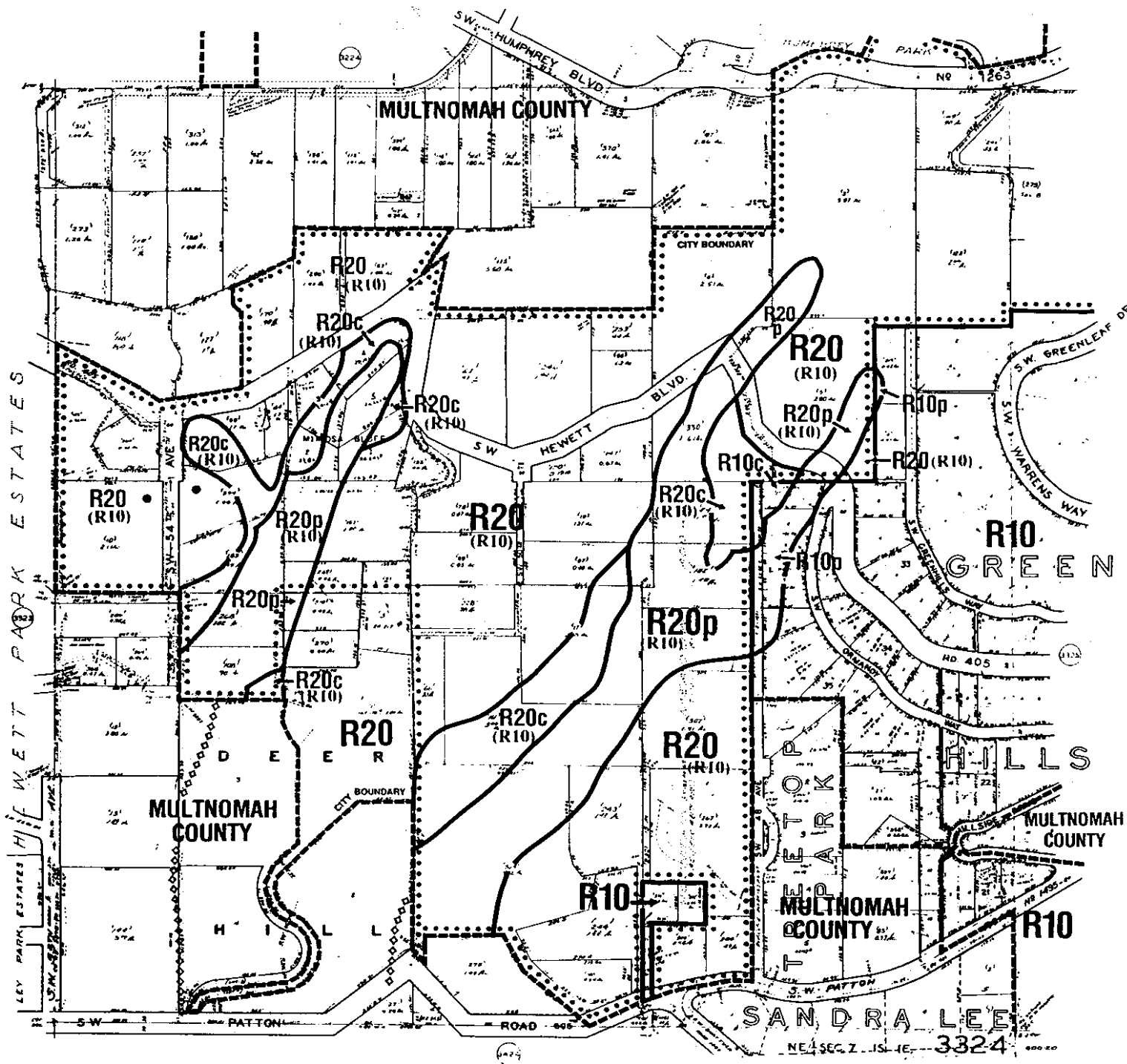
CHAPTER 33.910

DEFINITIONS

Pollution Reduction Facility. A facility specifically designed to remove pollutants from stormwater. Pollutants may include sediment, heavy metals, or plant nutrients. These facilities generally include native wetland plants which blend into surrounding habitat.

Practicable. Capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.

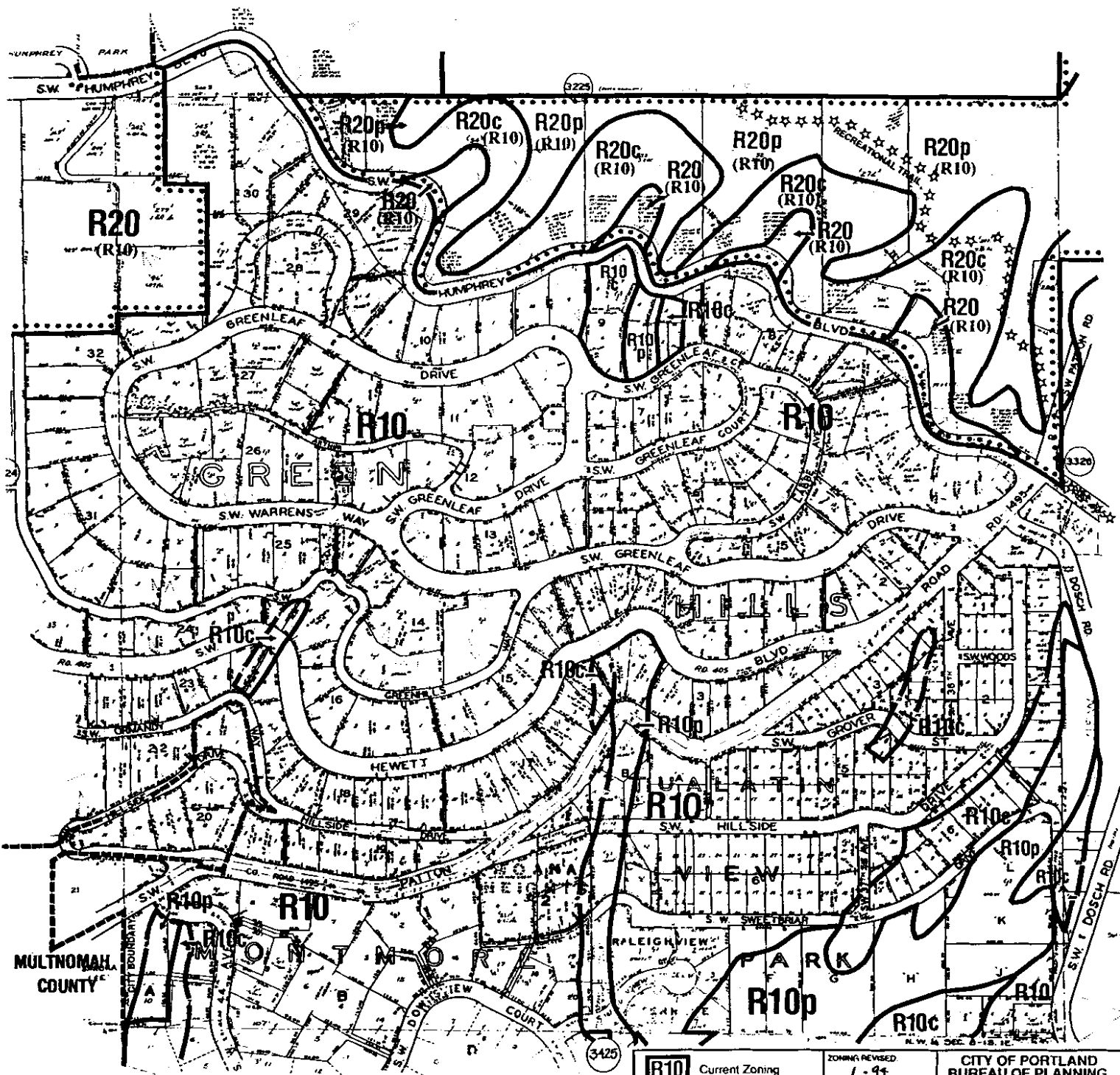
NEW ZONING MAPS



◆◆◆◆ WATER FEATURE: delineates natural drainage courses; topo map or field verification may be necessary

● HISTORIC LANDMARK
 NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

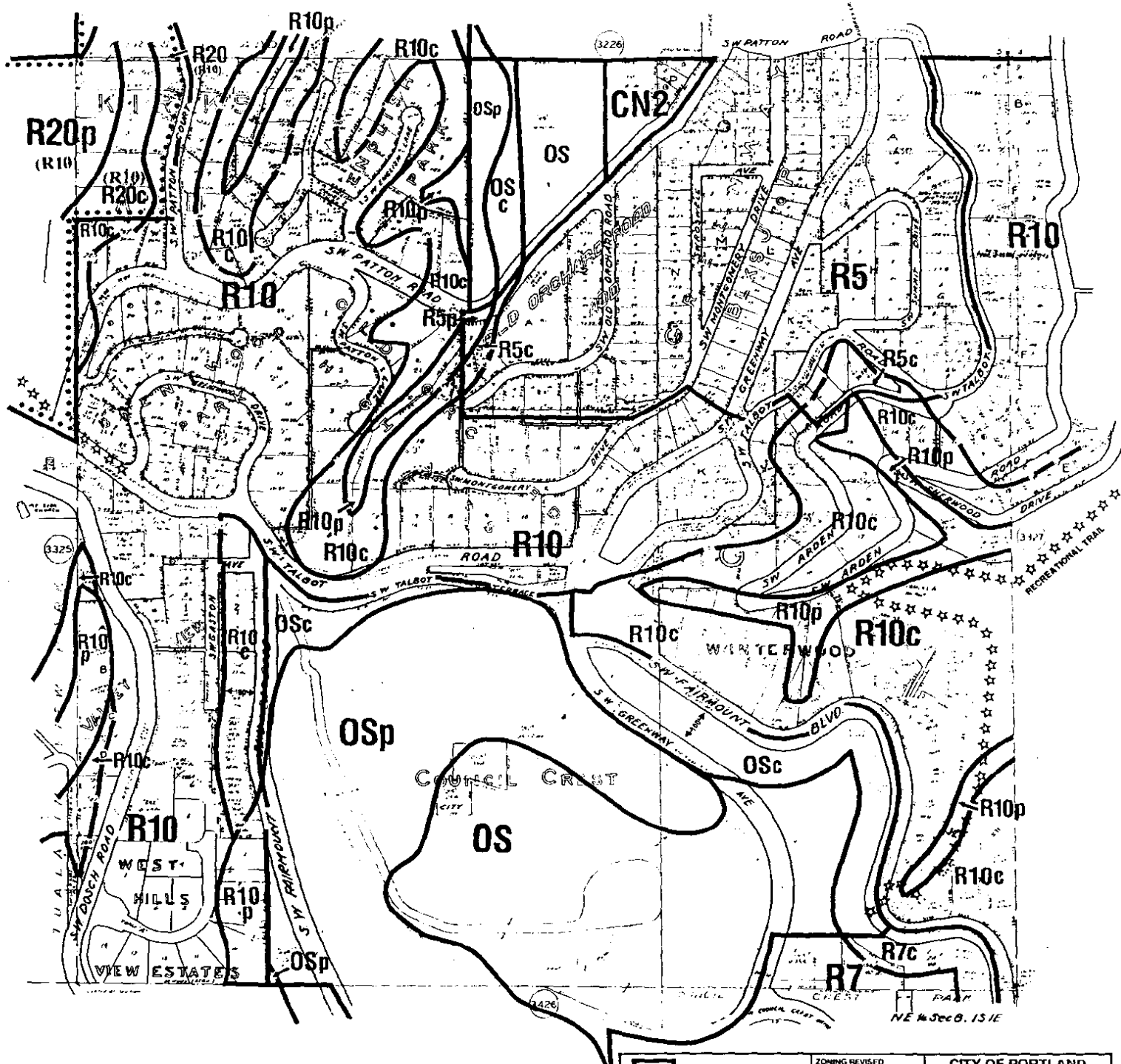
R10 Current Zoning Maximum Potential Zoning as per Comprehensive Plan (R10)	ZONING REVISED 1-94 BASEMAP ACQUIRED 5-89 LEGAL DESCRIPTION NE 1/4 SEC. 7-15-1E	CITY OF PORTLAND BUREAU OF PLANNING 0 100' 200' 300' SCALE IN FEET 3324
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NOTE: Where indicated, width of environmental protection zone, p, is measured from center of drainage, with 1/2 distance on each side.

NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

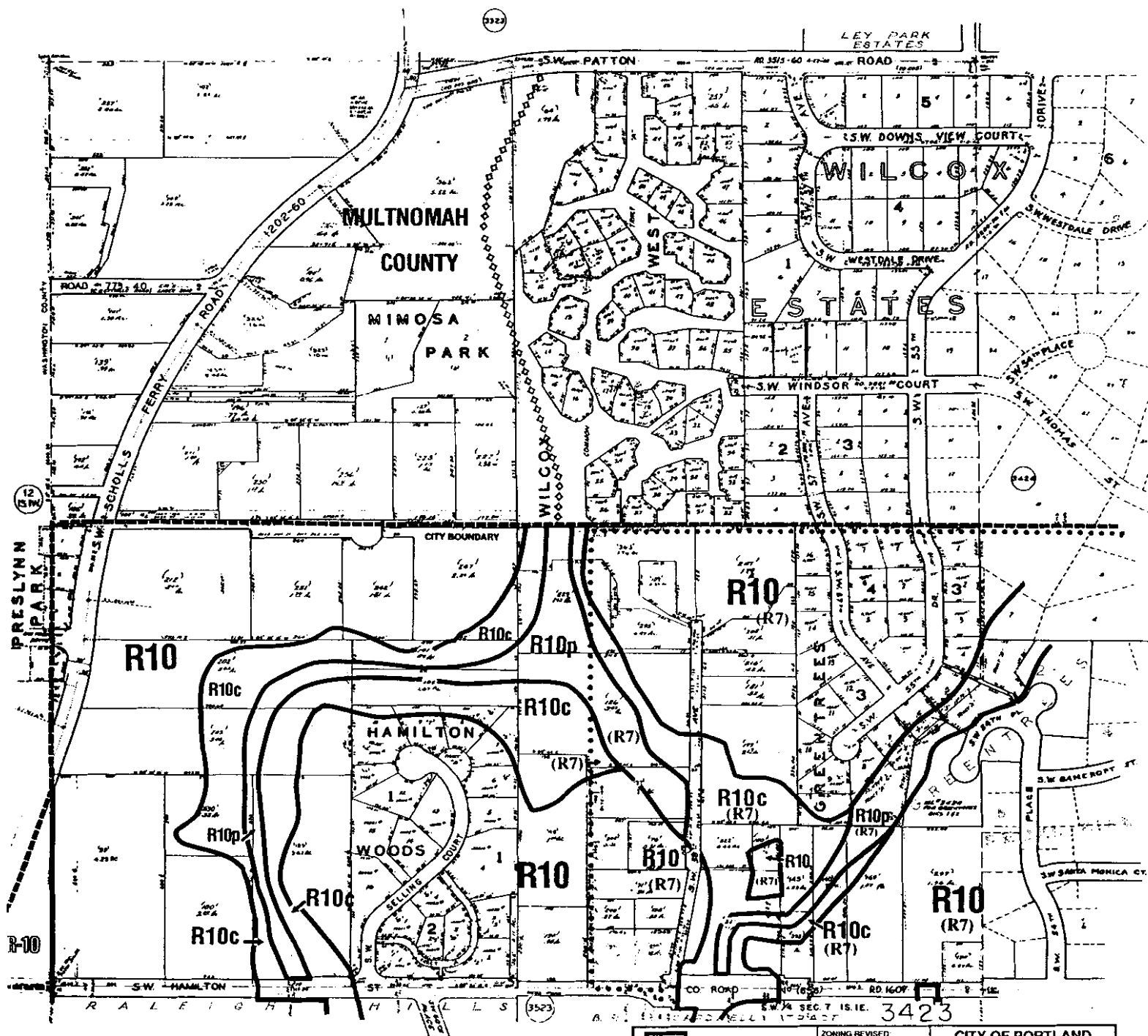
R10 Current Zoning	ZONING REVISED 1-94	CITY OF PORTLAND BUREAU OF PLANNING SCALE IN FEET 3325
..... Maximum Potential :(R10): Zoning as per Comprehensive Plan	BASEMAP ACQUIRED 5-84	
	LEGAL DESCRIPTION NW 1/4 SEC. 8-1S-1E	



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

NOTE: Where indicated, width of environmental protection zone, p, is measured from center of drainage, with 1/2 distance on each side.

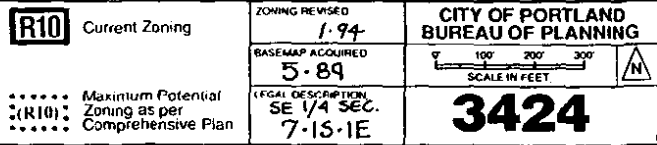
R10 Current Zoning	ZONING REVISED 1-94	CITY OF PORTLAND BUREAU OF PLANNING
..... Maximum Potential :(R10): Zoning as per Comprehensive Plan	BASEMAP ACQUIRED 2/82	0 100 200 300 SCALE IN FEET
	LEGAL DESCRIPTION NE 1/4 SEC. 8-15-1E	3326



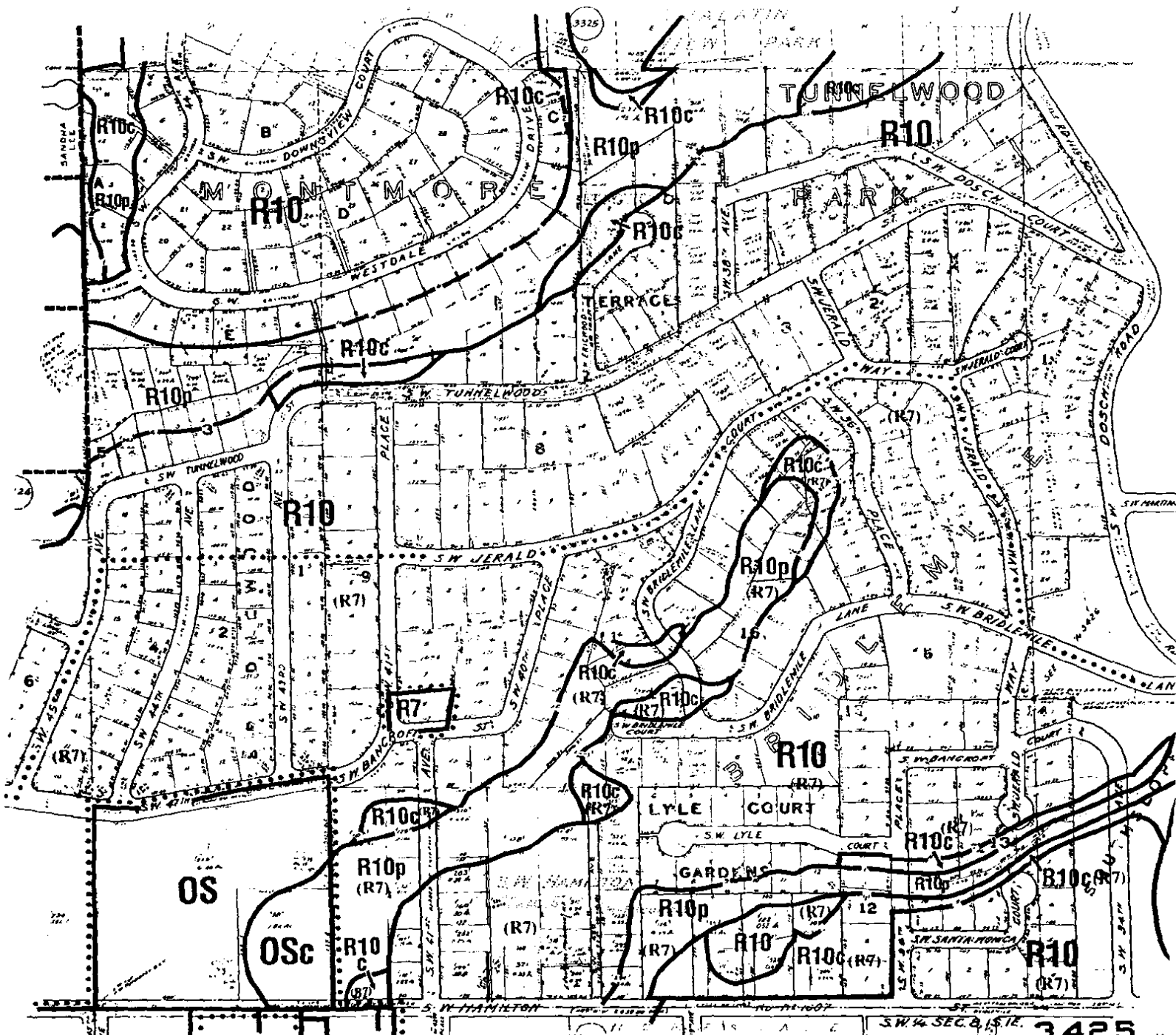
NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

♦♦♦♦♦ WATER FEATURE: delineates natural drainage courses; topo map or field verification may be necessary

[R10] Current Zoning	ZONING REVISED: 1-94	CITY OF PORTLAND BUREAU OF PLANNING
Maximum Potential Zoning as per Comprehensive Plan	BASEMAP ACQUIRED 5-89	SCALE IN FEET 0 100 200 300
	LEGAL DESCRIPTION SW 1/4 SEC. 7 IS. 1E.	3423

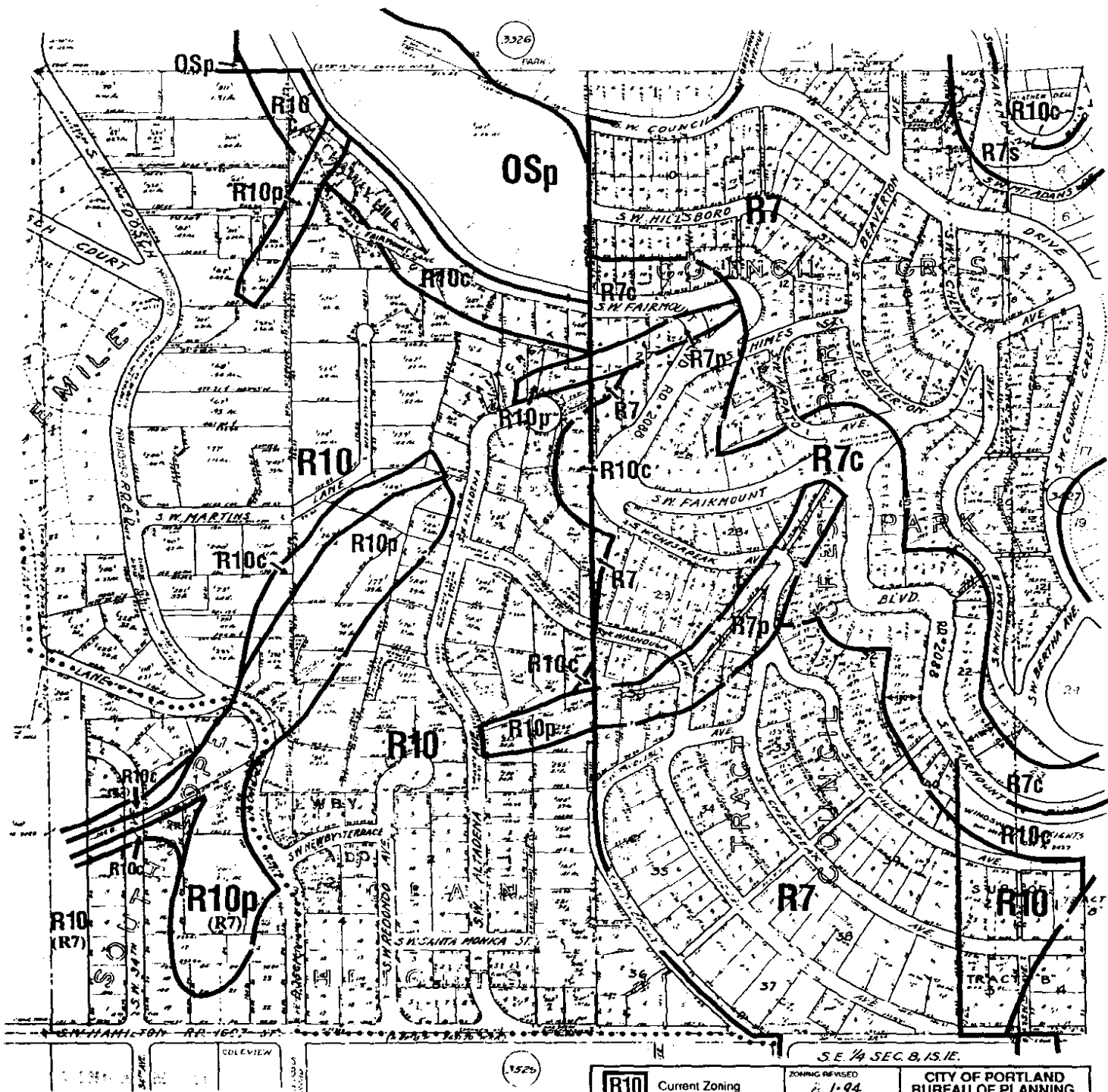


NOTE: Zoning designations are subject to change, verify zoning prior to development or sales.



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential (R10) Zoning as per Comprehensive Plan	ZONING REVISED 1-94 BASE MAP ACQUIRED 5-89 LEGAL DESCRIPTION SW 1/4 SEC. 8-1S-1E	CITY OF PORTLAND BUREAU OF PLANNING 3425
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NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

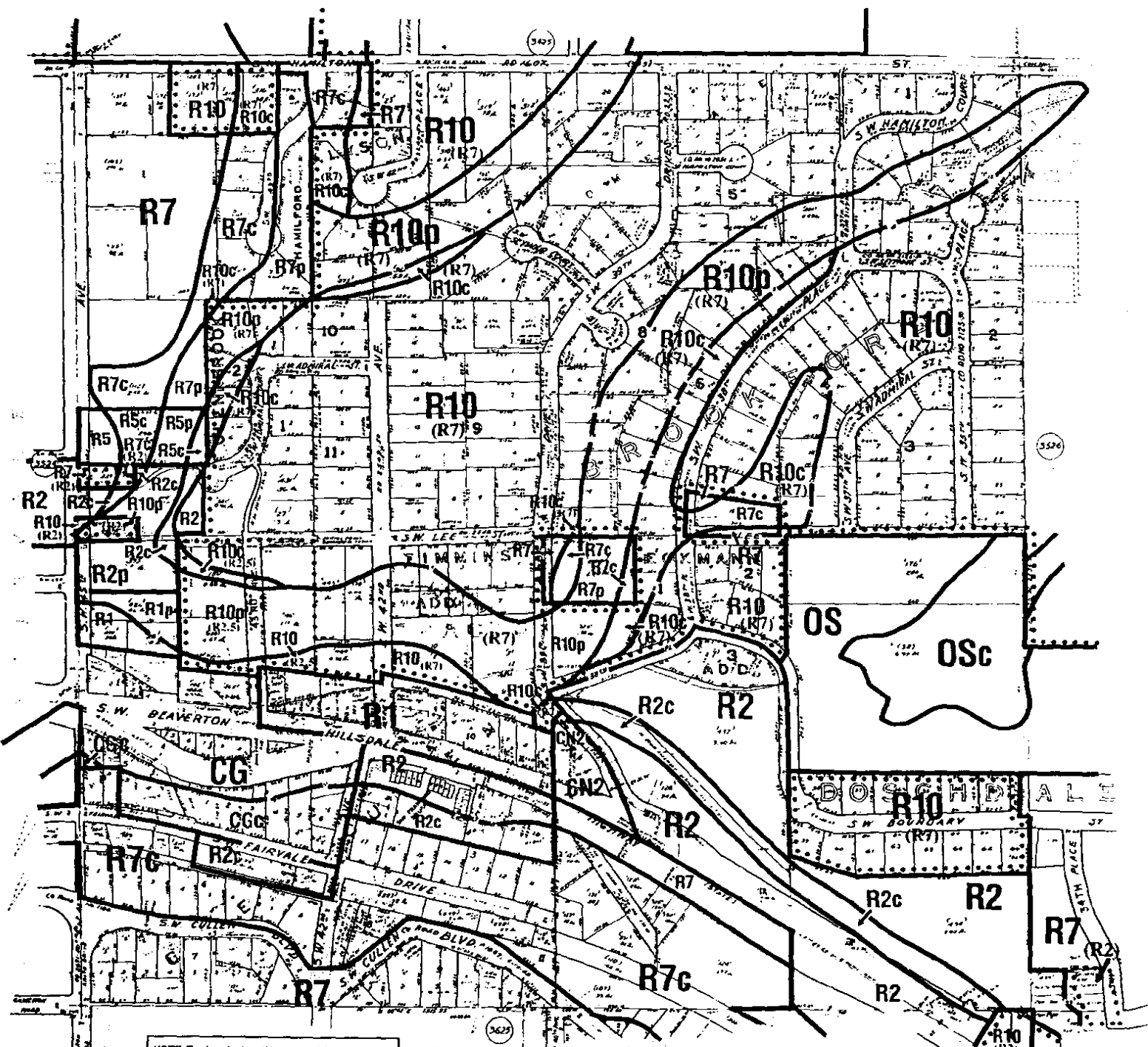
R10	Current Zoning	ZONING REVISED 1-94	CITY OF PORTLAND BUREAU OF PLANNING
		BASEMAP ACQUIRED 5-89	
..... :(R10):	Maximum Potential Zoning as per Comprehensive Plan	LEGAL DESCRIPTION SE 1/4 SEC. 8-15-1E	3426



● HISTORIC LANDMARK

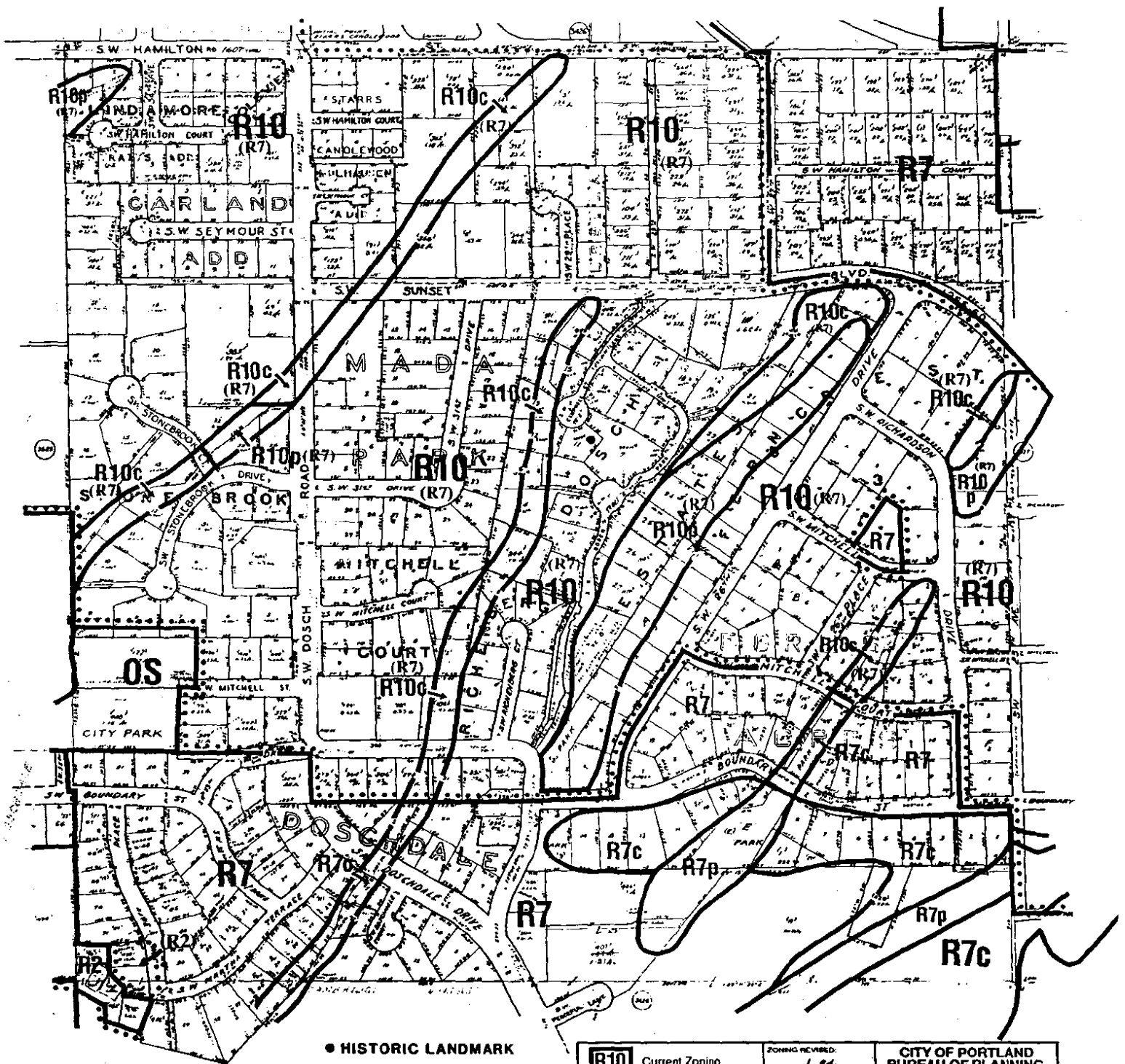
NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential Zoning as per Comprehensive Plan	ZONING REVISED: 1-94 BASEMAP ACQUIRED: 5-89 LEGAL DESCRIPTION: NE 1/4 SEC. 18-15-1E	CITY OF PORTLAND BUREAU OF PLANNING SCALE IN FEET: 0 100 200 300 3524
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NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

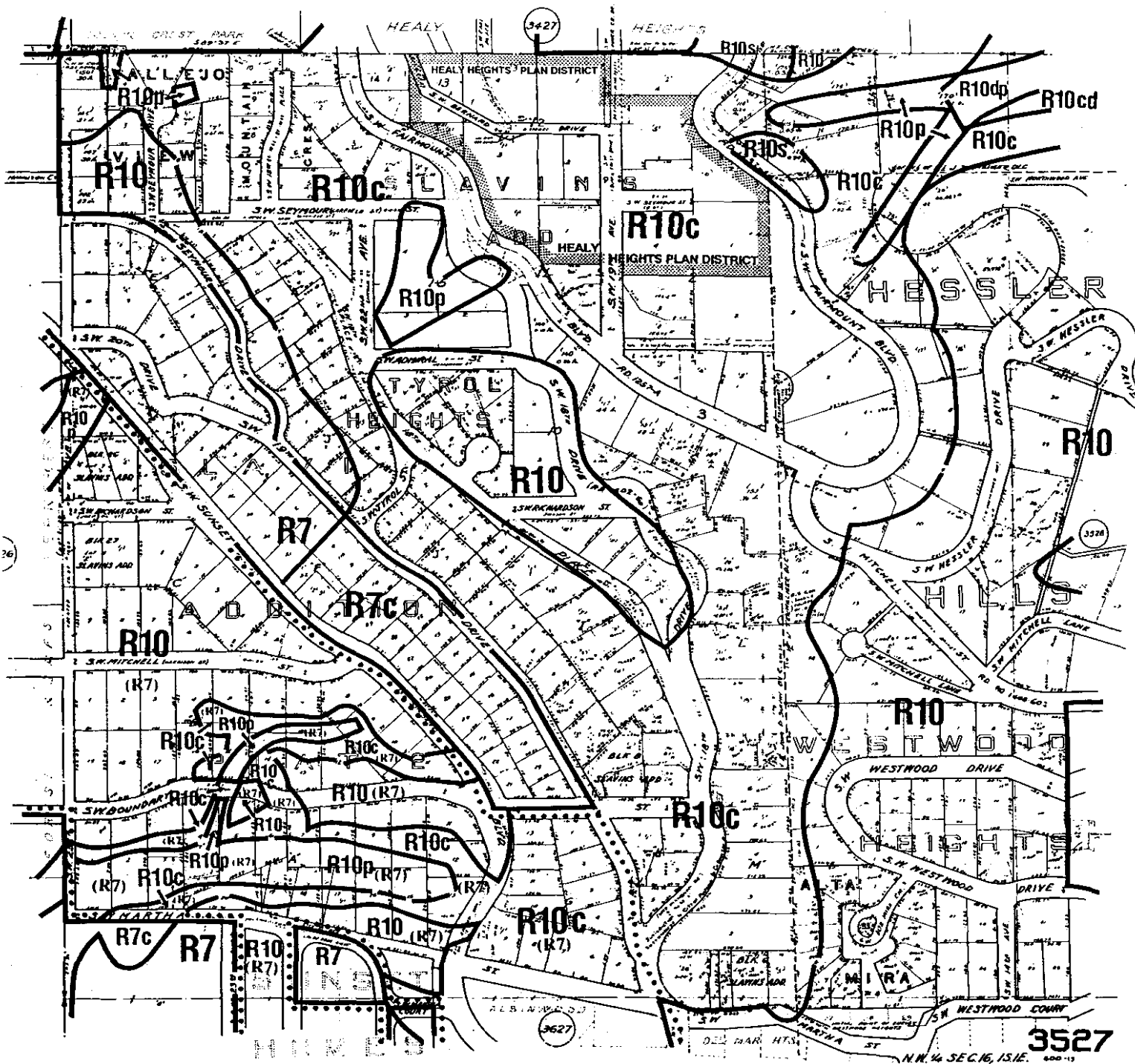
R10 Current Zoning	ZONING REVISED 1-94 BASEMAP ACQUIRED 7/84	CITY OF PORTLAND BUREAU OF PLANNING 0 100 200 300 SCALE IN FEET
..... Maximum Potential (R10) Zoning as per Comprehensive Plan	LEGAL DESCRIPTION NW 1/4 SEC. 17-15-1E	3525



● HISTORIC LANDMARK

NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

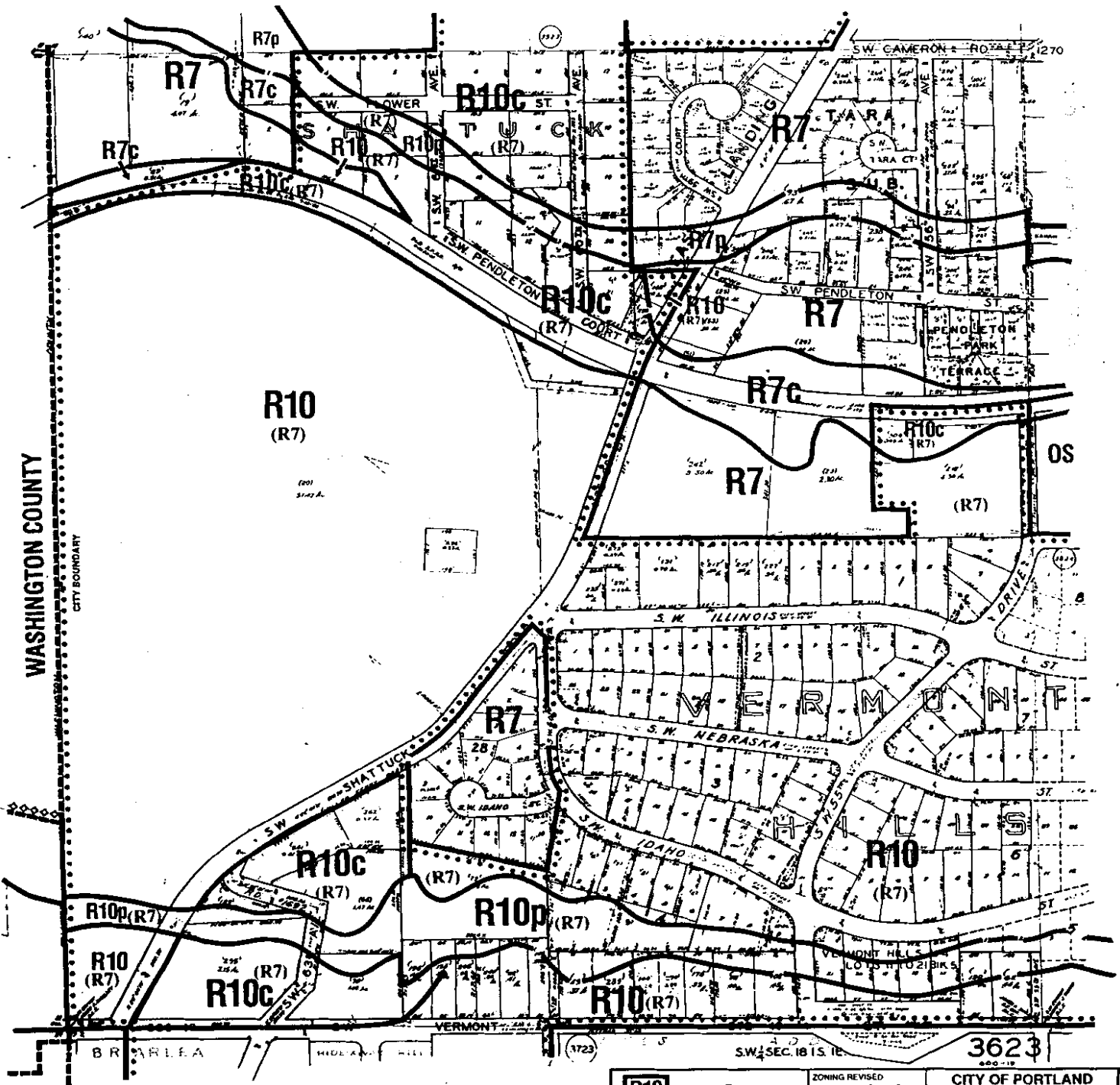
R10 Current Zoning Maximum Potential - - - - - Zoning as per Comprehensive Plan	ZONING REVISION:	CITY OF PORTLAND BUREAU OF PLANNING	
	BASEMAP ACQUIRED:	0' 100' 200' 300' SCALE IN FEET	
	LEGAL DESCRIPTION:	NE 1/4 SEC. 17-15-1E	
		3526	



NOTE: Where indicated, width of environmental protection zone, ϕ , is measured from center of drainage, with 1/2 distance on each side.

NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

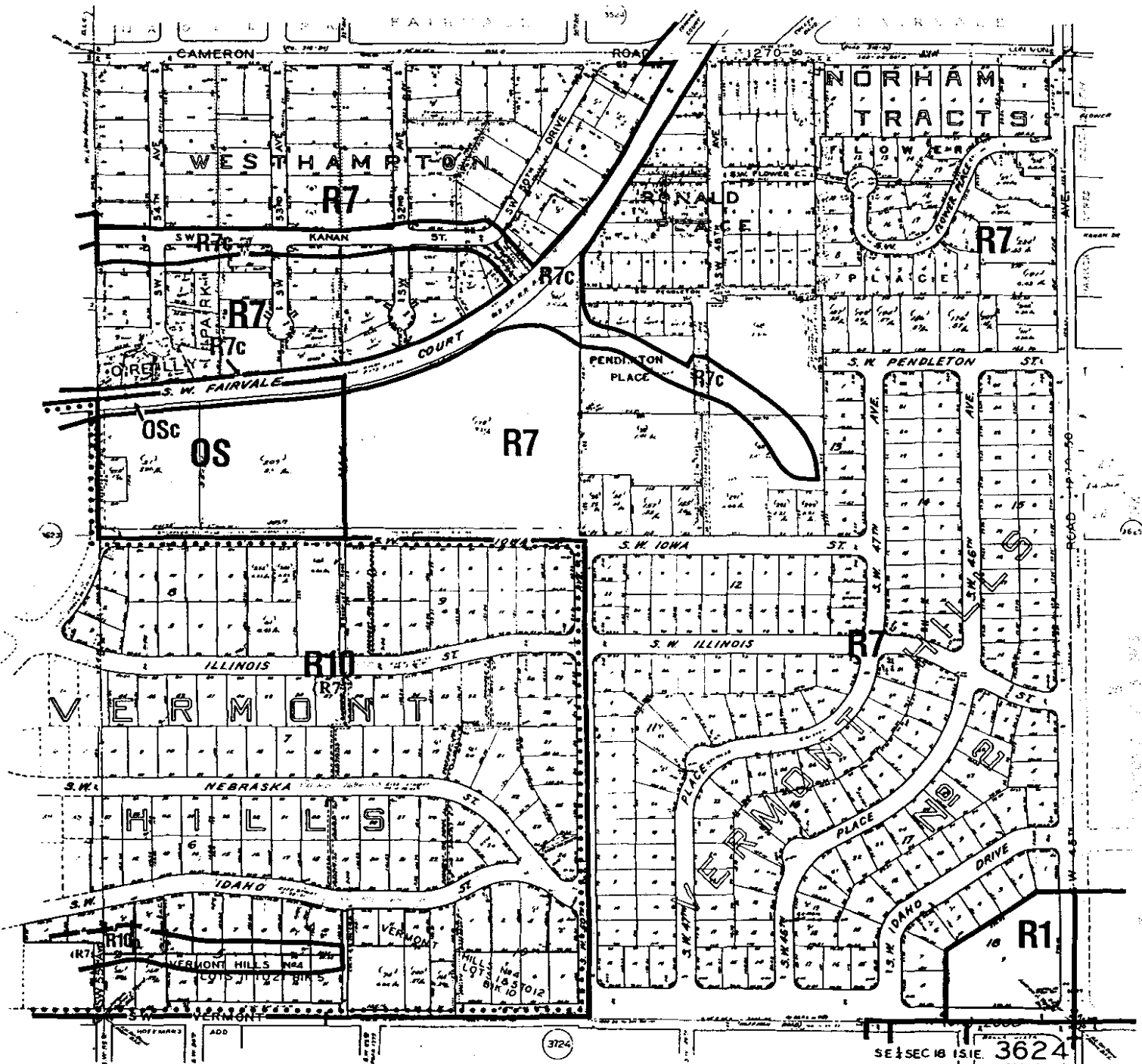
R10 Current Zoning Maximum Potential : (R10) : Zoning as per Comprehensive Plan	ZONING REVISED 1-94 BASEMAP ACQUIRED 10-89 LEGAL DESCRIPTION NW 1/4 SEC. 16, 15-1E	CITY OF PORTLAND BUREAU OF PLANNING 0 100 200 300 SCALE IN FEET 3527
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NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

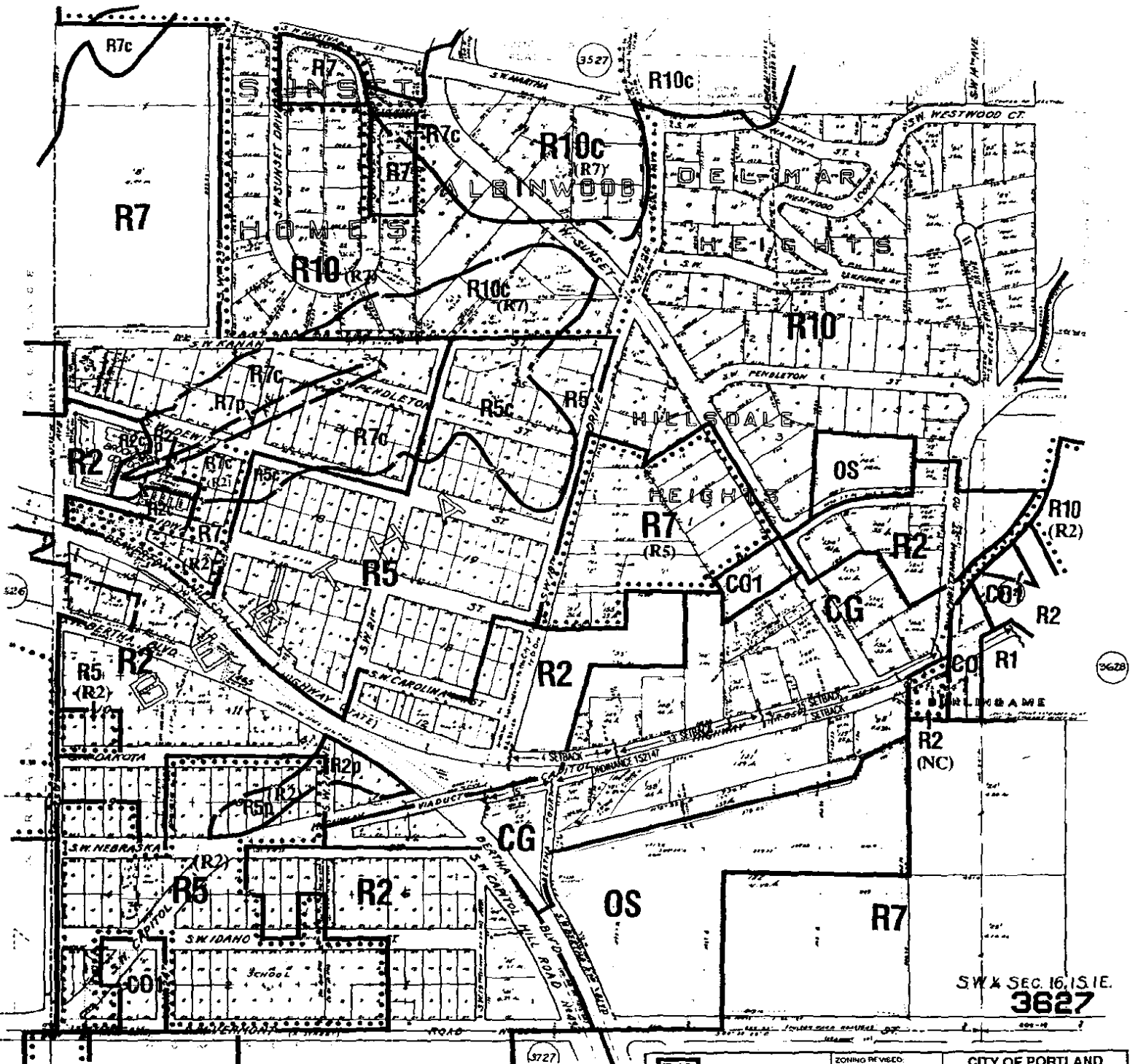
♦♦♦♦ WATER FEATURE: delineates natural drainage courses; topo map or field verification may be necessary

R10 Current Zoning	ZONING REVISED 1-94	CITY OF PORTLAND BUREAU OF PLANNING
Maximum Potential Zoning as per Comprehensive Plan	BASEMAP ACQUIRED 5-89	SCALE IN FEET 0 100 200 300
	LEGAL DESCRIPTION SW 1/4 SEC. 18-15-1E	3623



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential : (R10) : Zoning as per Comprehensive Plan	ZONING RE-USED 1-94 BASEMAP ACQUIRED 5-89 LEGAL DESCRIPTION SE 1/4 SEC. 18-15-1E	CITY OF PORTLAND BUREAU OF PLANNING 0' 100' 200' 300' SCALE IN FEET 3624
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NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential Zoning as per Comprehensive Plan	ZONING REVISED: 1-94 BASEMAP ACQUIRED: 5-89 LEGAL DESCRIPTION: SW 1/4 SEC. 16, 15, 1E	CITY OF PORTLAND BUREAU OF PLANNING SCALE IN FEET: 0 100 200 300 3627
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WASHINGTON COUNTY

VERMONT ROAD

CEDARWOOD

LEESADO

ROUND TREE

LAINTREE

HILL

SUE

DAN

OS

OSc

OSp

R7

R10

R10c

R10p

SW FLORIDA P

SW CALIFORNIA

SW TEXAS

SW NEVADA

SW NILES

SW JAN TREE COURT

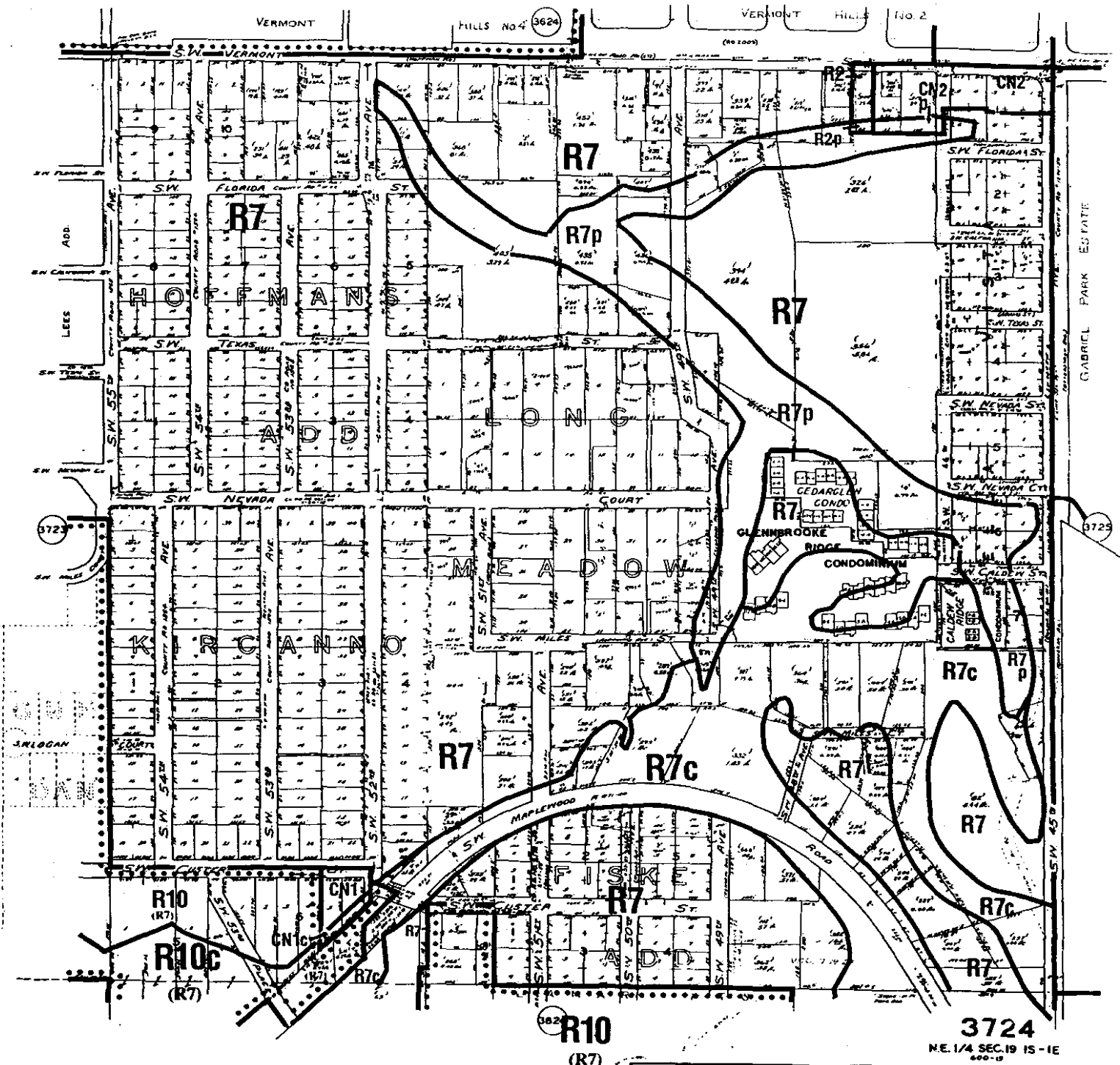
SW CANY

SW GYSTER

NW 1/4 Sec. 19, T. 15 N. R. 10 E.

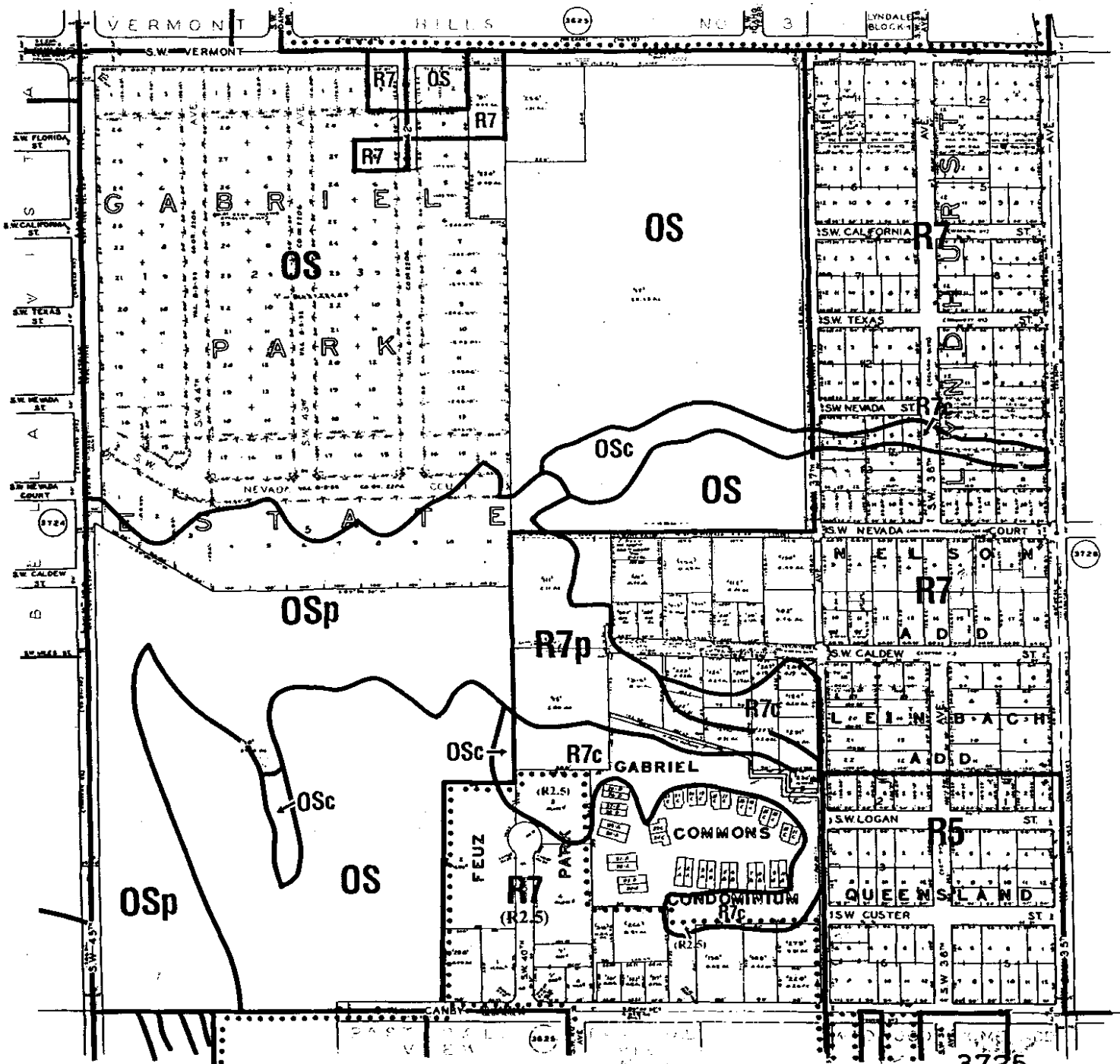
2/100

CITY OF PORTLAND • BUREAU OF PLANNING	
R5 Current Zoning	SCALE 1" = 400'
(R5) Maximum Potential Zoning as per Comprehensive Plan	ZONING REVISION: 1-94 
	3723



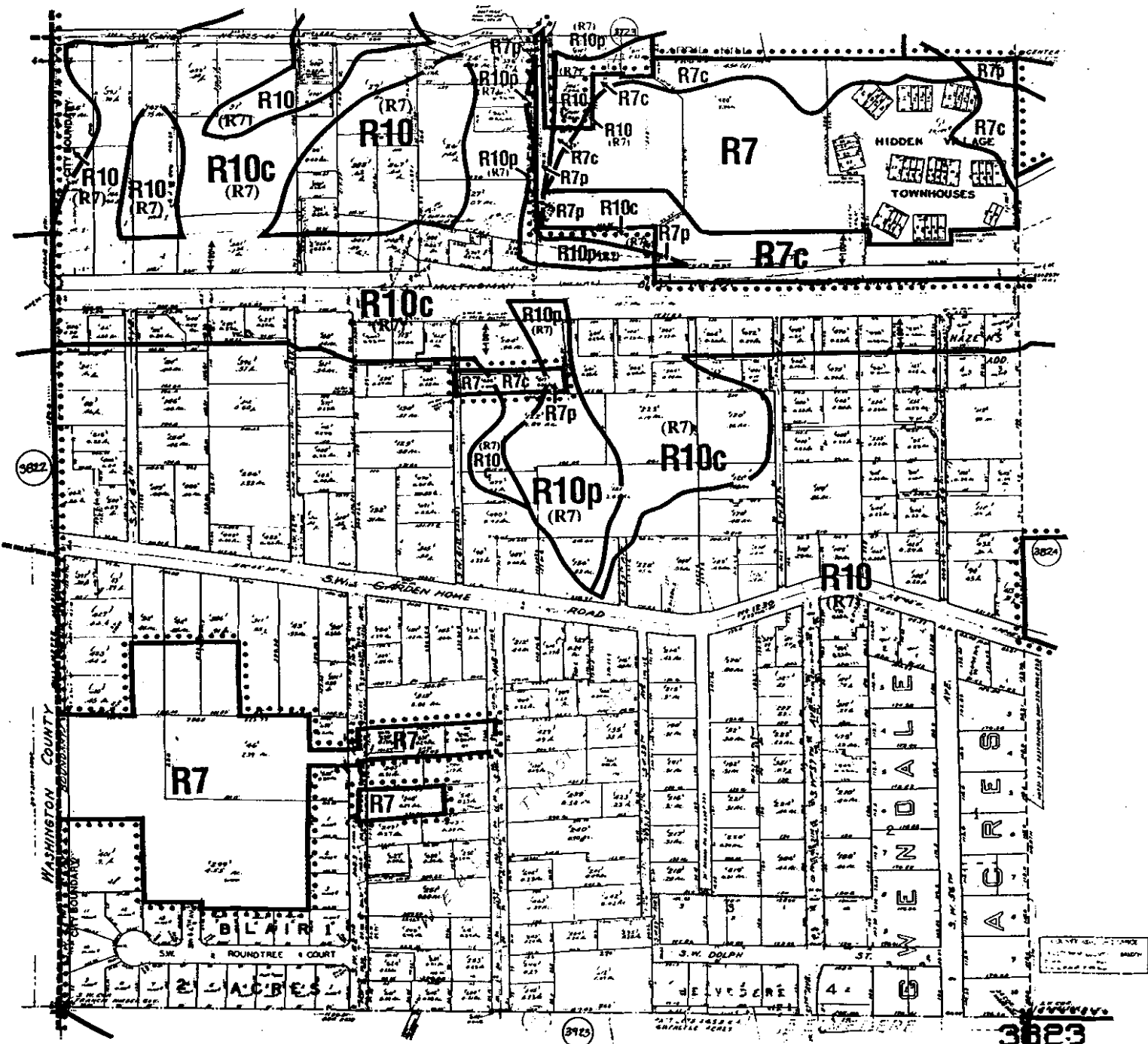
NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential Zoning as per Comprehensive Plan	ZONING REVISED: 1-94 BASEMAP ACQUIRED: 10-89 LEGAL DESCRIPTION: NE 1/4 SEC. 19 1S-1E	CITY OF PORTLAND BUREAU OF PLANNING 0 100 200 300 SCALE IN FEET 3724
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NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10	Current Zoning	ZONING REVISED: 1-94	CITY OF PORTLAND BUREAU OF PLANNING  SCALE IN FEET 3725
..... (R10):	Maximum Potential Zoning as per Comprehensive Plan	BASEMAP ACQUIRED: 5-89	
		LEGAL DESCRIPTION: NW 1/4 sec. 20-15-1E	



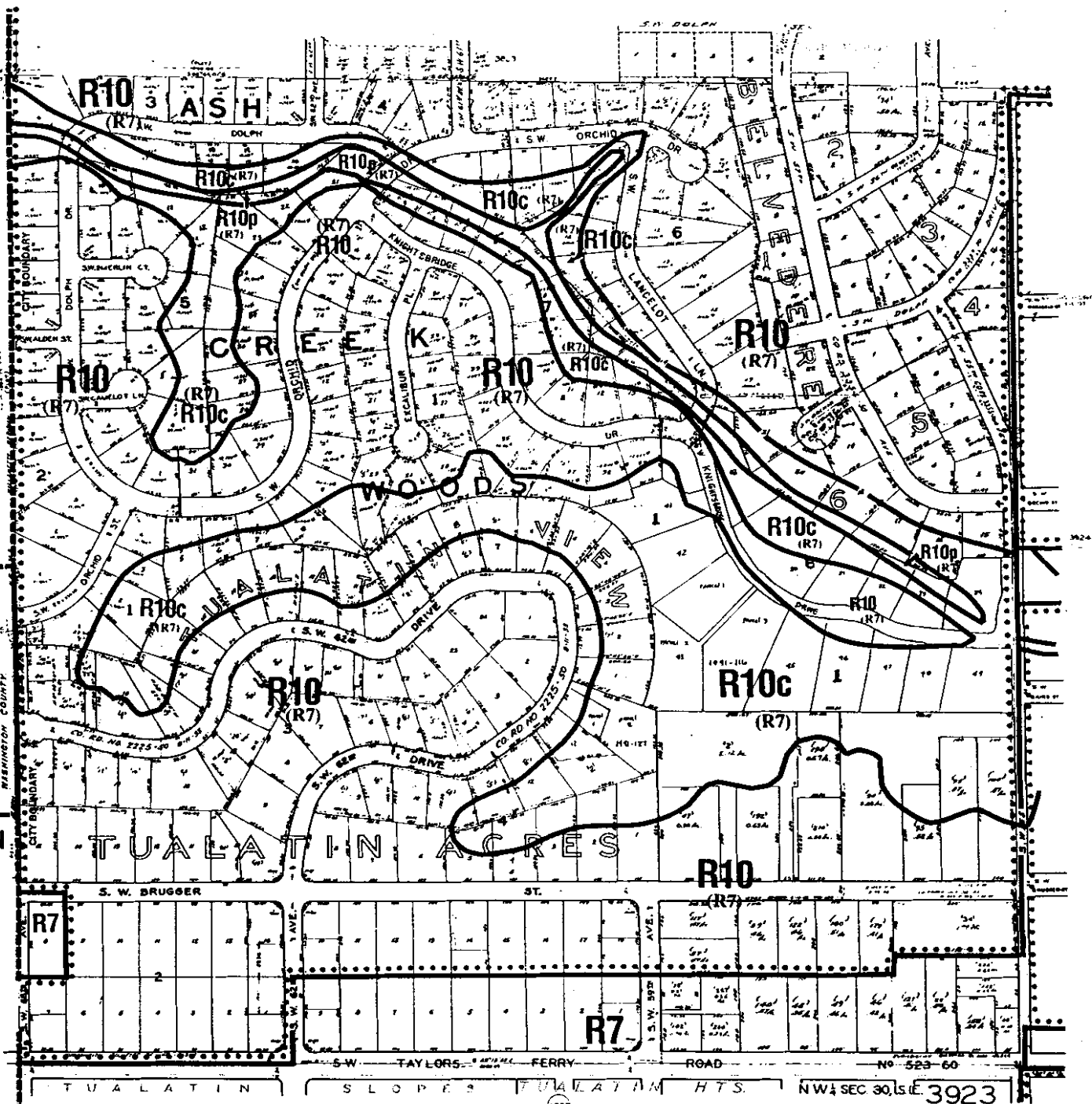
NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential (R10) Zoning as per Comprehensive Plan	ZONING REVISED: 1-91	CITY OF PORTLAND BUREAU OF PLANNING SCALE IN FEET 3823
	BASEMAP ACQUIRED 5-89	
	LEGAL DESCRIPTION: SW 1/4 SEC. 19-15-1E	



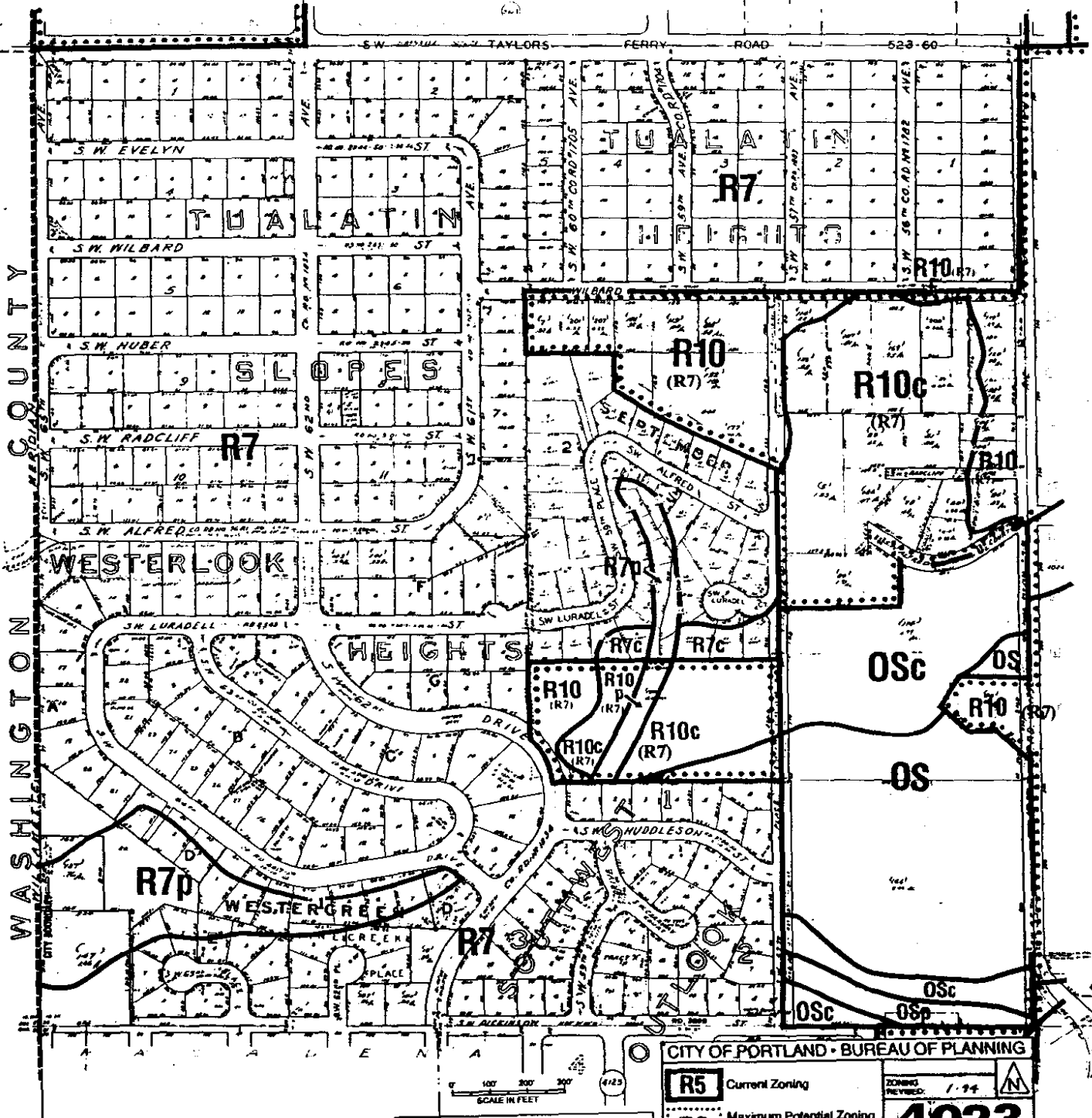
R10 Current Zoning	ZONING REVISED <i>1-94</i>	CITY OF PORTLAND BUREAU OF PLANNING
	BASEMAP ACQUIRED 5-89	
..... Maximum Potential (R10): Zoning as per Comprehensive Plan	LEGAL DESCRIPTION SW 1/4 SEC. 20-15-1E	3825

ASHINGTON COUNTY



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

[R10] Current Zoning	ZONING REVISED:	1-94	CITY OF PORTLAND BUREAU OF PLANNING
	BASEMAP ACQUIRED:	5-84	
	LEGAL DESCRIPTION:	NW 1/4 SEC. 30, 1S-1E	
..... Maximum Potential			3923
..... Zoning as per			
..... Comprehensive Plan			



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

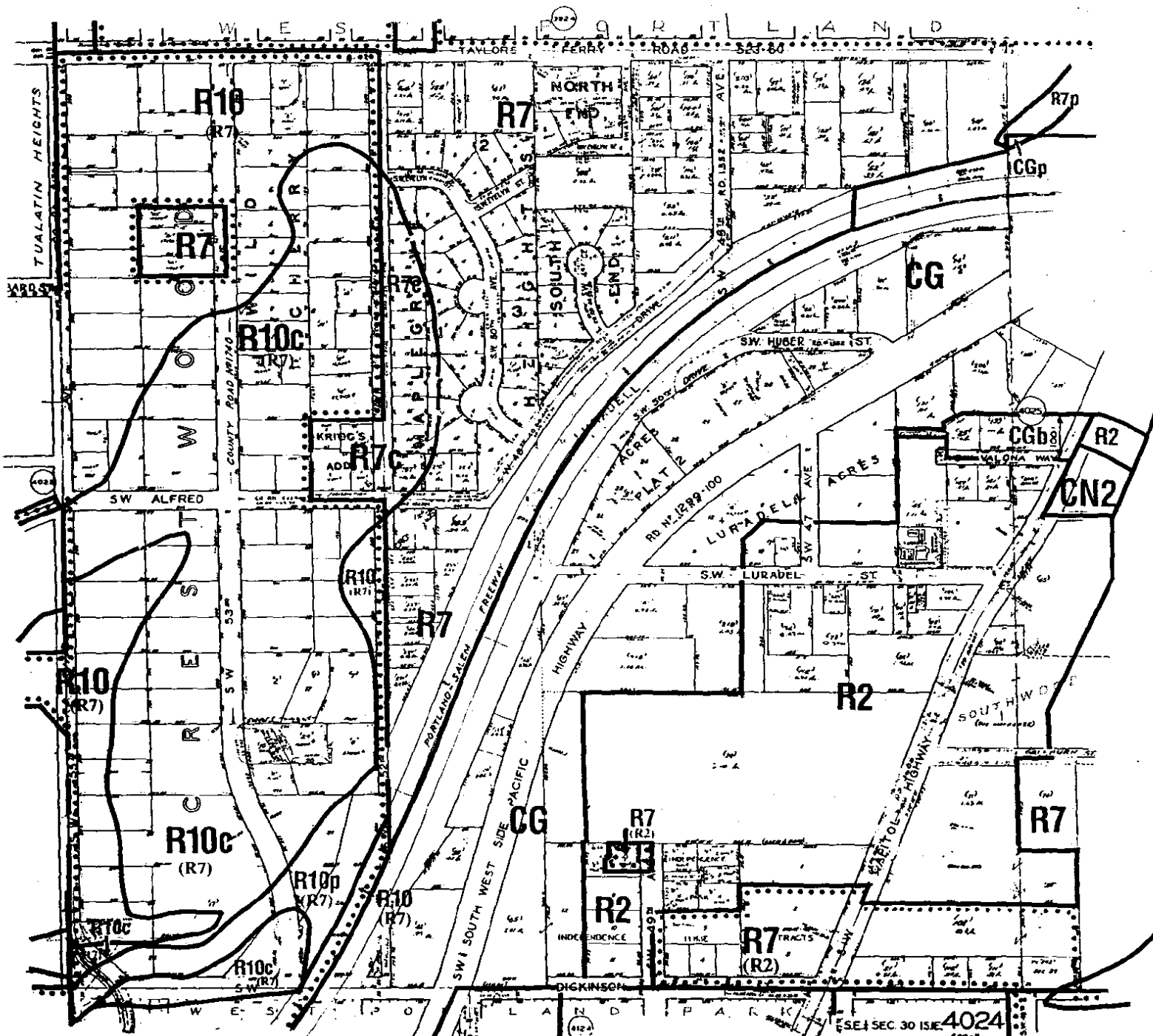
CITY OF PORTLAND • BUREAU OF PLANNING

R5	Current Zoning
(R5)	Maximum Potential Zoning as per Comprehensive Plan

4023

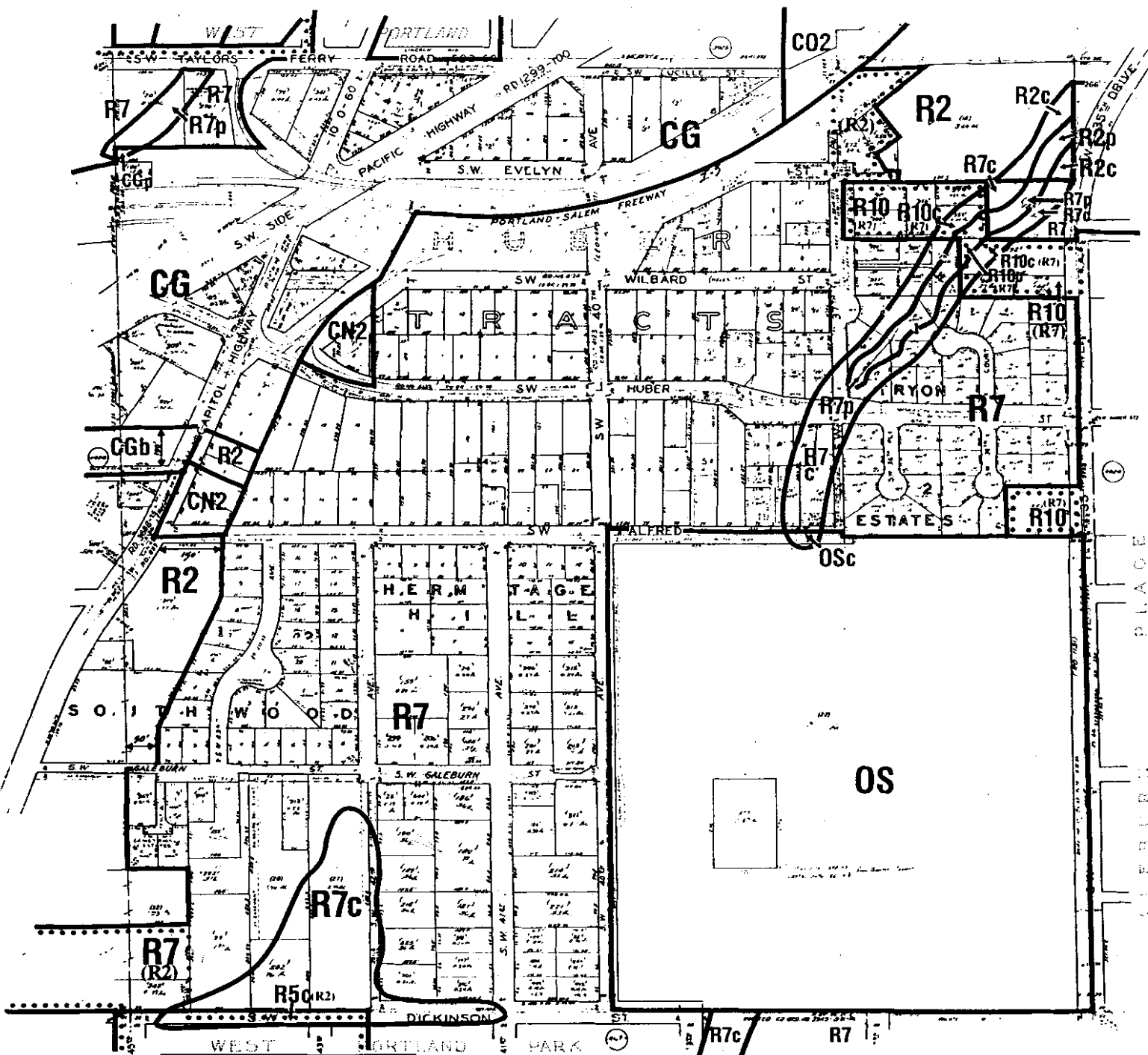
Scale: 1" = 1/4"

North Arrow



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

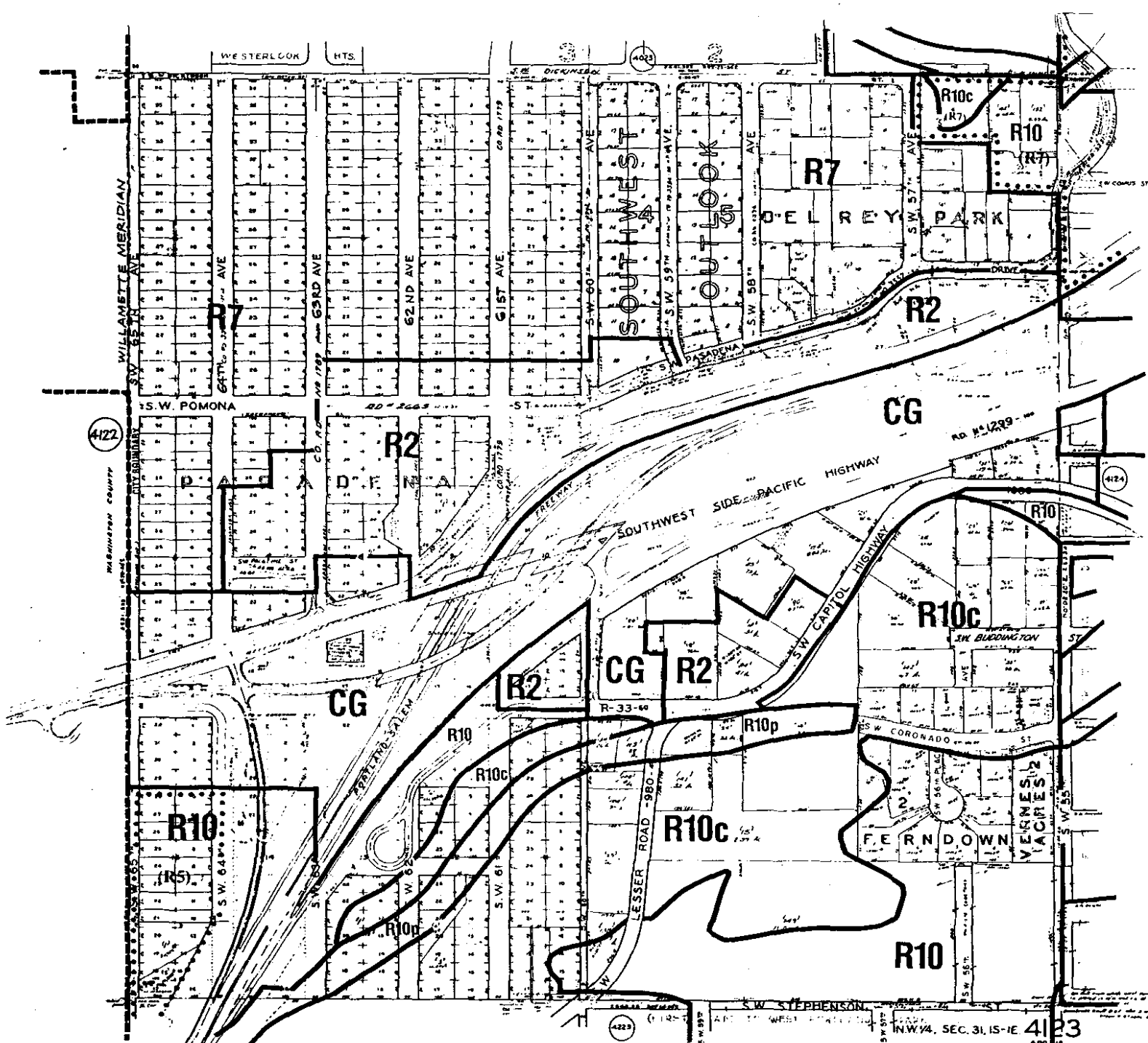
R10 Current Zoning	ZONING REVISED 1-94	CITY OF PORTLAND BUREAU OF PLANNING
..... Maximum Potential (R10) Zoning as per Comprehensive Plan	BASEMAP ACQUIRED 5-84	SCALE IN FEET 0 100 200 300
	LEGAL DESCRIPTION SE 1/4 SEC. 30 15-1E	4024



NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

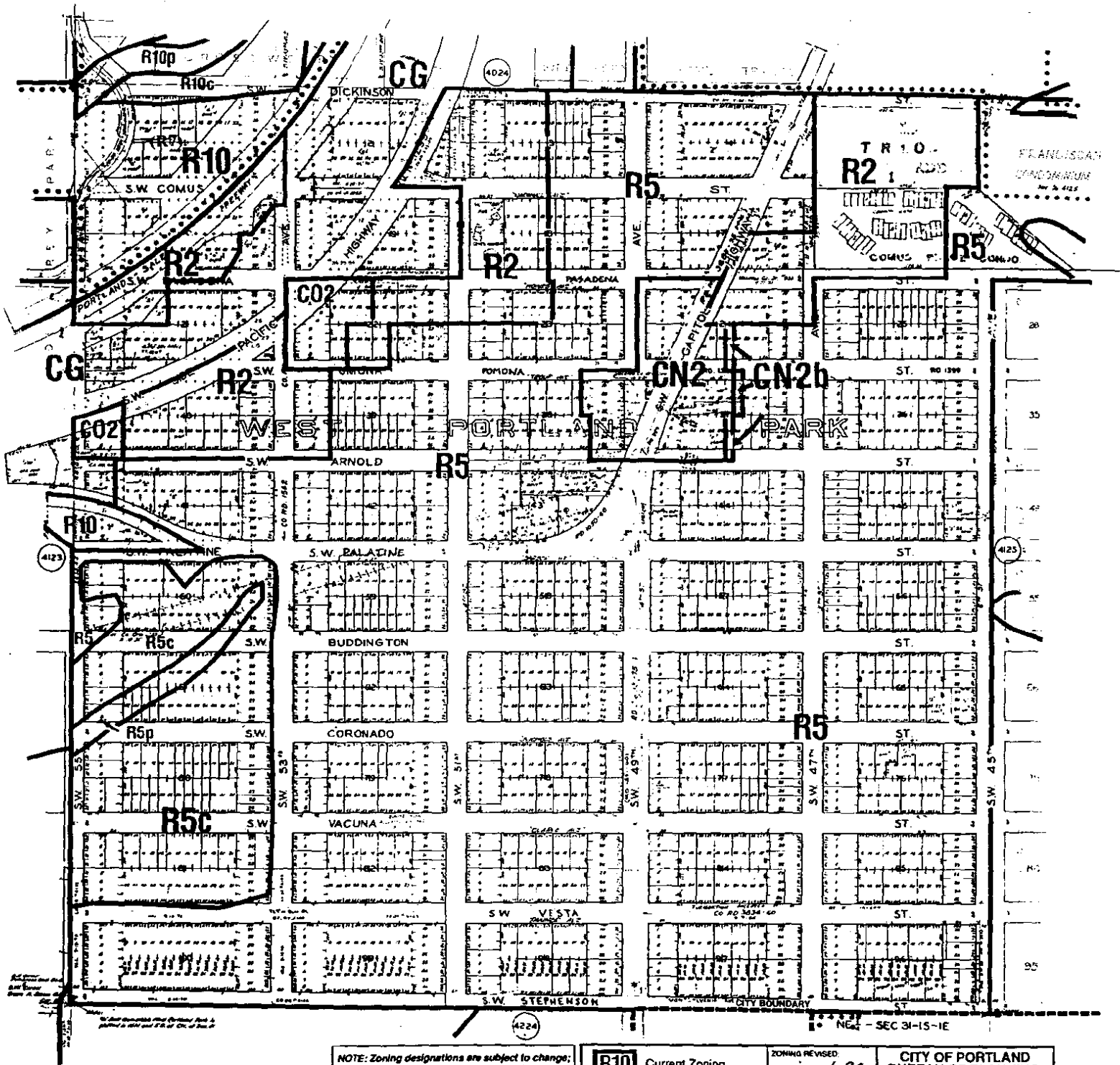
NOTE: Where indicated, width of environmental protection zone, p, is measured from center of drainage, with 1/2 distance on each side.

R10 Current Zoning	ZONING REVISED 1-94	CITY OF PORTLAND BUREAU OF PLANNING
..... Maximum Potential	BASEMAP ACQUIRED 4-84	
:(R10): Zoning as per	LEGAL DESCRIPTION SW 1/4 SEC.	
..... Comprehensive Plan	29-15-1E	
		4025



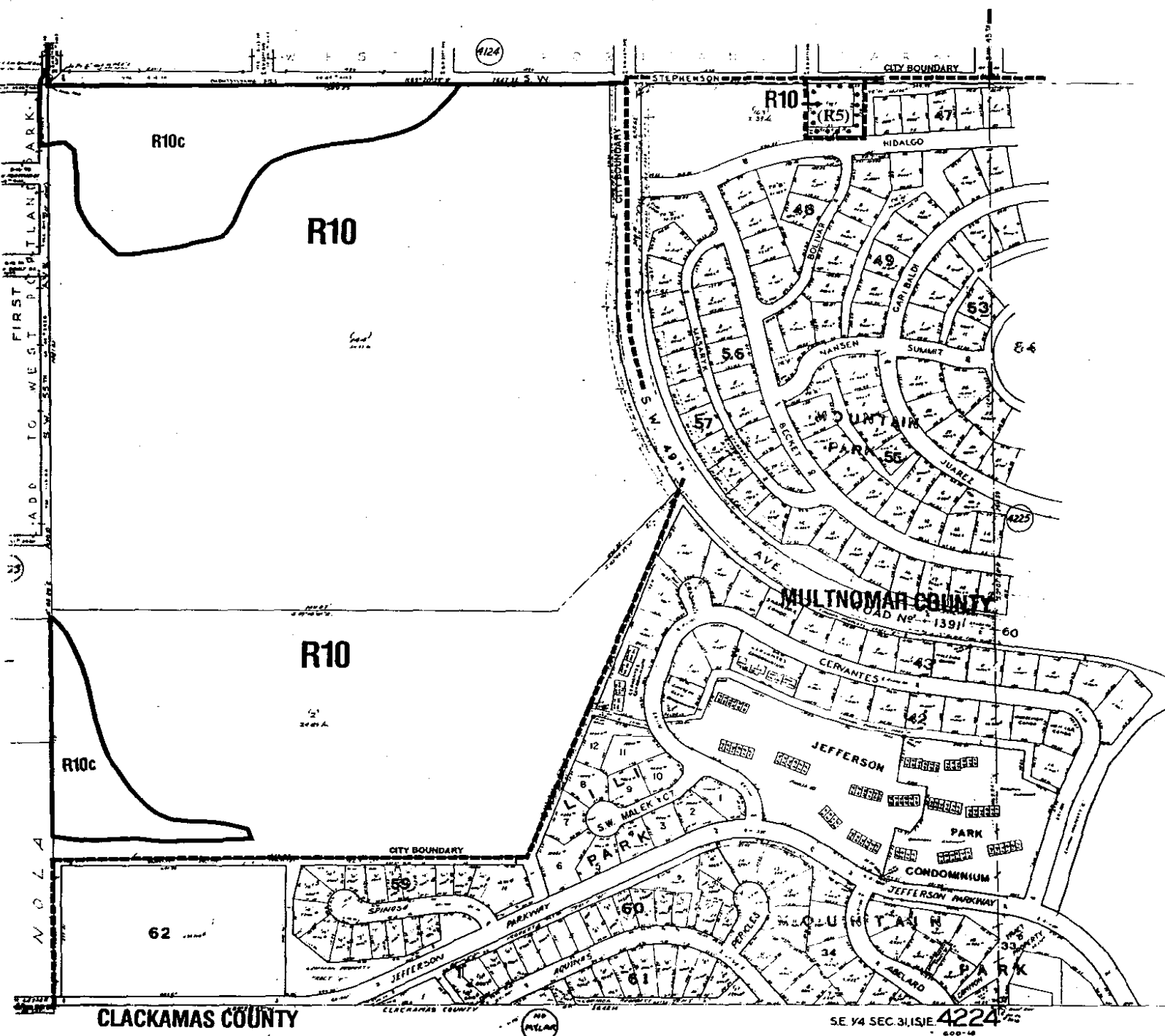
NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential ::(R10):: Zoning as per Comprehensive Plan	ZONING REVISED 1-94 BASEMAP ACQUIRED 5-84 LEGAL DESCRIPTION NW 1/4 SEC. 31-1S-1E	CITY OF PORTLAND BUREAU OF PLANNING 0 100 200 300 SCALE IN FEET 4123
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NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

(R10) Current Zoning Maximum Potential Zoning as per Comprehensive Plan	ZONING REVISED: 1.94 BASEMAP ACQUIRED: 5-89 LEGAL DESCRIPTION: NE 1/4 SEC. 31-15-1E	CITY OF PORTLAND BUREAU OF PLANNING SCALE IN FEET 4124



CLACKAMAS COUNTY

SE 1/4 SEC. 31, 1S, 1E 4224

NOTE: Zoning designations are subject to change; verify zoning prior to development or sales.

R10 Current Zoning Maximum Potential Zoning as per Comprehensive Plan (R10)	ZONING REVISED 1-94 BASEMAP ACQUIRED 5-89 LEGAL DESCRIPTION SE 1/4 SEC. 31-1S-1E	CITY OF PORTLAND BUREAU OF PLANNING 0' 100' 200' 300' SCALE IN FEET 4224
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