

**Lane County Roadsides
New Perspectives for Vegetation
Management**

Prepared for:

**Department of Public Works
Engineering Division**

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ATTACHMENT 2 – Proposed Permitted Herbicide Product Materials Safety Data Sheets

**Lane County Roadsides
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Department of Public Works
Engineering Division**

At the request of Lane County Department of Public Works (Lane County), Jones & Stokes Associates (Jones & Stokes) prepared this report in an effort to help Lane County implement Ordinance No. 12-03: Roadside Vegetation Management and Last Resort Herbicide Use Policy (the ordinance) enacted by the Lane County Board of Commissioners August 12, 2003. The purpose of the Ordinance was to further Lane County's goal to promote "environmentally sensitive roadside vegetation management that protects the health and safety of the public and [the] County's employees." The intent of the ordinance was to require Lane County to gradually reduce the amount of herbicide application to the point that only certain herbicides would be used in certain situations, according to criteria set forth in the ordinance. In addition, Lane County was to explore and develop alternative methods of vegetation control and management that would facilitate such a reduction. Thus, the primary purpose of this report is to assist Lane County in (1) evaluating alternatives to using pesticides for roadside vegetation maintenance and (2) to implement an integrated plan that will reduce pesticide use over time. The secondary purpose is to present methods or ideas to aid Lane County in making the overall Integrated Vegetation Management (IVM) program more efficient and cost-effective.

This report is arranged in the following sections (generally following Lane County's Scope of Work):

- I. Definitions - An annotated list of definitions not addressed in the ordinance.
- II. Current Roadside Vegetation Management (RVM) Methods – A brief review of existing vegetation management methods and research.
- III. Synopses of Current IVM Programs of Other Jurisdictions - Summaries of RVMPs and the non- or reduced herbicide-use programs of other jurisdictions applicable to Lane County.
- IV. Recommended Vegetation Control Methods – Recommendations for Lane County based on the information presented in Sections II and III, with particular emphasis on action thresholds for roadside vegetation management and noxious weed control.
- V. Cost Comparison of Control Methods – a qualitative assessment of the relative costs of the various recommended control methods.
- VI. Recommended Herbicide Products – A list of herbicide products recommended for roadside vegetation management, as well as an explanation of criteria used for that determination.

- VII. Training, Education, and Implementation – A summary of training opportunities and recommendations in that regard.
- VIII. Public Notification – Recommendations with regard to public notification per *LC15.520 Public Notification*.
- IX. Record Keeping – A review of the existing record keeping system currently used by Public Works per *LC 15.525 Record Keeping*.
- X. Annual Report Template – A review of current annual reporting with recommendations regarding content and style.
- XI. References

The first four sections lay the groundwork for the cost assessment in Section V. The remaining sections relate to more administrative issues associated with the IVM program as it relates to the ordinance.

I. DEFINITIONS

Lane County requested that the following list of terms found in the ordinance be defined:

- Acutely Toxic LC 15.510(4)(d)¹
- Additives LC 15.510(4)
- Available to the Public LC 15.530
- Extremely Low Mobility LC 15.510(5)(b)
- Ineffective LC 15.530
- Intolerable Damage LC 15.510(2)(c)
- Known or Identified LC 15.510(3)(d)(viii)
- Least Persistent LC 15.510(3)(d)(ii)
- Least Toxic LC 15.510(3)(d)(ii)
- Legal Requirements LC 15.510(3)(d)(vi)
- Migration LC 15.525
- Pending LC 15.520(6)
- Periodically LC 15.510(3)(c)
- Publicly Accessible LC 15.525
- Responsible LC 15.515(2)
- Risk to Children LC 15.510(d)(ix)
- Risk to Environment LC 15.510(d)(ix)
- To County Roadsides LC 15.510(3)(d)(vii)
- Very Low Mobility LC 15.510(5)(b)

1. Acutely Toxic

“Acutely toxic chemicals” are forerunners of Superfund Amendments and Reauthorization Act (SARA) Title III “extremely hazardous substances” (sections 302 and 304). The term “acutely toxic” is not formally defined under any current statute.

In the context of the ordinance, “acutely toxic” seems to refer to products labeled as EPA Toxicity Category I or II (Table 1). Ordinance language is not consistent with that of EPA: EPA language utilizes “danger” and “warning” for Category I and II substances, respectively, not “danger” and “poison” as stated in the ordinance. We recommend amending the ordinance accordingly.

¹ Ordinance citation.

Table 1. EPA toxicity categories and related labeling and dosage information.

EPA Toxicity ¹	Label Word	Human Hazard Signal Word ²	Fatal Dose in Humans	Oral LD50 (mg/kg) ³
Category I	Highly Toxic	Danger	A few drops	<50
Category II	Very Toxic	Warning	Up to one ounce	50 to 500
Category III	Moderately Toxic	Caution	Up to one pint	500 to 5,000
Category IV	Least Toxic	Caution	Up to one quart	>5,000

¹The toxicity category for a product is determined by assessing toxicity associated with five exposure pathways: oral (the example shown in Table 2), dermal, inhalation, eye effects, and skin effects². Based on these tests, the product is assigned to a toxicity category associated with the most toxic test result.

²All EPA-registered substances have a "signal word" on the label that indicates toxicity. EPA-designated signal words include: Danger, Warning, and Caution. These signal words refer to the acute hazard of the product, not to the potential for long-term effects.

³The EPA uses an "LD50" system to rank pesticides into four toxicity categories: The most toxic, Category I, the least toxic, Category IV. The LD50 system consists of subjecting laboratory animals to substances to determine the amount required to kill half of the test population. The result is the LD50 - the lethal dose for 50% of the test population.

2. Additives

A substance added to another to improve or otherwise alter the latter.

In the context of the ordinance, this refers to a broad group of adjuvants (e.g., surfactants, fertilizer-based substances, etc.). "A pesticide adjuvant is broadly defined as any substance added to the spray tank, separate from the pesticide formulation, [which] will improve the performance of the pesticide. This can include everything from wetter-spreaders to feeding stimulants. This is the range of functions covered by regulations in states that require registration of agricultural adjuvants. Washington and Idaho do require registration of adjuvants; Oregon does not." "Sometimes adjuvants are more narrowly defined as a substance added to a pesticide mixture to improve its physical qualities and hence its effectiveness. This still includes wetter-spreaders, stickers, penetrants, compatibility agents, and so on (James M. Witt, Extension Chemist and Toxicologist, Oregon State University)."

3. Available to the Public

Obtainable through reasonable means by a member of the community.

In the context of the ordinance, this phrase is particular to required reporting and implies that the County should, for instance, maintain copies of documents such that they may be viewed and reproduced by members of the community.

4. Extremely Low Mobility and Very Low Mobility

These terms are the lowest two of six "movement ratings" by which the relative movement rates of substances (particularly pesticides) through the environment are measured (Kerle, et al. 1996). The ratings are derived from the Groundwater Ubiquity Score (GUS), an empirically derived value that indicates the potential for particular pesticides to move toward groundwater (Table 2). Pesticides with a GUS less than 0.1

² See http://www.epa.gov/pesticides/health/tox_categories.htm for a detailed explanation.

are considered to have an extremely low potential to move toward groundwater; values of 0.1 - 1.0, very low potential.

Table 2. Relationship between GUS values and movement ratings.

GUS Value	Movement Rating
Less than 0.1	Extremely low
0.1 - 1.0	Very low
1.0 – 2.0	Low
2.0 – 3.0	Moderate
3.0 – 4.0	High
More than 4.0	Very High

5. Ineffective

Not having the intended or expected effect.

A method is determined to be ineffective if it does not meet the purpose and need of the use.

6. Intolerable Damage

The point at which detrimental impacts to a resource or facility require repair or maintenance beyond a usual or reasonable level of service.

Examples include damage caused by excessive plant growth (includes root invasion by adjacent trees) degrading the road shoulder or standing water within the alignment, degrading asphalt.

7. Known or Identified

Understood, distinguished, or otherwise specified.

In the context of the ordinance, this phrase is particular to school bus stops but can be extrapolated to other geographically important features, such as wetlands. Lane County currently maintains a simple geographic information system (GIS) to track these known or identified facilities or features of concern. Lane County's level of effort to solicit and/or collect this information must be determined by the County. The current practice is to solicit a list from each school district, which is augmented by via forms sent to parents.

8. Least Persistent

In a toxicological context, that substance which exists in an environment for less time relative to other considered substances.

In the context of the ordinance, this would likely be a pesticide with the shortest half-life in the environment. Note: Most toxins have a range of half-lives depending on environmental context.

9. Least Toxic

An EPA term referring to a Category IV substance, the least toxic of substances considered toxic.

This term is misused in the context of the ordinance, which requires that State agencies determine the meaning of the term and the toxicity of the substance in question. This definition is only relevant when Lane County proposes to use a pesticide which is not on the Permitted Products List.

10. Legal Requirements

Constraints requisite or essential by law.

In the context of the ordinance, legal constraints placed on Lane County regarding the use of pesticides. Examples include requirements particular to a pesticide (label or usage requirements), or the use of pesticides in a particular environment (e.g., near streams given Endangered Species Act and similar protections).

11. Migration

Movement from one location to another; movement of a substance away from the site of use/application.

In the context of the ordinance, record keeping requires notation of any off-site movement of the applied pesticide, e.g., spills, run-off, drift, etc. In a formal toxicological context, determining migration requires on- and off-site sampling, as well as background sampling, which would likely be used only in the case of a substantial spill. We recommend this ordinance language be modified to improve clarity.

12. Pending

Not yet decided or settled.

In the context of the ordinance, this term relates to herbicide applications that are planned but have not yet happened. Lane County will need to determine within what time horizon planned applications will be disclosed to the public.

13. Periodically

At regular intervals.

Periodicity of tasks shall be determined by Lane County staff, in cooperation with the Vegetation Management Advisory Committee (VMAC), for such tasks as the periodic review of new vegetation management techniques and products, invasive species threats, and other IVM program issues.

14. Publicly Accessible

See "Available to the Public" above.

15. Responsible

Legally or ethically accountable

In the context of the ordinance, this term refers to a particular Lane County staff person who is responsible for implementation of the ordinance chapter. However, it should be noted that regardless of the ordinance language, that person is an agent of the County

and assumes no personal legal or ethical responsibility beyond that of the position, i.e., such a person cannot assume County liability.

16. Risk to Children

The likelihood of children sustaining injury, disease, or death due to exposure to a potential hazard.

In the context of the ordinance, this term refers to possible harm to children as determined by the Director of Public Works (the Director). The Director may consult qualified toxicologists, the EPA, or others to assist with this task, as needed.

17. Risk to Environment

The likelihood of harm to the environment by a potential hazard.

In the context of the ordinance, this term refers to possible harm to the environment as determined by the Director of Public Works. The Director may consult qualified toxicologists, the EPA, or others to assist with this task, as needed (See also Table 1 above and related literature).

18. [To] County Roadsides

Areas adjoining traveled ways managed by Lane County.

In the context of the ordinance, areas maintained by Lane County's roadside vegetation management crew, generally consisting of one or more of the following: shoulder, ditch, clear strip, and, and vegetated zone.

ADDITIONAL DEFINITIONS

In addition to the definitions above, we recommend the following additional definition changes and additions:

Herbicide

A substance made to kill plants.

The definition presented in the ordinance is overly verbose and incorrect. While some herbicide products may have other ad hoc uses, e.g., as plant growth regulators, those uses are not technically herbicidal.

Feasible Alternative

An alternative that is practicable given technical, financial, and logistical constraints.

Feasibility is a function of the three parameters listed above.

II. CURRENT ROADSIDE VEGETATION MANAGEMENT METHODS

A number of jurisdictions, from those as large as the California Department of Transportation (Caltrans) down to small neighborhoods, have adopted policies that require or promote increased efficiency in roadside vegetation management; many also require or promote a reduction in pesticide/herbicide use. To that end, many jurisdictions continue to explore a variety of biological, mechanical, and procedural methods to make roadside vegetation management more efficient and to reduce potential adverse effects. A review of the most applicable of these methods is presented below, followed by synopses of methods currently used by jurisdictions similar to Lane County. A basic summary of service levels for these jurisdictions is also included.

VEGETATION CONTROL METHODS

Biological Methods

“(a) Good planting techniques, mulching, composting, irrigating, fertilizing, and use of native and pest-resistant plant species to avoid conditions where undesirable plant species, disease and pests can develop into problem conditions.” (Lane County Scope of Work)³

Several “alternative vegetation management” studies and experiments similar to that requested by Lane County have been conducted in the recent past, and a subset of those that seem to be the most applicable are presented here.

Caltrans Study

In 1997, Jones & Stokes conducted an analysis⁴ of vegetation management strategies for the Caltrans. The intent of the analysis was to support the Caltrans IVM, which included a goal to reduce chemical use: 50 percent by 2000 and 80 percent by 2012. The main objective of the Jones & Stokes analysis was to determine which management methods would best meet Caltrans’ needs.

The Caltrans analysis initially considered forty-five methods. Each method was screened for its ability to meet 6 main goals: (1) increase public safety, (2) increase worker safety, (3) improve environmental quality, (4) reduce herbicide use, (5) decrease life cycle costs, and (6) improve public perception. Twenty-nine management methods that passed the first screen were then evaluated and ranked based on 23 sub-criteria associated with the six main goals. Four of these were biological methods (Table 3), each of which is discussed below:

³ References to Lane County’s scope of work are included to show what was requested of Jones & Stokes.

⁴ Jones & Stokes. 1997. California Roadsides: A New Perspective. Sacramento, California. (JSA 94-150). 101+ pp.

Table 3. RVMP prevention methods evaluated for Caltrans; ordered by descending score.

Method Reviewed	Score
Use/promotion of preferred vegetation	89
Use of organic mulches	71
Use of introduced insects/fungi/pathogens	68
Use of inorganic mulches	57

Use of Preferred Vegetation

The use and promotion of preferred vegetation ranked highest and was the preferred alternative among all 29 methods reviewed during the second screen. This method involves planting or allowing colonization of desired native and selected non-native species within the right-of-way. Appropriate vegetation can provide the following benefits:

- buffer adjacent land uses
- screen oncoming traffic (medians)
- stabilize slopes and minimize erosion
- provide wind barrier and dust control
- improve water quality of road runoff
- inhibit growth of invasive exotic species
- add visual/aesthetic benefits and promote driver awareness
- promote biodiversity beneficial to wildlife

Caltrans has had some successes with this method but has found that the cost is too high for major implementation. They determined, based on their resources, that this method is best implemented gradually in targeted areas and in areas following construction where re-vegetation is needed. Success of this method is dependent on site evaluation, species selection, site preparation, and the planting method used. Thus, use of this methodology requires planning prior to implementation.

Use of Organic Mulches

Organic mulch may be an effective ground cover material along many roadsides and other portions of the right-of-way, including planted or bare areas⁵. Mulch typically consists of wood chips, tree bark, or urban green waste and is readily available at low or no raw material cost near urban areas. Organic mulch has many benefits:

- inhibits weed growth by preventing ground contact needed for weed seeds to germinate, chokes emerging weeds, and blocks photosynthesis

⁵ Refer to Section 20 of the State of California Department of Transportation Standard Specifications for additional information.

- buffers impact of rainfall and spray irrigation to avoid erosion potential of displaced soil particles
- prevents sheet flow of surface runoff; allows water to infiltrate and minimizes erosion
- retains moisture and reduces evapotranspiration for highway plantings and desired vegetation
- insulates bare earth and roots of highway plantings to minimize frost damage
- promotes social benefits, such as improved aesthetics and use of recycled material

Caltrans has generally had success over the hundreds of acres where this method has been implemented. An issue has developed with supplying enough mulches, however, which is the main reason they have moved to experimenting with and using inorganic mulches (see below).

Introduced Insects/Fungi/Pathogens

Introduced insects, fungi, or pathogens are used as biological controls for some weed species. Insects, fungi, and pathogens are often specific to certain host plants, and may parasitize, sterilize, or otherwise negatively affect those hosts. Introduced fungi and other inoculants are also used for their beneficial effects and are essential for the success of certain native plant species. Because each inoculant affects only specific hosts, costs and efficacy must be evaluated on an individual basis. Disadvantages of introduced insects, fungi, and pathogens may be generalized as the following:

- the degree of control over the pest may be difficult to manage, meaning that it may spread to adjacent areas or adapt to other hosts
- time lags are inherent to biological control methods and results may be difficult to monitor
- may be uneconomical
- labor-intensive application may present safety concerns.

In cooperation with the California Department of Food and Agriculture, Caltrans generally uses this methodology in the same fashion as Oregon, which involves careful planning, testing, and highly focused usage and monitoring. Lane County would likewise need to cooperate with the Oregon Department of Agriculture for assistance.

Inorganic Mulches

Inorganic mulches include gravel, small-particle mine tailings, and volcanic cinder grindings applied to suppress vegetation and stabilize bare soil. Cinder grindings may also be found on the road shoulder, incidentally, from snow removal activities. Inorganic mulches are inexpensive, easy to apply, and inhibit weed growth because they provide a soil-less and nutrient-deficient environment. Inorganic mulches also have significant disadvantages:

- smaller particles may contribute to airborne dust as they are displaced by wind and traffic, which creates health and safety concerns
- airborne particles may strike and damage vehicles

- safety of the vehicle recovery area (road edge) may be reduced by unstable particles (soft shoulder)
- particles may wash downslope and potentially contaminate water supplies
- Some of these disadvantages may be alleviated by use of a polymer, resin, or other soil stabilizer.

Caltrans is experimenting with many kinds of inorganic mulches, composed mainly of recycled materials. For instance, matting made from recycled plastics seems to work very well. A more detailed list of mulches is included in the synopsis of the Caltrans program below.

Other Biological Methods

Fertilizers

Jones & Stokes generally cautions against the use of fertilizers, particularly when trying to establish native plants and prevent weeds. Native plants (or select non-natives) tend not to need significant soil amendments. Moreover, fertilizers often enhance recruitment of undesirable species. Thus, use of fertilizer should be evaluated on a per-project basis.

Irrigation

Jones & Stokes generally recommends irrigation only for establishment of woody plants. Spot/drip systems are recommended, as irrigation may enhance recruitment of undesirable species. Native herbaceous species are generally much more tolerant of summer dry periods, which tend to give them a competitive edge over non-native weedy species; therefore, planting should coincide with fall or spring rains.

Mechanical Methods

“(b) Mechanical pest control techniques like hand pulling weeds, string trimming, flaming (where practical and allowed), mowing, aeration and thatching, vacuum removal, and thermal. ” (Lane County Scope of Work)

Caltrans Study

Three mechanical methods were identified which met the needs of Caltrans (Table 4).

Table 4. RVMP mechanical methods evaluated for Caltrans; ordered by descending score.

Method Reviewed	Score
Use of alternative labor	70
Spot burning	58
Mowing and brush-cutting	48

Alternative Labor

Alternative labor involves the use of volunteers, special interest groups, or others as substitutes for County staff. The Adopt-A-Highway program is an example of alternative labor that allows businesses, community organizations, or other interest groups to be responsible for litter removal, wild-flower planting, or other stewardship activities for selected highway segments. Convicts or other non-voluntary work parties are already responsible for some litter and brush removal. Advantages of alternative labor include:

- direct labor costs are reduced
- communities and groups may gain a sense of pride through involvement
- community participation contributes to better roadsides and favorable public perception.

A disadvantage of alternative labor is that the tasks are often limited to manual methods of vegetation control due to limited skill levels and supervision. Such activities may expose workers to traffic, presenting safety concerns. In addition, alternative labor may be unreliable and infrequent compared to dedicated maintenance staff.

Spot Burning

Spot burning involves application of fire directly to vegetation to incinerate plants. Spot burning is applied to individual plants and small clusters, unlike broadcast burning (addressed below) which involves setting aflame a field or area. A possible application method involves small jets of flame mounted on a horizontal boom behind a tractor, similar to agricultural applications. Many native grasses benefit from burning and are better able to compete against exotic species following fire. Disadvantages of spot burning are the need for skilled application, need for repeated applications, and the possibility of smoke obscuring visibility or causing air quality impacts. Depending on the time of year, some level of fire control is suggested, e.g., a truck with a 100 gallon slip-on tank.

Mowing and Brush Cutting

Mowing and brush cutting are traditional methods employed by many jurisdictions to control vegetation. In many areas, they are effective methods for controlling vegetation, reducing fire concern, and ensuring visibility. An advantage of mowing and brush cutting is that desired vegetation may be permitted, especially certain grasses or other herbaceous species.

Mowing has some disadvantages:

- increased dust
- engine exhaust
- repeated applications
- intensive maintenance of equipment
- safety concerns for workers due to exposure to traffic
- mowing in dry areas may ignite fires from sparks, exhaust, and heated equipment.

Shoulder Conditioning Methods

There are a number of shoulder treatment methods that are currently being used by various jurisdictions, either regularly or on an experimental basis. Below are summaries of interviews and relatively recent articles from various sources, including ODOT's *Research Notes* and *The IPM Practitioner* (a publication generally devoted to tracking innovation of "least-toxic" pest management).

Berm Shaper

ODOT District 3 developed their own shoulder conditioning equipment, which they call the "Berm Shaper." It consists of two rows of angled disks, two blades and a hydraulic wing. The disks break up the sod along the roadside and brings rock and gravel closer to the surface within a six-foot swath. The equipment is adjustable and easy to maintain using standard grader bits, a 3-point hitch that can be attached to virtually any heavy equipment or tractor, and a hydraulic coupler to control the wing that is operated from the cab. District 3 reported that the Berm Shaper cuts down the need for herbicidal spray as it removes sod from roadsides and leaves very little suitable material for establishment of seed banks. (No notation of cost per mile or cost for the equipment itself).

-- ODOT. 2004. Personal Communication with Will Lacky.

-- ODOT. 2001. Improving Maintenance Practices. Oregon Department of Transportation. RSN 01-05. Salem, Oregon. 2 pp.

Retriever

ODOT District 4 first tested and continues to use a piece of equipment called "The Retriever." District 4's unit is front-mounted on a motorgrader. It contains rotating disks that churn the soil, mulch vegetation and pull material up to the shoulder to be placed in position for the motorgrader's blade. It can be installed on virtually any type of heavy machinery and has the ability to reclaim material on steep slopes. Installation and removal of the Retriever is typically accomplished in less than an hour. This equipment allows shoulder conditioning to be done with one pass of a motorgrader; a sweeper must follow the Retriever to remove any material left on the pavement.

In areas where cut banks are less than four feet, the Retriever pulls too much vegetation and debris to be effective. But for areas where shoulders are wider than four feet, approximately 35 lane-miles can be conditioned in a typical 8-hour workday using the Retriever. Cost is an average of approximately \$53 per mile.

Recently, District 4 personnel have added Berm Shaper-like equipment to the rear of the grader carrying the Retriever, thereby deriving the benefits of both technologies.

The two above technologies may potentially be available to the Lane County for use via an intergovernmental Agreement with ODOT.

-- ODOT. 2004. Personal Communication with Will Lacky.

--ODOT. 2001. Improving Maintenance Practices. Oregon Department of Transportation. RSN 01-05. Salem, Oregon. 2 pp.

Waipuna Weed Control System

The Waipuna weed control system is a diesel powered, computer controlled boiler that delivers a heated foam mixture to vegetation/weeds through a supply hose and

treatment wand. The system generates biodegradable foam from a mixture of corn and coconut sugars that are added to water. The foam produces a thin film that slows heat dissipation as hot water is released, alleviating the need to completely saturate target plant species and speeds treatment. Water leaves the boiler at temperatures above boiling (212° F) and exits the system onto the ground at approximately 208 degrees F. Very little heat is lost through the 100-foot delivery hose and that length of the hose allows for versatility in the field (Daar, S. 2001). Fifty gallons of solution provides enough boiling water for about 15 minutes of operation. A large portable reservoir would be necessary to efficiently cover an area where water may not be readily available.

The cost of the solution is about the same as the cost of Round up: a 55-gallon drum costs about \$900. A basic machine with one boiler costs \$28,500; a machine containing two boilers averages \$38,500 and works twice as fast. Application of the surfactant solution around areas that would normally be treated with manual spray or backpack herbicide application systems can be treated using the Waipuna system in the same amount of time. Treatment of large open areas can take 20-25 percent longer than treatment of the same area using herbicides.

This machine would be most effective in areas where use of herbicides is prohibited such as areas around schools, school bus stops, requested no-spray areas, etc. Effectiveness of this treatment is reported to be comparable to Round-up, though woody plants, such as Himalayan blackberry, are largely unaffected. Treatments performed in sunny weather were more effective than those applications during cooler weather.

Oregon BLM is currently using the Waipuna system as an alternative to herbicides, mainly for treating infestations of false brome. Given their wildland application regime, the system works well but is labor intensive and not particularly cost effective; herbicides would likely be a much more effective, both in controlling the false brome infestation and in terms of overall cost.

--Quarles, W. 2001. Improved hot water weed control system. The IPM Practitioner. Vol. XXIII: 1. p. 1-4.

--Institute for Applied Ecology. 2004. Personal Communication with Tom Kaye.

--Oregon BLM. 2004. Personal Communication with Chuck Fairchild.

Prescribed Broadcast Burns

Fire management is a common method used to control roadside vegetation. It is a relatively inexpensive, effective way of combating unwanted seed bank establishment. It is especially effective when combined with planting preferred species after burning.

Equipment costs can be modest (as little as a few hundred dollars). Supplies include drip torches, 5-gallon water backpacks, flappers, rakes, shovels and safety clothing (Harper-Lore B.L., M. Wilson. 2000). Fire equipment (preferably a vehicle equipped with several hundred gallons of water and a high-pressure pump) and at least one person with substantial fire management training (a "fire boss") is very highly recommended, if not required. Other workers should have enough training to readily control the fire should it begin to escape.

Site preparation is fairly straightforward: Firebreaks typically consist of the road and mowed strips, plowed fields, lawns or other similar areas. Objects to be cautious of include cracked wooden telephone poles, old wooden fence posts, and any dry plant debris left after harvest. It is not recommended that prescribed burns take place in any area where relative humidity is below prescribed levels, as fires quickly reach

temperatures that are too hot to control. Local conservation organizations or state natural resource staff may offer classes on how to properly conduct prescribed burns, or may even offer personnel.

Procedural Methods

Many jurisdictions, including Caltrans, ODOT, and several counties continue to evaluate their standards for road design and maintenance in an effort to reduce the level and costs of vegetation management in general and the use of herbicides in particular. In general, they have paid closer attention so curve radii and associated site distances for both new construction and refurbishment. They have also examined safety standards for ways to allow reduced vegetation management (to the point of almost no management in many cases).

RVMP PREVENTION SUMMARY

A plethora of alternative roadside vegetation management methods are available to Lane County. The question remains as to which of these are optimum for Lane County and the many vegetation regimes therein. The various alternatives are evaluated in Section V.

III. SYNOPSES OF CURRENT IVM PROGRAMS OF OTHER JURISDICTIONS

With the help of NCAP staff, Jones & Stokes has developed the following synopses of vegetation management programs (including experimentation) implemented in jurisdictions in our region that are currently operating with reduced or no pesticide use. The jurisdictions include Jefferson County, WA; San Juan County, WA; Thurston County, WA; Marin County, CA; Caltrans, and ODOT.

Jefferson County, Washington

Jefferson County has been maintaining roadsides without the use of pesticides for over 22 years. The county maintains approximately 800 lane miles annually. The annual cost of roadside vegetation maintenance in Jefferson County is approximately \$249,700 (based on a three-year period average).

Mowing

Jefferson County's chief method of roadside vegetation control is machine mowing. Annual mowing of all 800-lane miles generally takes place during the growing season (April through September). Mowers are set at a height of 6 to 8 inches to encourage the establishment of low growing woody and herbaceous plants, as opposed to cutting at a low height, which allows sunlight to reach bare soil and encouraging weed seed germination. Once desirable low growing shrubs and herbaceous species become established, mowers are more often able to skip these areas and focus on problem areas. Advantages to mowing include erosion control, promotion of grasses providing competition for undesirable weedy species, aesthetic value, and increased sight distance for drivers. Disadvantages include repetition in the mowing cycle, especially on steep slopes and uneven ground, increased annual cost.

Cost of mowing in Jefferson County is approximately \$19,000 for 800-lane miles and is based on a three-year period average.

Brush Cutting

Jefferson County also uses rotary tractor mowers to control woody plant species along roadsides, i.e., brush cutting. Brush cutting occurs year round and most areas require annual treatment. The treatment threshold for brush cutting is a brush height approximately two feet above adjacent grasses. The County found that brush cutting increases populations of small competitive plant species. Brush cutting is a slow process, hence the need for year-round service.

Brush cutting is the primary expense in Jefferson County's vegetation management budget, costing \$168,700 annually for treatment of approximately 481 shoulder miles per year on average (based on a three-year period). Machinery costs are high and the need for flaggers to accompany brush cutting operations further increases costs.

The aesthetic value of brush cutting is highly variable depending on the area. Near rural residences, where the vegetation along private drives is preferred, complaints of occasional "brown-outs" caused by brush cutting have occurred.

Manual Control

Manual vegetation control is another method that is utilized concurrently with brush cutting and mowing. Manual control includes such methods as using gas powered weed eaters, chainsaws, and hand cutting tools. This method of control is applied to areas where it is impractical to use heavy machinery such as near signage, guardrails, and culvert inverts. Approximately 150-lane miles were treated annually based on a three-year period average. The cost of this method of control varies drastically and is usually contracted out to private professional crews.

Shoulder Conditioning

Grading of roadside shoulders is another common method of vegetation control. This method is utilized to inhibit sod build-up encroachment on roadways and to clear drainage ditches of unwanted vegetation. Jefferson County utilizes an aggressive approach to maintain roadside ditches in which two graders are used in tandem. One grades out soil and vegetation from ditches and deposits it on the roadway while the other places the deposited spoils on a conveyor belt that load them onto a truck for disposal. This method aids the control of noxious weed infestation in roadside ditches by disposing of potential seed banks that have built up in the soil.

Preferred Vegetation

Jefferson County has also adopted the policy of hydroseeding all new road construction sites with desirable grasses and wildflowers. Competitive planting has proven to be a cost-effective combatant to help eliminate the colonization of unwanted vegetation. Hydro-seeding has also proven to be an effective method of erosion control.

Summary – Jefferson County

Total Cost: \$249, 700

Lane Miles Treated: 800

Main Treatment Methods: Mowing and brush cutting.

Thurston County, Washington

Thurston County implemented an IPM program in the mid 1980s. The County maintains approximately 2000 lane miles. The annual cost of roadside vegetation maintenance is approximately \$930,000/yr, including 16 FTEs (includes traffic control).

Pesticide use along roadsides is generally only for noxious weeds and must be approved by the Board of Health (County Commissioners). Requests to use pesticides are submitted via a prescription that explains the problem, why pesticides are needed, and describes the site(s) where pesticides will be used.

The Noxious Weed Board contracts out spraying. Prescriptions generally call for spot spraying with hand held or backpack sprayers. The County has a prescription for use of herbicides under and around guardrails but has never used herbicides in those areas.

Mowing

The County uses four deck mowers for clear zone and shoulder maintenance. The County prioritizes mowing by road class (arterial, collectors and local). Most roads are only mowed once or twice a year, a few requiring more frequent mowing.

Brush Cutting

The County uses five boom mowers to cut light to heavy brush (up to 4 inches in diameter) along ditches and the back slope.

Manual Control

A brush crew manages hazard tree removal, canopy management, and maintaining clear zone line-of-site. The 6-person crew is always very busy, particularly with hazard tree removal during winter. Each spring, the crew also prepares any roads that are scheduled for resurfacing.

The crew also uses handheld string trimmers to control weeds near signposts and under guardrails.

Shoulder Conditioning

The County used a grader for mechanical scraping/pulling of sod along shoulders, generally only clearing a one-foot strip, and only as needed.

General Management Techniques

The following are various methods used by Thurston County that facilitate vegetation maintenance:

The County has 4 quadrants (North, South, East, and West). Each quadrant has its own mowers and maintenance shop. The County likes to keep the same crew working the same sections of road; this seems to reduce conflicts between road crews and the local community, i.e., the road crew understands and has an “administrative memory” of the needs of those people.

The County often mows on weekends to avoid weekday traffic.

There are three zones on the right of way: shoulder, ditch and back slope. The County tries to manage all three zones. The three zones together can be anywhere from 5–20 feet in width.

The County calls the school district each year to find out what roads may need brush cutting so that there is good visibility and the trees do not brush up against the school buses.

As the County becomes more urban, it is responding to businesses and homeowners requesting more aesthetically appealing roadsides. The County is generally using push mowers in these areas.

Summary – Thurston County

Total Cost: \$930,000

Lane Miles Treated: 2000

Main Treatment Methods: Mowing and brush cutting.

San Juan County, Washington

San Juan County has been maintaining roadsides without the use of pesticides for approximately 10 years. They manage approximately 600 lane miles annually. Their annual budget for roadside vegetation management is approximately \$625,000 (Harvey, R. 2004). Conditions throughout the County vary considerably as climate zones range

from sea level to approximately 2,000 feet. Annual rainfall varies from 12-55 inches per year. Roads tend to be narrow and winding with vegetation right up to the shoulder in many areas.

Mowing

Mowing is San Juan County's primary method of vegetation management. The County employs three deck mowers that cut a five-foot swath and cover approximately 250 miles of road 1-5 times annually depending on vegetation growth. Paved roads near schools and residences are mowed more often than less traveled gravel roads or roads in rural areas.

Brush Cutting

Brush cutting is the secondary management method employed. The County utilizes a heavy arm/boom mower to cut light to heavy brush, including blackberries. This method typically occurs in the spring and fall and covers all 600-lane miles annually utilizing 3 mowers that cut a 5-foot swath. The county also utilizes cutting and chipping methods. These methods occur during the wet season and are identified by supervisors.

Shoulder Conditioning

The County also employs mechanical scraping and pulling of shoulder and ditches concurrent with hydro seeding. Scraping and pulling is a method by which a backhoe pulls up all the vegetation on the shoulder of the road and within the ditch. The combination of scraping and hydro seeding are utilized in areas where erosion control is needed or there is a troublesome noxious/ invasive weed area. No specific seed mix is used throughout the County due to the variability of ecosystems present within the County.

Alternative Weed Management Methods

Problem areas have begun to arise with invasive plants throughout the County. Knapweed, ragwort and poison hemlock have become targeted problem species. The County is exploring alternative methods to manage these invasions including mulching, hand pulling and changing timing of mowing operations.

Summary – San Juan County

Total Cost: \$625,000

Lane Miles Treated: 600

Main Treatment Methods: Mowing and brush cutting.

California Department of Transportation (Caltrans)

Caltrans maintains approximately 15,000 miles of highway and 230,000 acres of rights-of-way. Caltrans has been working on a phased approach to reducing pesticide/herbicide use since 1997. In 5 years (1997-2002), they were able to reduce pesticide use by 50 percent using a number of management strategies and combinations of management techniques. They are working toward minimizing pesticide use by another 30 percent by 2012, though that goal will likely not be attained (Pers. Comm.: Sheree Edwards 2004)

Reduced Maintenance

The primary management method Caltrans has employed is to reduce the use of pesticides by creating areas that require little or no maintenance. Techniques used included the application of spray polyureas, rock blankets, rock slope protection used in conjunction with an underlying fabric, shotcrete, gravel mulch, aggregate base, recycled glass, and a variety of experimental weed control mats made of asphalt, rubber, recycled plastics, and fiber. Utilizing these methods, Caltrans was able to cut herbicide use along the median, under guardrails and signposts, and at road edges; thus, many roadsides that were previously treated with pesticides now require little or no management.

Caltrans also conducted a detailed review of local-level treatment protocols and activities and found that, in many cases, managed areas were receiving treatments too often or larger areas were being managed than required (e.g., eight feet of right-of-way was being managed where only four feet of management was needed). In some areas, management was reduced by more than 50 percent.

Mowing

Caltrans tries to minimize mowing as they consider it not cost effective.

Alternative Methods

Caltrans is actively experimenting with several alternative treatment methods including more focused chemical control, planting ornamental and native vegetation, and use of herbicidal fabrics and organic mulching around plantings to reduce weed infestation. Caltrans is also currently experimenting with combining management methods to maximize vegetation management.

Caltrans Cost Summary

Caltrans was unable to provide annual budget information but did provide approximate costs of the following vegetation management-related treatments.

- Mowing: To minimize cost, workers often make only a single pass (8-foot swath) with the mower. Some places warrant 2 passes (16-foot swath). Unable to provide costs.
- Chemical control for fire control and invasives: (4 foot swath; in high fire danger areas swath may be 8 feet). Unable to provide costs.
- Asphalt concrete. \$20–80/m²
- Aggregate base (with Emulsion). \$15–35/m²
- Shotcrete: \$15–35/m²
- Gravel mulch: \$13–25/m² on side slopes.
- Herbicidal fabric: \$45–60/m² with gravel cover. \$20–45/m² with native soil cover.
- Irrigated/ornamental vegetation: \$12–20/m² (3 year plant establishment period).
- Native vegetation – non irrigated: Native sod in development stage - \$6–10/m²; plug planting - \$4 –6/m²; drill seeding - \$1 –2/m²; hydroseeding - \$2–3/m². All amounts include cultivation.

- Organic mulch: \$13–50/m³
- Patterned concrete: \$35-80/m²
- Polyureas: \$25–40/m²
- Rock blanket(mortared cobble) \$25 –65/m²
- Rock slope protection: \$100 –300/m³
- Stamped asphalt: \$25 –45/m²
- Weed control mats: (fiber). \$25 –45/m²
- Weed control mats: (rubber). \$20 –40/m²

Marin County, California

Marin County has been maintaining roadsides without the use of pesticides for approximately 10 years. Marin County maintains approximately 840 lane miles annually, of which 300 lane miles require some level of vegetation management (Buckle 2004). They use the following methods:

Mowing and Brush Cutting

Mowing is the main method of roadside vegetation management used by Marin County. They employ 4 persons, two deck mowers, and one arm mower for about five months during the late spring, summer, and early fall. Crews set mowers as low as possible. (Pers. Comm.: Buckle 2004)

Shoulder and Ditch Management

Marin County uses heavy machinery to pull up all the vegetation along the roadside and in the adjacent ditch. Ditches are “pulled” every few years.

Summary – Marin County

Total Cost: >\$128,000 (labor only - 4 Temp. FTE for 5 months)

Lane Miles Treated: 300

Main Treatment Methods: Mowing and brush cutting.

IVM Program Summary

The following is a brief summary of our analysis of the vegetation management programs of the four similar jurisdictions above and Caltrans, with particular attention to the management methodologies and program costs.

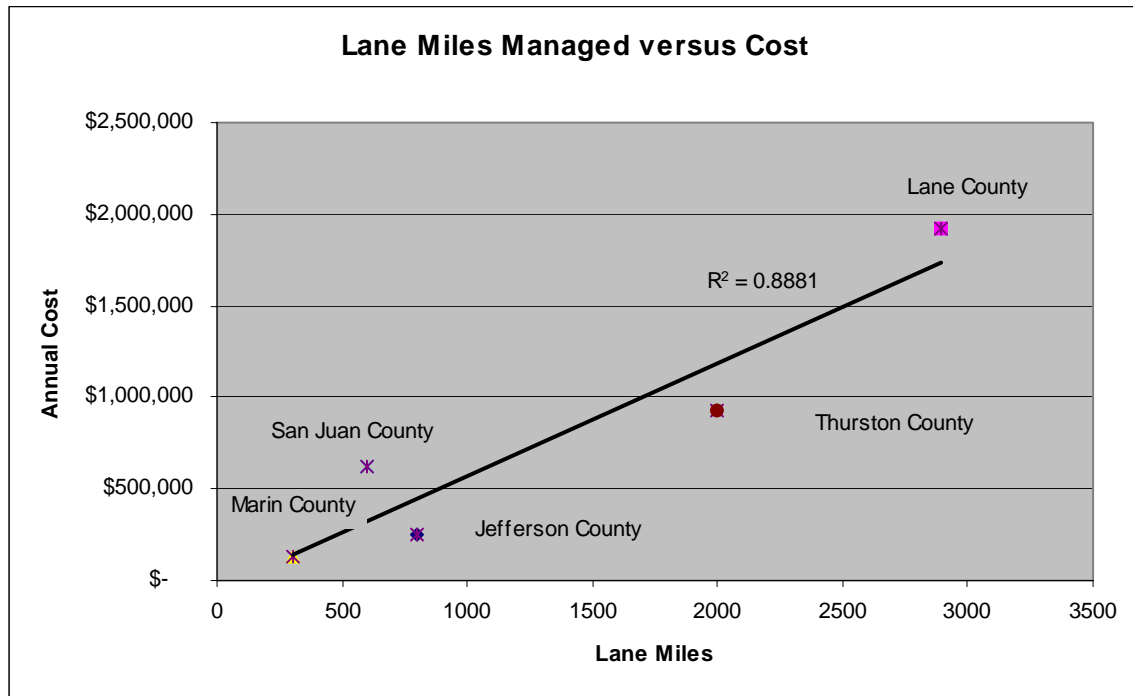
Program Costs

With regard to the number of lane miles managed, Lane County manages the most of the jurisdictions considered (Table 5). In terms of cost, Lane County is within the expected range given the number of lane miles managed (Figure 1). Costs are expected to be somewhat higher for Lane County given the combination of a wide range of habitat types (Cascade Range to coast), large expanses of open areas (narrow roadsides bordering forested areas often require less maintenance), and a significant number of urban and suburban interfaces relative to the other counties.

Table 5. Lane miles and associated cost of vegetation management for Lane County and several other northwestern jurisdictions.

County	Lane Miles	Cost
Jefferson County, WA	800	\$249,700
Lane County, OR	2889	\$1,916,007
Marin County, CA	300	\$128,000
San Juan County, WA	600	\$625,000
Thurston County, WA	2000	\$930,000

Figure 1. Lane miles versus average annual vegetation management program costs.



Methods Used

With the exception of Caltrans, all of the jurisdictions investigated primarily use several forms of mowing as their primary form of vegetation control. These include deck mowing, brush cutting, or similar methodology. However, jurisdictions have successfully altered some mowing methods to optimize control and thereby lessen mowing frequency and reduce cost.

Shoulder and ditch maintenance is generally done utilizing traditional methods, such as scraping with a grader and clearing ditches with a backhoe or similar equipment. However, ODOT has been developing and using a number of innovative pieces of shoulder treatment equipment that would likely be available if the County were interested in conducting trials.

Caltrans again being the exception, only a modicum of alternative vegetation control methods are generally used by the various jurisdictions.

IV. RECOMMENDED VEGETATION CONTROL METHODS

This section addresses methods for monitoring roadside vegetation, and action thresholds for managing roadside vegetation and noxious weeds.

RECOMMENDED ACTION THRESHOLDS:

“(a) Monitor roadside vegetation growth to determine if and when control is needed. This issue is related to 15.510(1)(c). This will depend on the action thresholds that are set for each of the plant species that should be controlled.”

“(b) Establish threshold levels of vegetation below which control is not required. The thresholds will also need to include all species that are problematic in a roadside vegetation management program, not just the ones on the noxious weed list. The main list will include plants that are common to Lane County roadsides and the list of noxious weeds (as listed by the Oregon Department of Agriculture) that are established in Lane County and are known to exist in adjacent counties.” (Lane County Scope of Work)

Roadside Vegetation Monitoring

Currently, Lane County relies on a system of visual inspection by zone vegetation supervisors to monitor roadside vegetation, supplemented with reports by road construction personnel and comments by the public. This method is used by many jurisdictions and seems to be effective for Lane County. Therefore, we recommend that Lane County continue using this method. However, Lane County may want to formalize this process more as part of recordkeeping. A basic GIS-based system might also assist in monitoring vegetation levels and noxious weed infestations.

Roadside Vegetation Maintenance Thresholds

We make the following recommendations for general roadside vegetation management thresholds; these are based on methods found to be successful in other jurisdictions:

1. Maintain roadsides composed mainly of grasses at heights of at least six to eight inches. Areas where native grasses occur in relatively solid stands, should be left unmanaged, if possible. These thresholds will promote grass stands thick enough to inhibit woody plants and promote desirable grasses.
2. Allow roadsides composed of a mix of grasses and preferred woody plants (non-exotic weeds) to grow to a height of at least one to two feet, depending on the rate of growth, i.e., cut those areas that grow faster no shorter than one foot. Also, where roadbeds are elevated a significant amount above the clearstrip, vegetation may be managed to take advantage of that height difference, i.e., allowed to grow taller prior to control.
3. Implemented cutting when preferred shrub species reach approximately two feet above the level of roadside grasses, cutting back to one foot.

These management thresholds should be integrated with fire control issues on a case-by-case basis. We recommend that Lane County begin a dialogue with local fire authorities to review these proposed thresholds.

Weed Management Action Thresholds

Noxious weeds constitute a major economic and health threat to Lane County in particular and the State of Oregon in general. A consequence of inadequate weed control along roadsides is often a higher use of herbicides to control weeds on adjacent private lands. For example, farms often strive to maintain “clean” crops by using more herbicides.

Lane County supplied Jones & Stokes with a list of plant species determined to be problematic for Lane County (Appendix A). Jones & Stokes reorganized this list into three groups based on the level of threat associated with each: High, moderate, and low. These groups are loosely based on the Oregon Department of Agriculture (ODA) ranking system of “A” and “B” designated weeds and better illustrate the threat to County/community assets. We also added several species that are now known to pose a potential problem since that list was produced.

High Threat Species

Species in the “High Threat” category should not be tolerated within the County’s jurisdiction (Table 6). These plants may present a serious economic threat to the community and/or a may present a potentially serious drain on County assets if more widespread control becomes necessary. The ODA designated these as “A-List” or “A-Designated” species. The County list includes two of these species: giant hogweed and kudzu. We have added purple nutsedge because it is present near the I-5 corridor in the Rogue Valley and may be easily transported into Lane County.

Table 6. High threat plant species.

Common name	Scientific name	Family
<u>giant hogweed</u> ^{1*}	<i>Heracleum mantegazzianum</i>	Apiaceae (parsley family)
<u>kudzu</u> [*]	<i>Pueraria lobata</i>	Fabaceae (pea/bean/legume family)
purple nutsedge	<i>Cyperus rotundus</i>	Cyperaceae (sedge family)

1. Underlined common names are those for which ODA’s website lists additional information at the time of writing.
(http://www.oda.state.or.us/Plant/weed_control/weedlistcommon.html)

* Plant names ending with an asterisk are designated as priority noxious weeds by the State Weed Board. ODA is responsible for implementing a State-wide management plan for control of these species.

If any of these species are encountered anywhere in the County, ODA should be informed immediately, as they will have the most up-to-date control protocols available for use and will likely provide valuable consultation.

Moderate Threat Species

Species in the “Moderate Threat” category range from being fairly common to almost unknown within Lane County (Table 7). These plants may present a range of economic threats to the community and some may present a potential drain on County control assets if they become more wide-spread more control becomes necessary.

Any species identified as "B-designated" by the ODA should be considered a moderate threat. The County list includes 21 of these species. We have added Italian and slenderflower thistles to the list, as they are serious noxious weeds that have begun to appear in the Eugene area and should be eradicated when encountered (Note that these two species will likely soon appear on ODA's A or B lists).

Because of the relatively wide range of threat associated with species within this category, we suggest the following two-tier protocol:

1. **Common weeds:** If the species encountered is a well known or common problem (e.g., blackberry, Canada thistle, etc.), then a control prescription should be developed, approved, and used; a set of methods covering a range of infestation sizes may be developed as needed, e.g., larger infestations may require large equipment or herbicide treatment(s) to be effective. A simplified sample prescription we have designed for use by our clients is attached as an example (Appendix B).
2. **Uncommon weeds:** If a species that is not well known is encountered, that staff person should inquire with a County staff person designated to effectively and knowledgably address the potential problem (see Section XI - Summary and Recommendations below). If a new protocol is needed to address the infestation, the County may engage ODA or the County's on-call environmental consultant, as needed. If the timeframe for approval of a new protocol is too long to address immediate control issues, ODA or the County's on-call environmental consultant can help identify a non-herbicidal, emergency protocol, e.g., removal and bagging noxious thistle heads prior to seed set.

Control methods for these species should be determined on a case-by-case basis. We recommend that a trained weed specialist review any new control method and situation. Such consultation often results in more focused and cost-effective methods.

Table 7. Moderate threat plant species.

Common name	Scientific name	Family
bull thistle ¹	<i>Cirsium vulgare</i>	Asteraceae (sunflower family)
butterfly bush	<i>Buddleja davidii</i>	Loganiaceae (butterfly bush family)
Canada thistle	<i>Cirsium arvense</i>	Asteraceae (sunflower family)
diffuse knapweed [†]	<i>Centaurea diffusa</i>	Asteraceae (sunflower family)
dyers woad	<i>Isatis tinctoria</i>	Brassicaceae (mustard family)
English ivy	<i>Hedera helix</i>	Araliaceae (aralia family)
false brome [†]	<i>Brachypodium sylvaticum</i>	Poaceae (grass family)
field bindweed	<i>Convolvulus arvensis</i>	Convolvulaceae (morning glory family)
French broom	<i>Cytisus monspessulanas</i>	Fabaceae (legume family)
giant horsetail	<i>Equisetum telmateia</i>	Equisetaceae (horsetail family)
giant knotweed	<i>Polygonum sachalinense</i>	Polygonaceae (knotweed family)
gorse*	<i>Ulex europaeus</i>	Fabaceae (legume family)
Himalayan blackberry	<i>Rubus discolor(precerus)</i>	Rosaceae (rose family)
Italian thistle [†]	<i>Carduus pycnocephalis</i>	Asteraceae (sunflower family)
Japanese knotweed [†]	<i>Polygonum cuspidatum</i>	Polygonaceae (knotweed family)
johnsongrass	<i>Sorghum halepense</i>	Poaceae (grass family)
jointed goatgrass	<i>Aegilops cylindrica</i>	Poaceae (grass family)
meadow knapweed ^{*†}	<i>Centaurea pratensis</i>	Asteraceae (sunflower family)
milk thistle [†]	<i>Silyburn marianum</i>	Asteraceae (sunflower family)
musk thistle [†]	<i>Cardus nutans</i>	Asteraceae (sunflower family)
Portuguese Broom ^{*†}	<i>Cytisus striatus</i>	Fabaceae (legume family)
puncture vine	<i>Tribulus terrestris</i>	Zygophyllaceae (puncture vine family)
purple loosestrife*	<i>Lythrum salicaria</i>	Lythraceae (henna family)
Russian knapweed	<i>Acroptilon repens</i>	Asteraceae (sunflower family)
Scotch Broom	<i>Cytisus scoparius</i>	Fabaceae (legume family)
Scotch Thistle	<i>Onopordum acanthium</i>	Asteraceae (sunflower family)
slenderflower thistle	<i>Carduus tenuiflorus</i>	Asteraceae (sunflower family)
tansy ragwort*	<i>Senecio jacobaea</i>	Asteraceae (sunflower family)
wild proso millet	<i>Panicum miliaceum</i>	Poaceae (grass family)
yellow starthistle ^{*†}	<i>Centaurea solstitialis</i>	Asteraceae (sunflower family)

1. Underlined common names are those for which ODA's website lists additional information at the time of writing. (http://www.oda.state.or.us/Plant/weed_control/weedlistcommon.html)

* Plant names ending with an asterisk are designated as priority noxious weeds by the State Weed Board. ODA is responsible for implementing a State-wide management plan for control of these species.

† Plant names ending with a dagger are considered by Jones & Stokes to require immediate and fully integrated treatment to ensure rapid eradication. This assessment is based on an assessment of the list given Lane County's current exposure to the weed and the seriousness of successful invasion.

Low Threat Species

Species in the “Low Threat” category are common within Lane County (Table 8). While these plants present a variety of particular problems, they do not generally present a significant economic or health threat to the County. In fact, two of the four plants listed are native (poison oak and smooth scouring rush) and the other two, while potential nuisances, still provide valuable functions (e.g., teasel is a valuable food source for native birds and reed canary grass provides many wetland functions). These plants also present some of the most difficult control problems, so careful consideration should be given to the necessity of control and the methods used.

Table 8. Low threat plant species.

Common name	Scientific name	Family
poison oak	<i>Toxicodendron nervosa</i>	Anacardiaceae (mango family)
reed canary grass	<i>Phalaris arundinacea</i>	Poaceae (grass family)
smooth scouring rush	<i>Equisetum laevigatum</i>	Equisetaceae (horsetail family)
teasel (Fuller's)	<i>Dipsacus fullonum</i>	Dipsacaceae (teasel family)

V. COST COMPARISON OF METHODS

(c) To the extent practicable, use physical, mechanical, biological, and other alternative methods to keep vegetation amount and height low enough to prevent intolerable damage. Verify which methods of physical (manual), mechanical, biological and other alternative methods are most cost effective. After verifying the effective control methods, a cost comparison should be made. (Lane County (Mike Perkins) has done some basic work with this issue). Consultant work should build on that information.

Jones & Stokes offers the following qualitative cost comparison analysis of the various control methods discussed above (and recommended below in Section XI). We are unfortunately not able cite all costs for various control methods, generally due to a lack of detailed information from other jurisdictions and a lack of similar information from Lane County, e.g., there are many unknown costs that would take considerable recordkeeping to identify. For instance, the other jurisdictions reviewed are different in their needs due to differences in eco-region (precipitation, soils, adjacent plant communities, etc.) and a host of other variables. We therefore recommend that we work with Lane County to determine which alternatives are likely the most feasible and use those alternative methods in limited pilot studies to better ascertain the effectiveness and cost of each.

The discussion below is divided into the following three sections to set the stage for the final recommendations:

1. General Roadside Vegetation Maintenance, addressing the vegetation management program in general and the clearstrip/right-of-way in particular
2. Shoulder Maintenance
3. Noxious Weed Control

GENERAL ROADSIDE VEGETATION MAINTENANCE

We recommend the following changes in the way Lane County manages vegetation, in order of likely importance in terms of pesticide-use reduction and overall cost savings.

Procedural Changes

We propose an internal assessment of design and safety standards, much like that undertaken by Caltrans, will have the greatest likelihood of reducing herbicide use and costs. Such an exercise offers an opportunity to look critically at what activities are being undertaken under what circumstances. For instance, if crews are mowing twice the needed clearstrip in some areas, a substantial reduction in managing those areas might be possible. While Caltrans works at a different level of road maintenance than Lane County, we think that the same basic premises likely apply (Caltrans was apparently surprised many times during their review and Lane County may be surprised as well).

Mowing

Various forms of mowing (deck mowing, brush cutting/flailing, etc.) will likely remain the primary roadside vegetation management methods for Lane County. Cost savings will

likely be realized through (1) procedural changes recommended above and (2) testing and adoption of the action thresholds suggested above in Section IV.

Alternative Methods

Mulches or other products made from recyclables, such as those used by ODOT and Caltrans, offer opportunities for vegetation control. However, given the labor required to obtain, haul, and spread large amounts of mulch, this alternative method may only be cost effective for particular uses, such as around sign posts and similar structures that would normally require string trimming. Use of mulch blankets or plastic sheets to facilitate solarization may also be a useful methods, but likely not cost effective on a large scale. Opportunities to contract out mulching should be explored.

Manual Labor

Continued or increased use of Lane County's existing manual labor force(s), e.g., the County work release crew, is a valuable option. Optimizing the use of such crews may reduce costs for noxious weed control (e.g., manual removal) and focused vegetation control (e.g., using string trimmers to clear sign posts and guard rails).

SHOULDER MAINTENANCE

Maintenance of road shoulders is likely the application where alternative methods offer the greatest opportunity to reduce costs and herbicide use. Maintaining a relatively plant-free shoulder greatly increases the life of the roadway and reduces the risk of noxious weed introduction. Therefore, it is essential that these areas be carefully and thoroughly managed.

Shoulder Treatments

ODOT and Caltrans use and continue to experiment with various shoulder treatments. Some of these may be appropriate for Lane County. Most cost about \$5-30 per square meter. Whether or not use of these treatments is feasible will depend mainly on whether they are available at all or for a reasonable cost.

The most promising possibility is a product called "Sparkless Bark" created from recycled (ground/shredded) asphalt roofing. Produced in Lane County by a company called Roofgone, this product has worked well for ODOT and has allowed them to greatly reduce (about 80% reduction) their use of Casoron, one of the more toxic, long-term herbicides in common use. Currently available at about \$1 per cubic yard (likely less in larger quantities), this product has great potential as a shoulder maintenance tool. The Oregon Department of Environmental Quality has raised some toxicological concerns regarding this product. These concerns are as yet unsubstantiated and pose a host of other questions that will likely not affect use in the foreseeable future; in any case, this product is likely much less toxic than Casoron or similar products.

Mechanical Maintenance Methods

There are several alternatives to herbicide treatment to maintain shoulders that deserve consideration. As discussed above in Section II above, ODOT is currently using and continually improving several pieces of equipment for grading shoulders, e.g., Retriever,

Berm Shaper, and several transitory versions. This equipment has been developed to minimize treatment time and thereby reduce costs. Testing of this equipment by Lane County via an Intergovernmental Agreement is possible, and recommended. Other jurisdictions generally just use a grader to maintain shoulders. The only problem with this method is that disturbed areas are more likely to bring plant seeds to the surface and promote weed germination (An advantage of herbicides is that they do not involve disturbance of the soil.).

Alternative Methods

A Waipuna hot foam system, such as that currently used by BLM, may be a viable option for shoulder maintenance. The system's manufacturer maintains that the application works as well as Roundup™ on herbaceous vegetation, and BLM's monitoring support that claim. Thus, while this tool is unlikely to completely replace an herbicide boom sprayer, it may be a viable alternative when used in conjunction with occasional mechanical treatment (e.g., Berm Shaper). It might also be a valuable tool for treating vegetation in "no-spray" zones (e.g., near schools or wetlands). Another advantage of this system is that it does not tend to disturb soil surfaces.

The manufacturer is said to be developing a system that uses a short boom in place of a hose "live reel," which would be optimum for shoulder treatment.

NOXIOUS WEED CONTROL

Noxious weed control should be one of Lane County's highest priorities. The potential adverse effects of noxious weeds have often been underestimated by many jurisdictions that now greatly regret that miscalculation. Because of the economic importance of the agricultural community in Lane County, as well as the greater Willamette Valley, the successful invasion of a noxious species to the point of being "naturalized" could bring great hardship. It is for this reason that we believe a fully integrated approach to noxious weed control is of utmost importance, particularly when swift eradication measures are prudent.

Many noxious weeds are readily controllable, and depending on the particular weed and the size of the infestation, use of alternative methods to herbicides may be viable. However, given the current state of technology, herbicides are often necessary and may play a valuable role in treatment prescriptions, particularly for those weeds made more insidious by substantial underground parts (e.g., roots, rhizomes, tubers provide resource storage and may be transformed into a large number of reproductive structures if cut into pieces, thus exacerbating the infestation).

Jones & Stokes recommends that control prescriptions be developed for all of these species on an as-needed basis. The prescriptions will be based on the latest information regarding control and will likely contain alternative methods available given the circumstances of the infestation. Many prescriptions already exist for most, if not all of these species that may be readily altered to meet any needs particular to Lane County, i.e., there is likely no need to develop any prescription from scratch (See Appendix D for a list of prescription sources.).

In terms of costs, we offer some general guidelines for cost effective treatment of noxious weed infestations:

1. **Manual Removal (pulling)** - For very small infestations, manual removal is likely equal to the cost of herbicide treatments. This method may be used for weeds that can be removed entirely with relative ease. Examples include knapweed and some thistles. Manual removal may also involve removal of the seed heads of annual weeds prior to seed drop, sometimes without removal of the actual plant.
2. **Mulching – (organic and inorganic mulches, solarization)** – Mulching may be useful for controlling some noxious weeds, particularly grasses and forbs. Again, cost effectiveness is based on the size of the infestation and the availability of appropriate mulches. Mulches may be inappropriate where replanting is proposed following treatment.
3. **Biological Controls** – Introduction of a species of insect, fungus, bacterium, etc. may offer a very cost effective option for controlling a few weed species (e.g., tansy ragwort). Unfortunately, due to safety measures in place to ensure that biological controls do not present a threat to desirable species, there tend to be relatively few available. For those that do exist, the cost of a control “dose” or “release” tends to be relatively low and may be quite effective. Because these controls are most often linked to the population cycles of the target weed and may be detrimental to only one portion of the weeds life history, additional control measures are usually needed. The degree of additional work depends on many factors, such as what plant parts are affected and to what degree. In addition, to maintain these controls, some target weeds must survive to provide for continued reproduction of the control species, else additional controls must be introduced to aid with each infestation. Thus, many biological controls are most effective where weeds are already fairly common.
4. **Focused Herbicide Treatment (injection, brushing)** – Some weeds in small and clumped infestations may be treated with herbicides in the form of an injection, or herbicides may be “wicked” or brushed onto foliage, which will greatly reduce environmental exposure. Examples include Japanese knotweed and kudzu, species which may easily sprout from underground portions that tend to break off during manual removal. Costs for this technique are likely much less than manual removal, i.e., killing the entire plant reduces the number of additional visits required for eradication. This technique may also be used on large infestations given particular circumstances and equipment, e.g., large stands of weeds that may be treated with a “boom wick” system.
5. **Woody Plants (stump treatment)** – Mowing, followed by stump treatments with herbicides is often very effective for many woody species, such as blackberry, Scotch broom or poison oak. Again, these woody species tend to have large reserves of resources and will continue to sprout if not killed entirely. Mulching may be used in some limited cases in place of herbicide to inhibit re-sprouting, but often woody species are able to push through mulches that are not sealed (e.g., yard mulch, as apposed to polyeureas) or in large, strong, sheets (e.g., Visqueen or canvas).
6. **Large Infestations** – Large infestations, particularly when tens or hundreds of acres are infested, present many problems. Often, the most cost-effective method is to start with a “clean slate” with several rounds of herbicides and/or plowing followed by replanting. Fortunately, given their linear nature, roadsides do not often present such problems.

These are only a few of the most basic guidelines from which control prescriptions can be developed.

In conclusion, the cost of various treatments, whether they utilize herbicides, alternative methods, or a combination of the two, must first be weighed against the potential cost of not controlling and/or eradicating noxious weeds. Prudent control must always be the first priority. Use or testing of methods outside a proven prescription must be carefully managed to avoid potentially harmful consequences.

VI. RECOMMENDED HERBICIDE PRODUCTS

Jones & Stokes will develop a recommended list of Permitted Products for use of herbicides by LCPW using the standards within this section and section 15.510(5). Jones and Stokes will use the work that Lane County (Mike Perkins and Bill Manewal) has done, as well as that of the private and public sectors. Other information sources may include faculty at OSU and WSU that have expertise in this area.

Jones & Stokes will review, verify, or modify Product Consideration list prepared by Lane County (Mike Perkins). Jones & Stokes will accomplish this by gathering available information and using chemical expertise: State opinion/consideration of chemicals being used and how they fit into the program. Lane County is in the process of getting information from the chemical manufacturers as to how they think their products will fit into the Last Resort Policy. Some of the work that Lane County (Mike Perkins) has done may fit into this area.

Jones & Stokes recommends the herbicide products listed in Table 9 for use in controlling roadside vegetation and noxious weeds, the latter as indicated by prescription. Appendix C contains the detailed product matrix, including the criteria used to rank listed herbicides based on soil half-life, mobility, and, toxicity, weighted by the latter.

Table 9. Proposed permitted herbicide products for Lane County, listed in order of increasing toxicity.

HERBICIDE product name, manufacturer/supplier	Common Uses
ESCORT <i>DuPont</i>	foliar, noxious weeds
OUST <i>DuPont</i>	road shoulders
TRANSLINE <i>Dow AgroSciences</i>	noxious weeds, Japanese knotweed
GARLON 3A <i>Dow AgroSciences</i>	foliar, noxious weeds, brush, cut stumps
RODEO <i>Monsanto</i>	road shoulders, cut stumps, noxious weeds
ROUNDUP <i>Monsanto</i>	road shoulders, cut stump, noxious weeds
ROUNDUP PRO <i>Monsanto</i>	road shoulders, cut stumps, noxious weeds
SHARPSHOOTER <i>St. Gabriel Laboratories</i>	noxious weeds
GARLON 4E <i>Dow AgroSciences</i>	foliar, noxious weeds, brush, cut stumps

All of these herbicides are readily available and in common use.

VII. TRAINING, EDUCATION, AND IMPLEMENTATION

Research and provide Lane County Public Works with a list of available vegetation management training located within the region. LC 15.515 Training, Education, and Implementation.

Given the importance and cost of roadside vegetation management, one would expect there to be more readily available training and information on the subject, particularly given all of the various new and alternative management tools listed above; there are, however, few. One reason may be the significant differences in vegetation problems from region to region, or among eco-regions. Another reason may be that so much effort is spent on addressing noxious weeds, given their potential economic threat, that roadside vegetation management is considered less important. In any case, training options are relatively few and Lane County is very likely taking part in the best that is available in attending meetings of the Oregon Vegetation Management Association: The OVMA presents information and training specific to our state and the eco-regions included in Lane County.

In terms of national organizations, only one really exists: the National Roadside Vegetation Management Association. The NRVMA does offer a broader perspective than the OVMA, but for that reason, likely offers less value. Attendance at the annual meeting may be all that is needed to derive value from this organization.

Lastly, there are many organizations and training available for addressing noxious weeds. However, we suggest that the best way to remain informed of the latest problems and controls is to maintain a working relationship with the ODA and ODOT, again, likely through the OVMA. Both organizations must remain attuned to what the greatest threats are to Oregon, and will act as the best early warning system for Lane County. Moreover, ODA and ODOT often work together to develop control prescriptions as weed problems present themselves. Thus, Lane County has the opportunity to receive the benefits of this work and remained better focused on what is happening within the County.

WEB LINKS

North American Weed Management Association – <http://www.nawma.org/>

National Roadside Vegetation Management Association - <http://www.nrvma.org/>

VIII. PUBLIC NOTIFICATION

Jones & Stokes will review the existing notification process developed by Public Works. Indicate any improvements (process, costs savings or others) that will provide better public notification per LC15.520 Public Notification

Jones & Stokes has reviewed the notification process used by Lane County prior to ordinance adoption to inform the public regarding herbicide spraying. In short, we believe that the former process provided adequate notification. Furthermore, we believe some details of the notification process mandated by the ordinance may be overly prescriptive and, in some cases, unrealistic or shortsighted, i.e., those crafting the ordinance may have been unaware of issues related to feasibility or safety. For instance, presentation of detailed information on posted signage may present traffic safety risks for those seeking to read those signs. We instead suggest that Lane County undertake an ongoing program to educate the public as to the spray program, including the basic meaning of the signage, and that signs carry only the information needed to obtain more detailed information, e.g., phone numbers and website URLs, where additional information may be obtained.

IX. RECORD KEEPING

Jones & Stokes will review the existing record keeping system currently used by Public Works per LC 15.525 Record Keeping. If changes are needed, provide any recommendations or improvements that will upgrade or streamline the process.

Current record keeping is fairly comprehensive and contains most, if not all, of the required data (most is already required by ODA). However, we recommend recordkeeping be better managed so it is focused on addressing information needed for preparing the Annual Report and for review at any time, e.g., via a spreadsheet as discussed below. Records kept should include but are not necessarily limited to the following:

- All data required by law (including the ordinance) in the required format.
- The number of lane miles receiving any application, including all manual, mechanical, herbicidal, alternative, and experimental treatments. This is mainly for internal cost analysis.
- The amounts of resources used for each treatment type, such as FTEs, machine hours, amounts of herbicide, and the estimated cost of all other pertinent materials (estimates should be based on quantitative trials). Again, this is mainly for internal analysis except where required by law or ordinance.
- All equipment costs, including new equipment, maintenance, and depreciation.

We suggest that Lane County develop an Excel spreadsheet to log work daily. This spreadsheet should include a running summary of the data outlined in the four bullets above. This will allow data to be easily assessed, as needed. We also suggest that the VMAC receive a copy of the running summary at each meeting as a way of assessing the program throughout the year.

X. ANNUAL REPORT TEMPLATE

Jones & Stokes will complete the following tasks to aid in addressing L.C. 15.530 Annual Report.

- 1. Develop a template for the annual report addressing the necessary reporting criteria listed in this section.***
- 2. Prepare a draft report for review by Lane County Public Works staff prior to the issuance of the final report.***
- 3. Prepare a final report for presentation to the Board of Health (aka Board of County Commissioners) including the Public Health Administrator & Public Health Advisory Committee, and the Vegetation Management Advisory Committee.***

An Annual Report template is included as Attachment 1. The Annual Report will contain the following sections:

- Introduction: The current mission statement of the Vegetation Management Program; a list of goals of the Vegetation Management Program, as well as the objectives set to meet those goals.
- Overview: Short qualitative summary of the state of the Vegetation Management Program that summarizes the County's activities during the previous year, including any challenges addressed (e.g., particular noxious weed infestations), and a summary of what is expected in the coming year.
- Results: A summary of the data collected as part of record keeping (see above), i.e., a "roll-up" of the summaries presented to the VMAC each month.
- Discussion: Summary explanations of how program goals and objectives have or have not been met.
- Appendices and attachments containing summaries of data suggested compiled as part of record keeping and reporting above.

XI. SUMMARY COMMENTS AND RECOMMENDATIONS

The staff of Jones & Stokes generally believes that prudent use of herbicides is a valuable tool in managing vegetation. We also believe that reductions in herbicide use in favor of other methods that are relatively equivalent in cost and effectiveness is a prudent course. Assessing the relative value of any management method against others, or combinations thereof, can be challenging, if not impossible. In addition, Lane County's complex ecological setting and highly variable roadsides offer further complications. Nonetheless, we believe there are a variety of actions Lane County can consider that will likely reduce herbicide use and improve the IVM program. We offer the following comments and recommendations in that regard.

General Comments and Recommendations

It appears that much of the work required by the ordinance was already being done prior to ordinance adoption, but that there was a lack of adequate and transparent reporting to highlight this work. We surmise that this shortfall led to misunderstandings and frustration by those that eventually proposed the ordinance. Furthermore, a lack of open, direct, and considerate communication exacerbated this problem and led to actions which were not the most efficient or fruitful for Lane County. Thus, in the future, we recommend that more transparent methods, such as facilitated discussions or workshops, be utilized to avoid such problems.

We recommend that the ordinance be revised at the County's earliest convenience to improve form, accuracy, and clarity. The document is rife with errors, inconsistencies, and excess verbiage, the removal of which would improve understanding. One particular recommendation is to measure herbicide use by the amount of product(s) used rather than by road or lane miles applied, e.g., roadsides and applications vary widely, making a lane miles-based measurement biased and inaccurate.

We recommend that Lane County consider developing a graphical Geographic Information System to improve monitoring of management in time and space and to facilitate notification. Having such a system's information available to interested parties, perhaps via a website (and hard copy on request), would also help to improve program transparency, recordkeeping, and reporting.

Lastly, we recommend that a realistic view be taken regarding the level of change that Lane County can be expected to accomplish for roadside vegetation management, given its ecological and geo-political setting. For instance, roadside tolerances with regard to safety, shoulder width, and vegetation tend to be much tighter and varied than State rights-of-way. Likewise, the growing season tends to be much more precocious, robust, and long-lasting than for those jurisdictions we have presented for reference. Thus, implementing and managing an IVM program will likely always be more difficult and expensive than average. Therefore patience, assessing new developments, and realistic expectations will be keys to a successful IVM program.

Roadside Vegetation

Summarized here are the recommendations we make above regarding monitoring and managing roadside vegetation (Noxious weed management is addressed separately, below). These recommendations are generally based on methods currently in use by other jurisdictions that have chosen to end or reduce herbicide use.

1. We recommend that Lane County maintain the “Vegetation Coordinator” position to ensure that adopted recommendations are implemented, that noxious weed control is better than adequate, and that both roadside vegetation and noxious weeds are adequately monitored.
2. We recommend a thorough review of safety and design standards with the intent of reducing the amount of roadside that is managed.
3. We recommend that Lane County undertake trials to assess various action thresholds for managing roadside vegetation; in particular, vegetation heights at which controls are implemented and to what height or degree vegetation is treated.
4. We recommend that Lane County undertake trials to assess alternative treatments, with particular attention to the following:
 - a. Use of alternative methods for shoulder treatment, such as application of “sparkless bark” or the use of improved equipment, such as the “berm shaper,” to increase management efficiency. Use of a hot foam system should also be considered. (Note that entities that own such specialized equipment are generally open to loaning or renting the equipment for trials.)
 - b. We recommend that Lane County plant preferred vegetation following construction or in appropriate disturbed areas, i.e., one or more seed mixes, consisting mainly of grasses, for various situations.
5. We recommend that the County conduct trials using focused herbicide treatments for common woody species, i.e., stump “painting” or “wicking” via available manual labor rather than broadcast or directed spray. This will likely reduce the quantity of herbicide used and the environmental exposure.

The above recommendations will likely involve some level of additional funding. This is the consequence of undertaking changes that may benefit Lane County financially and in terms of improved human and ecosystem health. Similar recommendations taken in other jurisdictions have also required some level of public education, mainly in terms of understanding changes in roadside aesthetics; Lane County should be prepared to undertake such education.

Weed Management

We cannot recommend more strongly that Lane County fully appreciate the threat of noxious weeds and fully support prudent controls. We recommend that County staff continue and strengthen their involvement with regional jurisdictions and organizations with regard to weed control. We suggest that Lane County strongly support a staff person (possibly the Vegetation Coordinator) well versed in noxious weeds and controls, as well as a host of materials to better inform other County staff and the public. We recommend annual weed-identification training for vegetation staff; perhaps this or separate training could also be open to the public. We recommend that the County maintain a collection of noxious weed resources, such as laminated field books and/or a weed-resource library; a suitable collection of web-based resources is a low-cost option.

XII. REFERENCES

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- Kerle, E.A., J.J. Jenkins, and P.A. Vogue. 1996. Understanding pesticide persistence and mobility for groundwater and surface water protection. Oregon State University Extension Service. EM 8561. 8 pp.
- ODOT Research Group. 2001. Research Notes: Improving Maintenance Practices. RSN 01-05. <http://www.odot.state.or.us/tddresearch/>.
- Quarles, W. 2001. Improved Hot Water Weed Control System. IPM Practitioner 23: 1-4.
- Quarles, W. 2003. Native Plants and Integrated Roadside Vegetation Management. IPM Practitioner 25: 1-9.
- Lopeman, M. 2004. Interview: Public Works, Jefferson County. (360) 385-0890.

ADDITIONAL INFORMATION SUPPLIED BY LANE COUNTY:

- Ordinance 12-03 with Lane Code changes
- Lane Code 15.500-15.530 (same wording, different format)
- Integrated Vegetation Management (IVM) Program Standards & Guidelines, 2001
- Integrated Vegetation Management (IVM) Program Policy Document, 1999
- Products Consideration: (per LC 15.510,5, a-e)
- Products Not Listed: (Per LC 15.510,4, a-e)
- Historical costs for providing IVM services.
- Methods of physical (manual), mechanical, biological and other alternative methods for vegetation management prepared by Lane County.
- Information from herbicide manufacturers.

ACKNOWLEDGMENTS

Jones & Stokes would like to thank the staff of all of the aforementioned jurisdictions for taking time to provide valuable IVM program information.

We would also like to thank the Northwest Coalition of Alternatives to Pesticides (NCAP) for their help in conducting initial interviews with many of the jurisdictions and providing much additional information.

APPENDICES



APPENDIX A

List of Species Determined to be Problematic for Lane County
(List supplied by Lane County)

Bull thistle (<i>Cirsium vulgare</i>)	Meadow knapweed (<i>Centaurea</i>)
Butterfly bush	Poison oak (<i>Toxicodendron nervosa</i>)
Canada thistle (<i>Cirsium arvense</i>)	Portuguese broom
Dyers woad	Puncture vine
English ivy	Purple loosestrife
False brome	Reed canary grass (<i>Phalaris arundinacea</i>)
Field bindweed	Russian knapweed
French brome	Scotch broom
Giant hogweed	Scotch thistle
Giant horsetail (<i>Equisetum arvense</i>)	Smooth scouringrush
Gorse	Tansy ragwort
Himalayan blackberry (<i>Rubus discolor</i>)	Teasel (<i>Dipsacum sylvestris</i>)
Japanese knotweed	Yellow starthistle
Kudzu	

APPENDIX B
Sample Vegetation Control Prescriptions

Integrated Vegetation Control Prescription for Common Weeds

Protocol	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<u>Weed Monitoring</u>								
Woody Weeds (blackberry, broom, butterfly bush)								
Thistles								
Other Weeds								

<u>Blackberry</u>								
<u>Scattered Plants</u>								
Method 1 - Manually removal - grubbing								
Method 2 - Spot spray (Garlon 4)								
<u>Thickets</u>								
Method 1 - Herbicide Application								
Broadcast Spray (Garlon 4)								
Mow or hand cut thickets and spot-spray or wick cane stubs								
Method 2 - Limited Herbicide Application								
Mow or hand cut thickets								
Spot spray or manually remove sprouts								

Protocol	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<u>Scotch Broom</u>								
Manually pull seedlings								
Cut mature plants near ground and spray or wick stubs within 15 minutes (Garlon 4)								

<u>Thistles</u>								
Method 1 - Spot Herbicide Application								
Uplands - Stinger or Transline (Clopyralid)								
Wetlands - Garlon 4								
* <u>Prior</u> to flower bud stage								
** Caution - avoid other plants								
Method 2 - Spot Herbicide Application								
Uplands - Roundup (glyphosate)								
Wetlands - Rodeo								

Protocol	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
<u>Poison Hemlock</u>								
<u>Small Infestations</u>								
Method 1 - Manually pull all plants prior to seed set								
Method 2 - Spot spray with Roundup or 2,4-D								
<u>Large Infestations</u>								
Method 1 - Mow just prior to flowering								
Repeat in late summer as needed								
Method 2 - Broadcast spray prior to seed set Roundup or 2,4-D								

	- Likely the optimum time for the activity
	- May be a good time for the activity, particularly given seasonal variations

APPENDIX C

Proposed Permitted Herbicide Products for Lane County

HERBICIDE product name, manufacturer/supplier	Active Ingredients	Common Uses	Soil Half Life	Soil Mobility	Water Solubility	Toxicity to Organisms	EPA Carcinogenicity	EPA Toxicity
ESCORT <i>DuPont</i>	Metsulfuron-methyl	foliar, noxious weed	14 - 180 days	Mobile	Unknown	Bee: Practically non-toxic Bird: Practically non-toxic Mammal: Practically non-toxic Fish: Practically non-toxic Invertebrates: Practically non-toxic	Category E: No evidence of carcinogenicity for humans	Category IV
OUST <i>DuPont</i>	Sulfometuron-methyl	road shoulder	30 - 60 days in sediment, 5 - 33 days in soil	Mobile	Unknown	Bird: Practically non-toxic Mammal: Practically non-toxic Fish: Practically non-toxic	Category E: No evidence of carcinogenicity for humans	Category IV
TRANSLINE <i>Dow AgroSciences</i>	Clopyralid	noxious weeds, Japanese knotweed	40 day average; (14 - 56 reported)	Mobile	Unknown	Bee: Practically non-toxic Bird: Practically non-toxic Mammal: Practically non-toxic Fish: Practically non-toxic	Unknown	Category III
GARLON 3A <i>Dow AgroSciences</i>	Triclopyr Amine	oliar, noxious weed, brush, cut stump	46 day average; (79 - 361 in colder climates)	Mobile	Unknown	Bee: Non-toxic Bird: Slightly toxic Mammal: Slightly toxic Fish: Practically non-toxic Invertebrates: Practically non-toxic	Category D: (Not Categoryifiable as human carcinogen) Data suggests does not cause cancer	Category III
RODEO <i>Monsanto</i>	Glyphosate	road shoulder, cut stump, noxious weeds	47 day average; (1 - 174 in field tests)	Not mobile in soil; Strongly absorbed to most soils	Highly soluble in water	Bee: Practically non-toxic Bird: Slightly toxic Mammal: Practically non-toxic Fish: Practically non-toxic	Category E: No evidence of carcinogenicity for humans	Category III
ROUNDUP <i>Monsanto</i>	Glyphosate	road shoulder, cut stump, noxious weeds	47 day average; (1 - 174 in field tests)	Not mobile in soil; Strongly absorbed to most soils	Highly soluble in water	Bee: Practically non-toxic Bird: Slightly toxic Mammal: Practically non-toxic Fish: Practically non-toxic	Category E: No evidence of carcinogenicity for humans	Category III
ROUNDUP PRO <i>Monsanto</i>	Glyphosate	road shoulder, cut stump, noxious weeds	47 day average; (1 - 174 in field tests)	Not mobile in soil; Strongly absorbed to most soils	Highly soluble in water	Bee: Practically non-toxic Bird: Slightly toxic Mammal: Practically non-toxic Fish: Practically non-toxic	Category E: No evidence of carcinogenicity for humans	Category III
SHARPSHOOTER <i>Monsanto</i>	Glyphosate, isopropylamine salt	noxious weeds	Unknown	Mobile	Unknown	Bee: Practically non-toxic Bird: Slightly toxic Mammal: Practically non-toxic Fish: Practically non-toxic	Unknown	No Consensus Value
GARLON 4E <i>Dow AgroSciences</i>	Triclopyr, butoxyethyl ester	foliar, noxious weed, brush, cut stump	46 day average; (79 - 361 in colder climates)	Low mobility	Unknown	Bird: Slightly toxic Mammal: Slightly toxic Fish: Moderate to highly toxic	Category D: (Not Categoryifiable as human carcinogen) Data suggests does not cause cancer	Category III

HERBICIDE product name, <i>manufacturer/supplier</i>	EPA Carcinogen Category	IARC Carcinogen	CA Prop 65 List	National Toxicity Program	Reproductive Toxicants (Prop 65)	Illinois EPA Endocrine Disruptors	Toxic Release Inventory
ESCORT <i>DuPont</i>	E	NL	NL	NL	NL	NL	NL
OUST <i>DuPont</i>	E	NL	NL	NL	NL	NL	NL
TRANSLINE <i>Dow AgroSciences</i>	E	NL	NL	NL	NL	NL	NL
GARLON 3A <i>Dow AgroSciences</i>	D	NL	NL	NL	NL	NL	NL
RODEO <i>Monsanto</i>	E	NL	NL	NL	NL	NL	NL
ROUNDUP <i>Monsanto</i>	E	NL	NL	NL	NL	NL	NL
ROUNDUP PRO <i>Monsanto</i>	E	NL	NL	NL	NL	NL	NL
SHARPSHOOTER <i>Monsanto</i>	Unk	NL	NL	NL	NL	NL	NL
GARLON 4E <i>Dow AgroSciences</i>	D	NL	NL	NL	NL	NL	NL

APPENDIX D

List of Sources for Noxious Weed Treatment Prescriptions

Oregon Department of Agriculture:

http://oregon.gov/ODA/PLANT/weed_index.shtml

Center for Invasive Plant Management:

http://www.weedcenter.org/inv_plant_info/states.htm#or

The Nature Conservancy – Invasive Species Initiative:

<http://tncweeds.ucdavis.edu/>

Invasivespecies.gov:

<http://invasivespecies.gov/>

APPENDIX E
Miscellaneous Web-Based Information Sources

Pesticide/Soil Mobility (includes GUS values)

<http://eesc.orst.edu/agcomwebfile/edmat/html/em/em8705/em8705.html>

Sources for Various Pesticide Lists (Includes those cited in the ordinance).

International Agency Research Cancer: <http://iadr.fr>

[List]: <http://www.inchem.org/pages/iarc.html>

California Proposition 61 List: http://www.oehha.ca.gov/public_info/TDHOMSC1a.html

Endocrine Disruptors:

[Information – EPA]: <http://www.epa.gov/scipoly/oscpendo/index.htm>

Toxics Release Inventory (TRI): <http://www.epa.gov/tri/>

PAN List of Lists: <http://www.pesticideinfo.org/Index.html>,