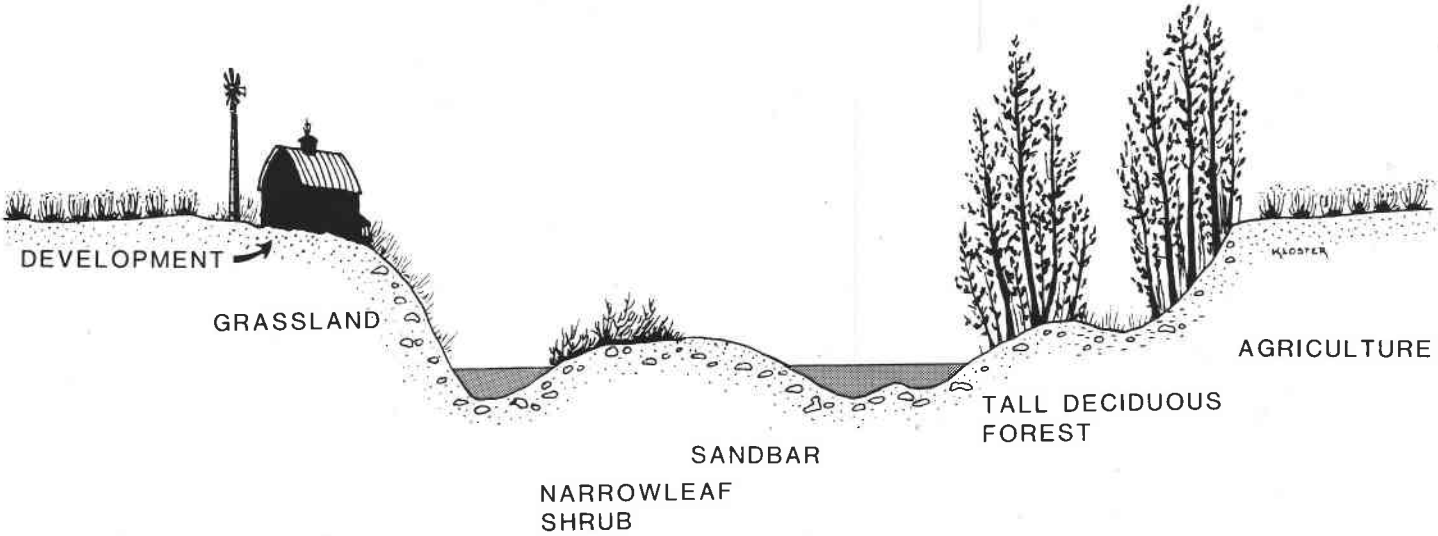
# VEGETATIONAL CHANGES IN THE WILLAMETTE RIVER GREENWAY IN BENTON AND LINN COUNTIES: 1972-1981

by ROBERT E. FRENKEL, ERIC F. HEINITZ, and
S. NIMAL WICKRAMARATNE




A Report to Oregon Department of Fish and Wildlife

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Water Resources Research Institute

Oregon State University

Corvallis, Oregon 97331

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A Report Submitted to the
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## ABSTRACT

Change in vegetation cover in the Willamette River Greenway, Benton and Linn Counties from 1972 to 1981 was mapped and measured from a time sequence of aerial photographs. Vegetation and land cover within the Greenway was first classified and mapped for 1976 using ten mapping categories and floristic composition of seven vegetation cover types listed. Aggregated vegetation cover was independently mapped for 1972 and 1981 and loss of riparian vegetation portrayed on a set of 29 vegetation change maps. Area of aggregated vegetation, agriculture, and development was measured for 1972 and 1981. There was a total loss within the Benton County Greenway of 436 acres of riparian vegetation or 8 percent of the County Greenway area of 5,505 acres. In Linn County there was a total loss of 290 acres or 4 percent of the Greenway area of 7,308 acres.


## FOREWORD

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# INTRODUCTION

## Research Goals

The purpose of this research is to:

1. classify the natural vegetation, semi-natural vegetation and land cover in the Willamette River Greenway in Benton and Linn Counties with respect to vegetation structure and land-use;
2. based on this classification with the aid of aerial photographs, map the Willamette Greenway vegetation and land cover in these counties; and
3. measure the gain and/or loss of natural and semi-natural vegetation in the Willamette Greenway for Benton and Linn Counties for the period of 1972-1981.

Ultimately, the goal of this research is to accurately document the character of land and vegetation cover in the riparian zone along the Willamette River Greenway and recent changes in cover in that zone. This information should assist public agencies in carrying out their administrative responsibilities.

## Riparian Zone Values and Vegetation

### Riparian Zone Values

The riparian zone is a relatively narrow strip of land adjacent to a stream which may have interrelationships to the river. Traditionally the riparian zone includes the water body. Swanson et al. (1982) emphasize the influence of the riparian zone upon the river while Stamp and Clark (1979) stress the position of the riparian zone "situated on the banks of a river". But, not all stream-side zones are riparian as is the case with rock cliffs and sagebrush-steppe forming river margin vegetation (National Research Council 1982). Many individuals regard the riparian zone as a wetland ecosystem occurring as a transition between upland and river (Cowardin 1979). In this regard bottomlands and flood-plains are considered broad extensions of the riparian zone.

Ecological values of riparian zones are many. Because of their ecotonal nature and high edge-to-area ratio, they serve as important wildlife habitat.

Habitat values are accentuated by diversity in vegetation structure and composition, high energy and nutrient inputs, and a mesic-to-hydric moisture regime. Recent important reviews of the ecological and economic values of the riparian zone include those by Johnson and Jones (1977), Johnson and McCormick (1979), and Swanson et al. (1982).

In the upper portion of the river continuum, the riparian zone is a major contributor to the ecological functioning of the stream. In the lower reaches of a river, the role of the riparian zone shifts as it increasingly receives ecological inputs from the river system corresponding to a shift in stream energetics from heterotrophy to autotrophy (Meehan et al. 1977).

Riparian vegetation provides:

> 1) streambank stabilization and erosion control which reduces . . . sediment, thereby helping to maintain intergravel water flows and in turn the supply of oxygen available to incubating fish eggs and alevins; 2) a filtering device to settle out sediments and reduce down stream siltation; 3) shade to maintain suitable water temperatures for aquatic resources; 4) organic debris to feed aquatic insects which are essential in the diets of many fish; 5) stability to minimize stream damage from torrential floods; 6) overhanging bank cover from the roots of trees, shrubs, and herbaceous vegetation to provide fish with protective cover and terrestrial insect food; and 7) groundwater recharge by its ability to absorb runoff (American Fisheries Society 1980, p. 6).

When the riparian vegetation is altered by man's activities the quality of the aquatic as well as the riparian habitat may be degraded.

## Riparian Vegetation

Despite its acknowledged value discussed above, riparian vegetation in the Willamette Valley and along lower rivers in the Pacific Northwest has not been described. Riparian plant cover, however, has been well-documented and classified in many other regions. Selected studies are reviewed by Wickramaratne (1983), Johnson and McCormick (1979), and by Johnson and Jones (1977).

The natural vegetation of the Willamette Valley shows diversity in species composition and structure. Franklin and Dyrness (1973) recognize four broad

assemblages: deciduous forest communities on dry sites, upland coniferous forest communities, grasslands on both wet and dry sites, and riparian communities. Riparian assemblages are typically dominated by deciduous hardwoods including: black cottonwood (Populus trichocarpa), Oregon ash (Fraxinus latifolia), and bigleaf maple (Acer macrophyllum). Cottonwood is often dominant along large rivers and on river islands. Ash is found more often on flooded and swampy habitats somewhat removed from the river. The riparian zone is also marked by dense low tree and shrub cover including: red alder (Alnus rubra), red-osier dogwood (Cornus stolonifera), black hawthorn (Crataegus douglasii), Nootka rose (Rosa nutkana), and willow (Salix fluviatilis, S. lasiandra, S. rigida, S. scouleriana, S. sessilifolia, and S. sitchensis). Open disturbed margins of the river are often dominated by introduced reed canarygrass (Phalaris arundinacea) and away from the stream by Himalayan blackberry (Rubus discolor). Although major dominants are known, the structure, composition, and classification of Willamette Valley riparian vegetation has yet to be investigated.

The level of concern over the management of the riparian zone and its vegetation is suggested by more than 209 laws, regulations and ordinances which apply to riparian zones in all 50 states; many of these measures are recent (American Fisheries Society 1980). Among these regulatory efforts is Oregon's Willamette River Greenway Program, a flexible approach to the protection of the riparian environment involving private land owners, county and state governments.

## Willamette River Greenway

The Willamette River Greenway Program was created by an act of the Oregon Legislature in 1967 in order to make available for recreational use the riparian environment of the main stem of the Willamette River (Willamette River Park System, Chapter 551, Oregon Laws, 1968). The original program, administered (with the advice of the Governor's Willamette River Park System Committee) by the State Parks and Recreation Branch of the Transportation Department, authorized the State Highway Commission to acquire property along the river by agreement and purchase. In the first five years of the program, only 20 of 408 Willamette River bank-miles became publicly owned. Funding of $10 million was by a combination of federal sources (Land and Water Conservation Funds) and state sources to match at 50 percent of the federal monies. Little participation

through the grants-in-aid program was shown by local authorities; no plan and no definition of the lateral extent of the Greenway were developed. The program from its inception engendered much controversy (Bauer 1980).

In 1973, the Oregon Legislature replaced the Willamette River Park System by the present Willamette River Greenway Program (ORS 390.310 to 390.368). Among other things, this law:

1. defined the maximum and minimum lateral extent of the Greenway (150 feet above ordinary low water and no more than an average of 320 acres per river mile);
2. specified that a Willamette River Greenway plan be prepared by the Department of Transportation (DOT) delineating the Greenway boundary, acquired state lands and potential acquisition areas;
3. required approval of the plan by the Land Conservation and Development Commission (LCDC); and
4. required implementation of the program through cooperation between state and local jurisdictions as part of comprehensive planning.

The legislation permitted farming as a compatible use within the Greenway and limited "intensification of use" within the Greenway. Restrictions were also placed on public acquisition of lands. The original plan prepared for DOT in 1974 by a consultant was revised several times and on December 6, 1975, the LCDC adopted the Preliminary Willamette River Greenway Plan together with the LCDC Comprehensive Planning Goal No. 15 pertaining to the Greenway.

Following a general directive in the Greenway legislation, management of the Greenway has followed two courses. First, Greenway resources are to be protected through local comprehensive plans and ordinances; however, prior to completion and acknowledgement of these plans, the LCDC has secondly adopted an Interim Order adopting the Greenway boundary as defined in the DOT plan and the standards in Goal 15 for protection of the Greenway area. Among these standards is the need for local planning authorities to designate uses of the Greenway consistent with conditions such as preservation of agricultural land, public access (except across private lands), protection of natural areas, protection of fish and wildlife habitat, provision for recreational use on public lands, and provision for partial timber harvest and gravel extraction.

Typically, Goal 15 has been implemented by zoning Greenway lands as either exclusive farm use (EFU), floodplain, or open space. Frequently an overlay zone procedure has been adopted. Protection is achieved by a specific plan or review procedure for overseeing proposed changes in use, e.g., intensification of use within the Greenway.

## Problem and Approach

### Vegetation and Land Cover Mapping

Identification of the character of vegetation and land cover in the Willamette River Greenway was based on information available on large scale aerial photographs. Floristic classification of riparian vegetation based on extensive sampling was not attempted. The steps followed included the development of a cover type classification, interpretation of aerial photographs using that classification, field checking the interpretation, and mapping.

Mapping was based on a physiognomic classification which was easily interpretable on the available imagery, compatible with more generalized vegetation and land cover hierarchical classifications (c.f., Anderson et al. 1976), compatible with detailed plant community classifications, and useful for land management purposes. Vegetation mapping was conducted directly on natural color air photos at a scale of 1:12,000 and working maps prepared by direct transfer on to base maps.

### Changes in Cover

Over the fourteen years of the Greenway program some Greenway lands changed character. There have been natural changes in the river with shifts of channel and the development as well as the destruction of sand/gravel bars. Embankments have been eroded and point bars extended. Protective structures including revetments have been emplaced by the U.S. Army Corps of Engineers. Farm fields have encroached on riparian vegetation and sand and gravel extraction operations have expanded. Land owners have also cut timber within the riparian zone. In a few instances, residential and commercial use has extended into the riparian strip. Although the Willamette River Greenway legislation addresses many of these man-made changes, it is not designed to prevent all changes but to guide land use within the Greenway without intensification of use.

Table 1. Selected information concerning imagery used in the analysis of vegetation and land cover change in the Willamette River Greenway.

| Year | Accession Number[a] | Type | Scale | Size | Stereo-Pair | Source | Purpose |
|---|---|---|---|---|---|---|---|
| May, 1972 | NPPCE | Black & white panchromatic prints | 1:48,000 | 9x9" | Yes | Corps of Engineers Portland District | Condition of Greenway in 1972 for mapping changes |
| 1974[b] | - | Green-tone "orthophotos" | 1:12,000 | 12x9" | No | Parks & Rec. Division, DOT | Greenway boundary and map base |
| August, 1976 | GWY-8 | Natural color | 1:12,000 | 9x9" | Yes | Parks & Rec. Division, DOT | Mapping vegetation and land cover |
| April, 1981 | CENPP | CIR positive transparency | 1:48,000 | 9x9" | Yes | Corps of Engineers Portland District | Condition of Greenway cover in 1981 for mapping changes |

[a] NPPCE = North Pacific Division Portland District Corps of Engineers, GWY = Greenway, CENPP = Corps of Engineers North Pacific Division Portland District

[b] Imagery used in A Proposal for the Willamette River Greenway, Book 3 was taken in October 1973 and January and March 1974.

Identification and measurement of changes in the Willamette River Greenway vegetation and land cover were based on a comparison of 1972 and 1981 air photo imagery. The 1972 imagery was taken close to the effective date of the legislative establishment of the Greenway and the 1981 imagery was the most recently available. Photographs at different scales and with different distortions had to be planimetrically justified on a set of base maps drawn from the 1976 Willamette River Greenway proposal book. The changes were identified, area determined by planimeter, and mapped on a separate set of vegetation and land cover change maps.

## METHODS

### Imagery Selection and Base Map Preparation

#### Imagery Selection

Available imagery of the Willamette River was inspected at the Portland District U.S. Army Corps of Engineers and at the Parks and Recreation Division of the Oregon Department of Transportation. Considerations guiding imagery selection included the need for: complete coverage of the river along the Greenway; stereo-pair images; clear images; and imagery at as large a scale as possible. The readily available Corps of Engineers River Mile books did not provide sufficient image quality. Images taken prior to the 1965 flooding would have introduced many major shifts in the course of the river and were not considered. Minimally, two sets of imagery were sought. One set taken closely to the time of establishment of the Willamette River Greenway Program in 1967 and a second set taken as recently as possible.

Four sets of imagery, however, were used: (1) thirty-three orthophotos appearing in A Proposal for the Willamette River Greenway, Book 3 (Oregon Department of Transportation 1976); (2) a set of 1976 natural color stereo-pair photos at a scale of 1:12,000 for vegetation and land cover mapping; (3) a set of panchromatic stereo-pair photos taken in 1972 at 1:48,000 for historic comparison; and (4) a set of color infrared positive transparencies taken in 1981 at 1:48,000 depicting present condition of the Greenway. Table 1 summarizes pertinent information concerning this imagery. Specific imagery used is referenced in Table 2.

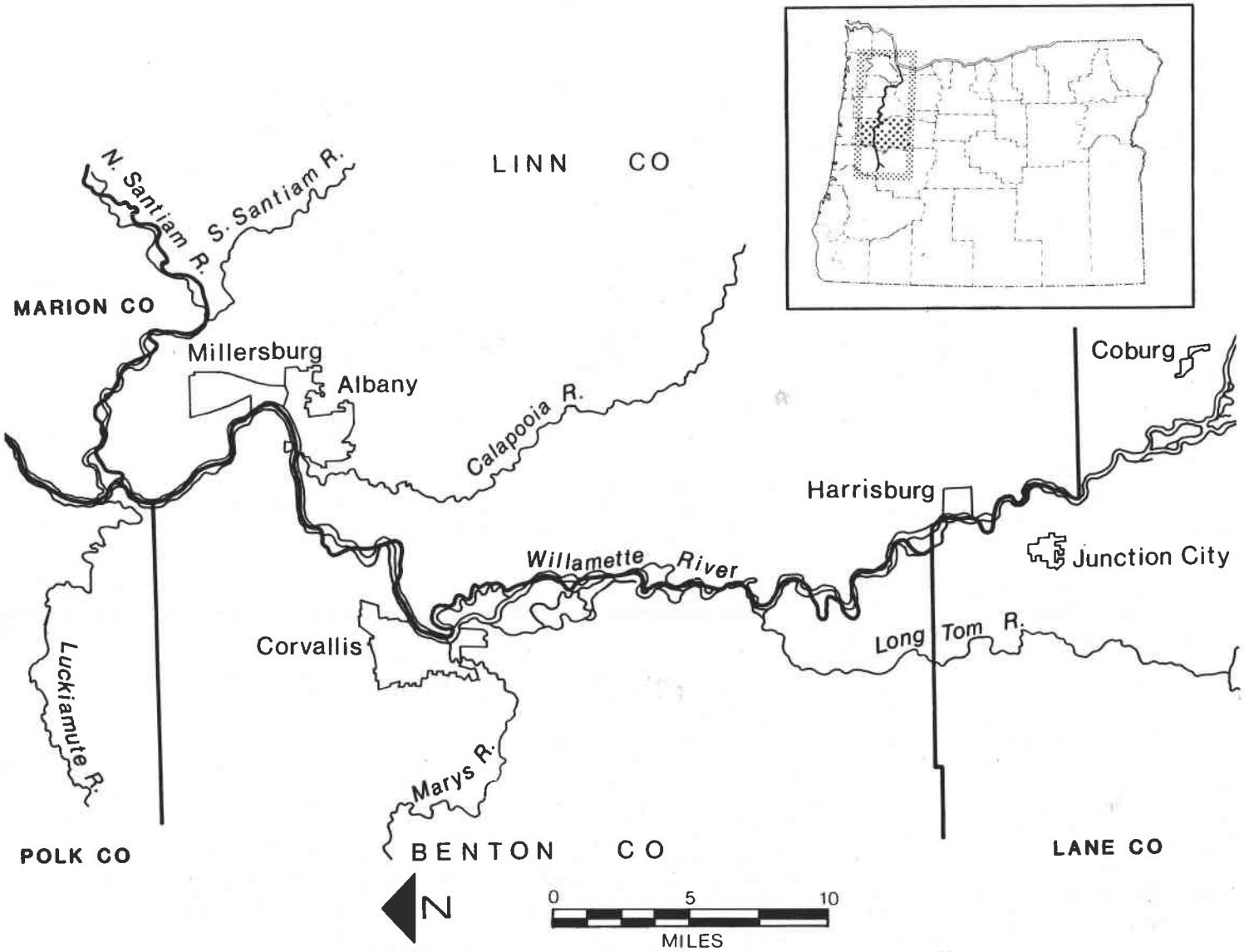


Figure 1. Willamette River in Benton and Linn Counties.

## Base Map Preparation

The Willamette River Greenway in Benton and Linn Counties encompasses approximately 60 river miles (River Mile 108 to 167, see Figure 1). Following the general subdivision of the Greenway in A Proposal for the Willamette River Greenway, Book 3, 29 base maps were prepared for segments of the Greenway of about two river miles per segment. The "Proposal" reproduced orthophotos, at a scale of 1:12,000, showed county and Greenway boundaries, township and range corner locations, river mile positions, water/land boundaries, and major cultural features such as field boundaries and roads useful in registering imagery and map. These features were drawn on clear mylar and four copies of ozalid base maps were prepared for subsequent mapping. The ozalid process did not introduce appreciable distortion into the base map copies.

For final display two sets of base maps were prepared. The first set of 29 base maps was inked on frosted mylar showing only those features needed to be displayed in common with both sets. The second set of mylar base maps was prepared by a photographic transfer ("washoffs"). The first set was used to produce the vegetation and land cover maps and the second set was used for the change maps.

## Vegetation and Land Cover Mapping

As preliminary to vegetation mapping and analysis of land cover change in the Willamette River Greenway, a classification of vegetation and land cover was developed based on field observations. A physiognomic vegetation classification appeared most appropriate as it was easily interpretable in the field and on aerial photographs at various scales. Such a classification could also accomodate more detailed information based on community analysis should this data be developed at a later date. Furthermore, a physiognomic classification could be related to a more general land cover classification, for example, the land cover classification of Anderson et al. (1976). The ten vegetation and land cover categories together with mapping symbols and representative species (see Appendix 2) identified in the Willamette River Greenway are:

Table 2. Imagery used in analysis of vegetation change in the Willamette River Greenway in Benton and Linn Counties.

| Map No. | River Mile | Imagery Coverage[a] | | |
|---|---|---|---|---|
| | | 1972 (NPPCE) | 1976 (GWY-8) | 1981 (CENPP) |
| 58 | 109-110 | 247 | 27-7 | 633/632 |
| 59 | 110-111 | 248 | 27-5/27-3 | 632-631 |
| 60 | 112-113 | 249 | 27-3/28-8 | 632-631 |
| 61 | 113-115 | 249/253 | 28-8/28-6 | 631/674 |
| 62 | 114-116 | 253/254 | 28-6/28-4 | 631/674 |
| 63 | 117-118 | 254/255 | 28-2/29-4 | 631/674 |
| 64 | 118-119 | 254/255 | 29-4/29-6 | 674/675 |
| 65 | 120-121 | 254/225 | 29-6/29-8 | 675/627 |
| 66 | 122-124 | 333/332 | 29-8/29-10 | 627/609 |
| 68 | 124-126 | 332/331 | 29-10/30-7 | 627/609 |
| 69 | 126-128 | 332/331 | 30-5/30-3 | 627/609 |
| 70 | 128-130 | 331/330 | 31-5/31-7 | 609/610 |
| 71 | 130-132 | 331/330 | 31-9/32-11 | 609/610 |
| 71a | 133-134 | 331/330 | 32-11/32-9 | 609/610 |
| 73 | 133-135 | 330/329 | 32-9/32-7 | 609/610 |
| 74 | 136-138 | 329/328 | 32-7/32-5 | 610/611 |
| 75 | 138-140 | 329/328 | 32-3/33-13 | 610/611 |
| 76 | 140-141 | 328/327 | 33-11/33-9 | 610/611 |
| 78 | 142-145 | 328/327 | 33-9/33-7 | 611/620 |
| 79 | 145-147 | 327/326 | 33-5/33-3 | 611/620 |
| 81 | 147-150 | 327/326 | 33-3/34-6,4 | 620/618 |
| 83 | 151-153 | 326/325 | 34-4/35-6 | 618/1749 |
| 84 | 153-155 | 326/325 | 35-6,4/36-11 | 618/1749 |
| 85 | 155-157 | 325/324 | 36-11/36-9 | 618/1749 |
| 86 | 157-159 | 325/324 | 36-9/36-7 | 1749/1748 |
| 87 | 159-161 | 324/340 | 36-7/37-15 | 1748/1747 |
| 88 | 161-163 | 324/340 | 37-13/37-11 | 1748/1747 |
| 89 | 163-165 | 340/341 | 37-11/37-7 | 1747/1746 |
| 90 | 166-168 | 340/341 | 37-7 | 1747/1746 |

[a] Imagery coverage is detailed in Table 1. Abbreviations of accession numbers are: NPPCE = North Pacific Division Portland District Corps of Engineers, GWY = Greenway, CENPP = Corps of Engineers North Pacific Division Portland District

Coniferous Forest (C). Conspicuous only in a few sites in the study area, this assemblage is dominated by Pseudotsuga menziesii together with Abies grandis and infrequently Pinus ponderosa. Also found in this cover type are Acer macrophyllum and Quercus garryana. The understory is composed of the shrubs Corylus cornuta, Holodiscus discolor and Rubus ursinus and the herbs Bromus vulgaris, Galium spp. and Tellima grandiflora.

Tall Deciduous Forest (T). Usually occurs as linear strips more or less parallel to the channel with the dominant species Populus trichocarpa. Fraxinus latifolia and Acer macrophyllum are found in this unit with Salix spp. toward the river bank. Examples of the understory species are Cornus stolonifera, Corylus cornuta, Crataegus douglasii and Symphoricarpos albus.

Low Deciduous Forest (L). Fraxinus latifolia, Acer macrophyllum, and occasionally Quercus garryana make up this type. Shrub layer is represented by Cornus stolonifera, Corylus cornuta and Symphoricarpos albus. Herbs are primarily Disporum spp., Tellima grandiflora and Urtica dioica.

Broadleaf Shrub (B). This type especially describes the secondary succession dominated by Rubus discolor. Although Rubus is aggressive and thickly grown, occasionally Crataegus douglasii, Rosa nutkana and Symphoricarpos albus are found.

Narrowleaf Shrub (N). This cover type distinguishes the Salix groves found near the river's edge and periphery of other water bodies. Several species of Salix are found with varying height. Low shrubs, Crataegus douglasii and Cornus stolonifera and the grasses Phalaris arundinacea and Hordeum brachyantherum also occur. This type is established on stabilized riverbars and shores.

Grassland (G). Grasslands occur as small patches on relatively stabilized cobble, gravel, and sand bars and on sites with poor drainage behind natural levees and filled-in oxbows. Except for the sporadic Salix and Populus, this type is characterized by Agrostis spp., Artemisia douglasiana, Avena fatua, Carex spp., Phalaris arundinacea, Poa pratensis, and many annual weeds.

Sand bars (S). Cobble, gravel and sand bar situations occur in meanders and shallow channels of the main river and this cover type exhibits high herbaceous species diversity. Chenopodium spp., Agrostis spp., Artemisia douglasiana, Plantago spp. and Polygonum spp. are common. This type colonizes recently formed bars.

Agriculture (A). As a land cover category, agriculture includes all crop land, cultivated and fallow, orchards, and live-stock areas. In the study area agricultural land is seen on well-drained sites mostly at the margins of the Greenway extending away from the river.

Development (D). This land cover type generalizes all urban areas, settlements, industrial sites including sand and gravel operations (Dx) and developed recreational sites.

Water. The main river channel and its tributaries, intermittent water courses, oxbow lakes, and ponds where water remains at least during part of the year are considered water bodies.

The ten cover categories were interpreted stereoscopically on the 1976 natural color imagery (1:12,000) and delineated in ink directly onto clear mylar overlays on which water boundaries, Greenway boundaries, and selected registration features were also depicted. Interpretation was checked in the field on many occasions assuring accuracy. The delineations were subsequently transferred to a set of inked mylar base maps producing the set of 29 "Willamette River Greenway Vegetation and Land Cover" maps appearing in Appendix 1.

## Vegetation and Land Cover Change

### Change Interpretation and Mapping

Five categories of cover were mapped independently based on the 1972 and 1981 imagery, respectively. The mapping categories were: aggregated vegetation (combining coniferous forest, tall deciduous forest, low deciduous forest, narrowleaf shrub, broadleaf shrub, and grassland); development (both urban/industrial and sand and gravel operations); agriculture; sand bar; and water. Because of different imagery characteristics, different interpretation techniques were used.

These five categories were interpreted on the 1981 color infrared imagery and projected by a Houston Fearless Corp. Variscan Mark II projector onto the ozalid base maps at a scale of 1:12,000. The projector magnified the positive color transparencies approximately 12 times onto a frosted screen.

The five categories above were also interpreted on the 1972 black and white imagery and transferred by a Bausch and Lomb Zoom Transferscope onto a second set of ozalid base maps. Distortion in the enlargement and transfer was minimized by using the center portion of the photographs.

Changes in aggregated vegetation cover from 1972 to 1981 were determined by comparing matched pairs of delineated ozalid maps for those years over a light table. Changes were identified and mapped onto a third set of ozalid base maps making concise "Willamette Greenway Vegetation Change" maps. A set of 29 change maps was then inked and appear here in Appendix 1 matched with the cover maps.

## Area Determination

Area of vegetation, land cover, and changes within the Greenway were measured with a Scientific Accessories Corporation Sonic Digitizing Planimeter. Each area was usually measured three times with attention paid to consistency in planimetering before recording digital output. Map areas in square centimeters were converted to hectares and acres. The digitizing of areas of overlap on the maps was avoided and most maps show a "veil line" representing the limit of coverage for a given map.

First, the total Greenway area for each county was measured. Area of water, sand bar, aggregated vegetation, agriculture, and development was measured on each of 29, 1981 vegetation and land cover ozalid maps (scale 1:12,000). The sum of these five categories was checked against the total Greenway area for accuracy. Second, the areas of vegetation and land cover change were measured on the 29 ozalid change maps. The areas of the 1972 vegetation and land cover were determined by adding the 1981 areas to the measured changes rather than repeating the tedious planimetering for the 1972 maps.

## Limitations and Errors

Over the study period, 1972-1981, changes within the Greenway are anticipated due to shifts in river channel, erosion, sand bar desposition, encroaching agriculture and development, and revegetation of abandoned fields. Assessing changes related to river channel shifts posed a problem because the three sets of imagery were taken at different times of the year meaning that the level and extent of the river was different in each set of imagery. Nonetheless, net gain/loss of aggregated vegetation related to differences of water level appeared to be small.

Changes due to encroachment of agriculture and/or development could easily

be observed and measured, especially when the imagery was registered with respect to roads, field boundaries, houses and other permanent features. On the other hand, revegetation of agricultural land (secondary succession) was difficult to depict unless the succession was well underway by 1972.

Three kinds of possible errors were recognized intrinsic to the techniques used in this research: base map errors, interpretation errors, and planimetering errors. Statistical analysis could only be made of planimetering errors and did not seem to be worthwhile determining alone.

Tilt-induced distortions were noticed in the published Greenway photo maps and therefore use of these maps introduced planimetric errors. These kinds of errors would be minor with respect to cover changes in the Greenway. Optical distortion of the projected image of the 1972 photos with the Zoom Transferscope occurred but were minimized by limiting the view to the central area of the photo. Distortions also occurred in projecting the 1981 transparencies in the Variscan but were minimized through frequent reregistration with respect to stable landscape features, and using the 1976 photos as a cross check.

Interpretation of airphotos is always error prone but field checking at a number of stages in the research reduced this kind of error. Split vegetation types were often noted and delineated, e.g., a mixture of low deciduous forest and grassland. We found difficulty in distinguishing low deciduous forest from tall, narrowleaf shrub from broad, and sand bar from grassland. However, none of these problems in identification interfered with the main objective of the research which was to determine changes in cover in the Greenway.

Errors in planimetering were reduced by repeating area determinations three times. When deviations occurred in excess to three percent still more measurements were run.

# RESULTS

## Vegetation and Land Cover

Ten cover classes are mapped for the Benton and Linn County portions of the Willamette River Greenway and appear in Appendix 1 as a set of 29 maps showing short segments, each covering about two river miles. Typical cross-sections are illustrated in Figures 2, 3 and 4. Detailed quantitative vegetation and floristic descriptions have not been attempted. A floristic list of common plants compiled for each vegetation type and sand bar cover is given in Appendix 2.

For the purposes of analysis and measurement, the six mapped vegetation cover types were aggregated. The areas of water, aggregated vegetation, sand bar, agriculture and development are given for 1981 by county in Table 3. Of the Greenway area studied 24 percent was natural water bodies, 39 percent aggregated vegetation, 3 percent sand bar, 27 percent agriculture, and 7 percent other development.

### Coniferous Forest

Of very limited distribution in the Greenway, coniferous forest occupied the highest elevations and typically was dominated by Douglas-fir (*Pseudotsuga menziesii*). Grand fir (*Abies grandis*) sometimes occurred as reproduction and was also represented by a few large trees. Other associated trees were: Oregon white oak (*Quercus garryana*), bigleaf maple (*Acer macrophyllum*) and occasionally ponderosa pine (*Pinus ponderosa*). Understory shrubs included hazelnut (*Corylus cornuta*) and snowberry (*Symphoricarpos albus*) and the herb layer was marked by sword fern (*Polystichum munitum*), spring beauty (*Montia sibirica*) and salal (*Gaultheria shallon*). Coniferous forest seldom occupied more than a few acres although it became a dominant cover away from the river. Isolated conifers were found in the low deciduous forest, particularly grand fir.

### Tall Deciduous Forest

This type typically was situated as a narrow strip parallel to the river occupying old slip-off slopes and natural levees. Often this riparian zone was marked by ropy topography consisting of ridges and swales running along the

Table 3. Area of aggregated vegetation and land cover in the Willamette River Greenway in Benton and Linn Counties in 1981 in acres.

| County | Water | Aggreg. Veg. | Sand Bar | Agric. | Develop. | Total Greenway Area | Percent of Greenway |
|---|---|---|---|---|---|---|---|
| Benton | 1,321 | 2,123 | 181 | 1,371 | 508 | 5,504 | 43 |
| Linn | 1,718 | 2,915 | 153 | 2,139 | 384 | 7,309 | 57 |
| Total | 3,039 | 5,038 | 334 | 3,509 | 893 | 12,813 | 100 |
| Percent of Greenway | 23.7 | 39.3 | 2.6 | 27.4 | 7.0 | 100 | |

river, the ridges forested by large, fast-growing black popular (Populus trichocarpa), the swales densely covered with reed canarygrass (Phalaris arundinacea). Often there were two to three such ridge systems and movement through this type was quite easy. Typical tree height within this cover was 110 feet (34m). Tall deciduous forest was among the least diverse of the cover types reflecting the strong dominance by trees and grass and the impact of flooding during winter. The type typically lay between the narrowleaf shrub and low deciduous forest.

Low Deciduous Forest

Commonly found in ample areas slightly distant from the river behind natural levees and artificial revetments and occupying broad depressions which are frequently flooded in winter, low deciduous forest is the most extensive vegetative cover in the Greenway. Typical positions for this cover are illustrated in the Halfmoon Bend transect (Figure 2) and Sam Daws Bend transect (Figure 3). The type may be densely forested but usually has openings of a quarter of an acre in size. Tree height averages 50 feet (17m). Topography is relatively level.

Because of its extensiveness and patchyness, the type exhibited considerable species richness. The dominant tree, by far, was Oregon ash (Fraxinus latifolia) but bigleaf maple (Acer macrophyllum), black poplar (Populus trichocarpa), and an occasional grand fir (Abies grandis) contributed to the dense canopy. Because the type is flooded, it is late to "leaf-out" and with increased late spring light and high soil moisture, a dense tangled understory is common including hazelnut (Corylus cornuta), snowberry (Symphoricarpos albus), salmonberry (Rubus spectabilis, Douglas' spiraea (Spiraea douglasii), Himalayan blackberry (Rubus discolor), Douglas' hawthorn (Crataegus douglasii), and trailing blackberry (Rubus ursinus). The herb layer is patchy and in places is occupied by sedge (Carex spp.), fringecup (Tellima grandiflorum), bedstraw (Galium spp.), Pacific waterleaf (Hydrophyllum tenuipes), spring beauty, Cooley's hedgenettle (Stachys cooleyae), stinging nettle (Urtica dioica) and yellow violet (Viola glabella).

Narrowleaf Shrub

Stabilized cobble, gravel and sand bars and strands are covered by this dense willow thicket. The thicket merges into the tall deciduous forest and,

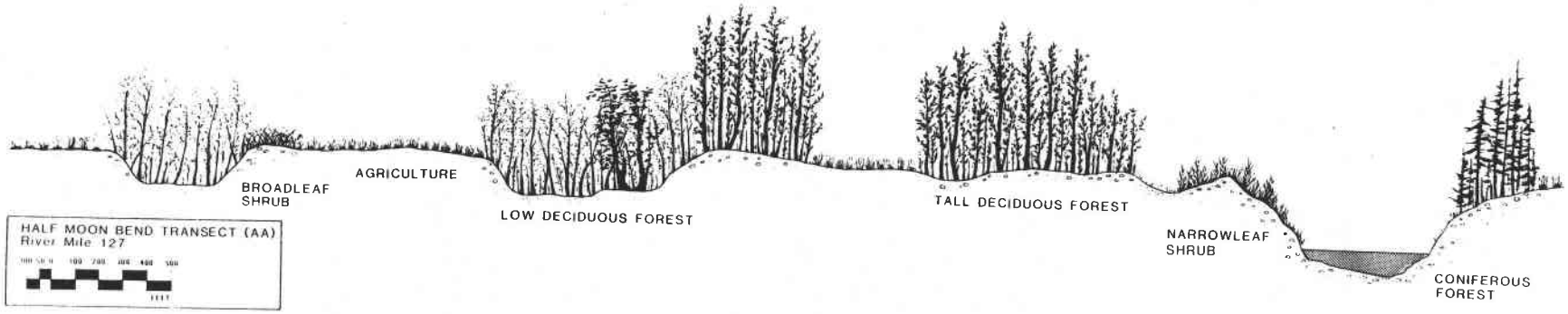


Figure 2. Half Moon Bend transect at River Mile 127.

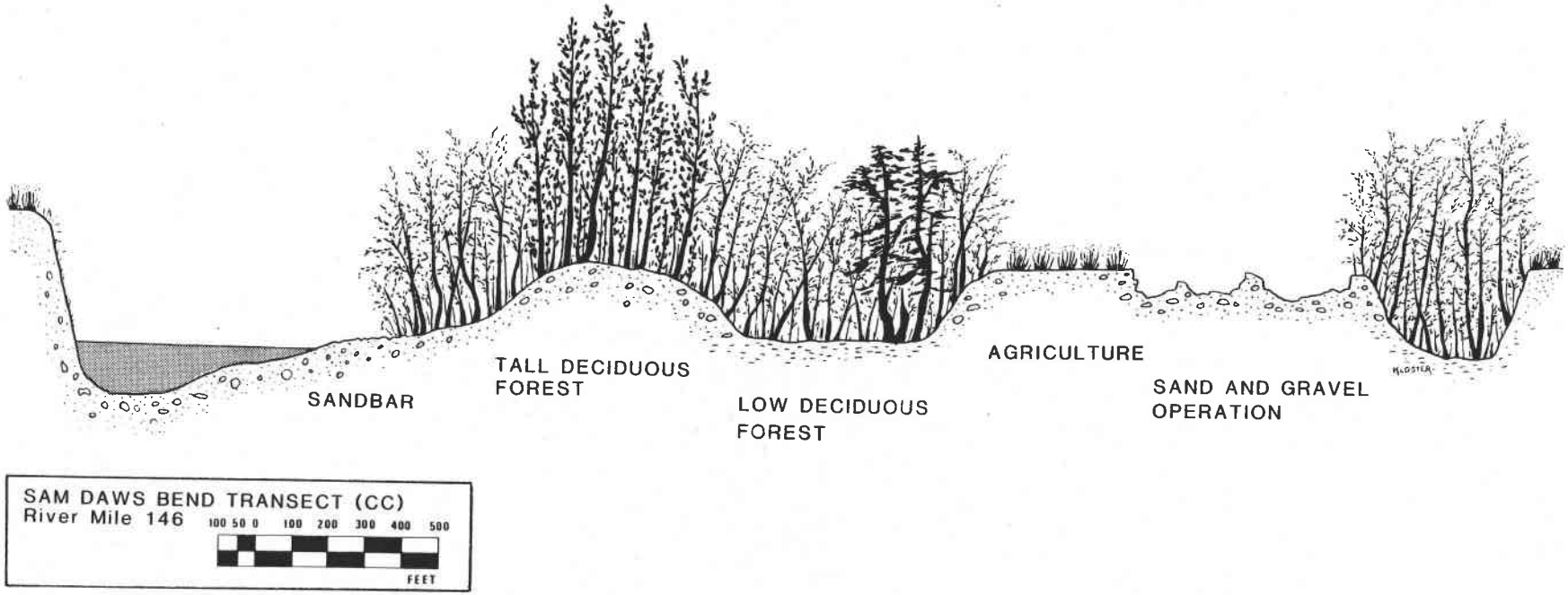


Figure 3. Sam Daws Bend transect at River Mile 146.

toward the river, into sand bar. Many of the willows approach tree height but the spreading form from a central crown remains a shrub pattern. Several species of willow contribute to the thicket: Salix fluviatalis, S. lasiandra, S. rigida, S. sessilifolia, S. scouleriana, and S. sitchensis. Additionally, snowberry (Symphoricarpos albus) and Douglas' hawthorn (Crataegus douglasii) are commonly encountered. The understory is frequently almost completely dominated by reed canarygrass (Phalaris arundinacea). This cover type is dependent on the high moisture contributed by the river and resists deformation by annual winter inundation.

## Broadleaf Shrub

Developed on higher disturbed ground than supports the narrowleaf shrub, this cover type is common at the margins of the low deciduous forest. Virtually impenetrable, the assemblage is armored by thorny shrubs, the most prominent of which are Himalayan blackberry (Rubus discolor), evergreen blackberry (R. laciniatus), salmonberry (R. spectabilis), Nootka rose (Rosa nutkana) and Douglas' hawthorn (Crataegus douglasii). Because of the dense tangle of shrubs, understory is typically very sparse. The shrub type occupies areas of cleared low deciduous forest and abandoned agricultural land. Although human disturbance sets the stage for the establishment of this cover, it also naturally colonizes disturbed situations along the river on non-sandy soils.

## Grassland

Two kinds of grassland were evident: (1) a river margin grassland dominated by reed canarygrass (Phalaris arundinacea) and (2) a dry grassland occupying former bars and strands, now well removed from the river. The second type has often been used for sheep or cattle grazing and includes many alien species. Common species on the dry grassland include silvergrass (Aira caryophyllea), soft brome (Bromus mollis), ripgut brome (B. rigidus), and six-week fescue (Festuca bromoides).

## Sand Bar

Of the Greenway cover types, the sand bar, including a range of sediment size from cobble to coarse sand, was most floristically diverse but there was little integration among the established plants. This habitat is submerged

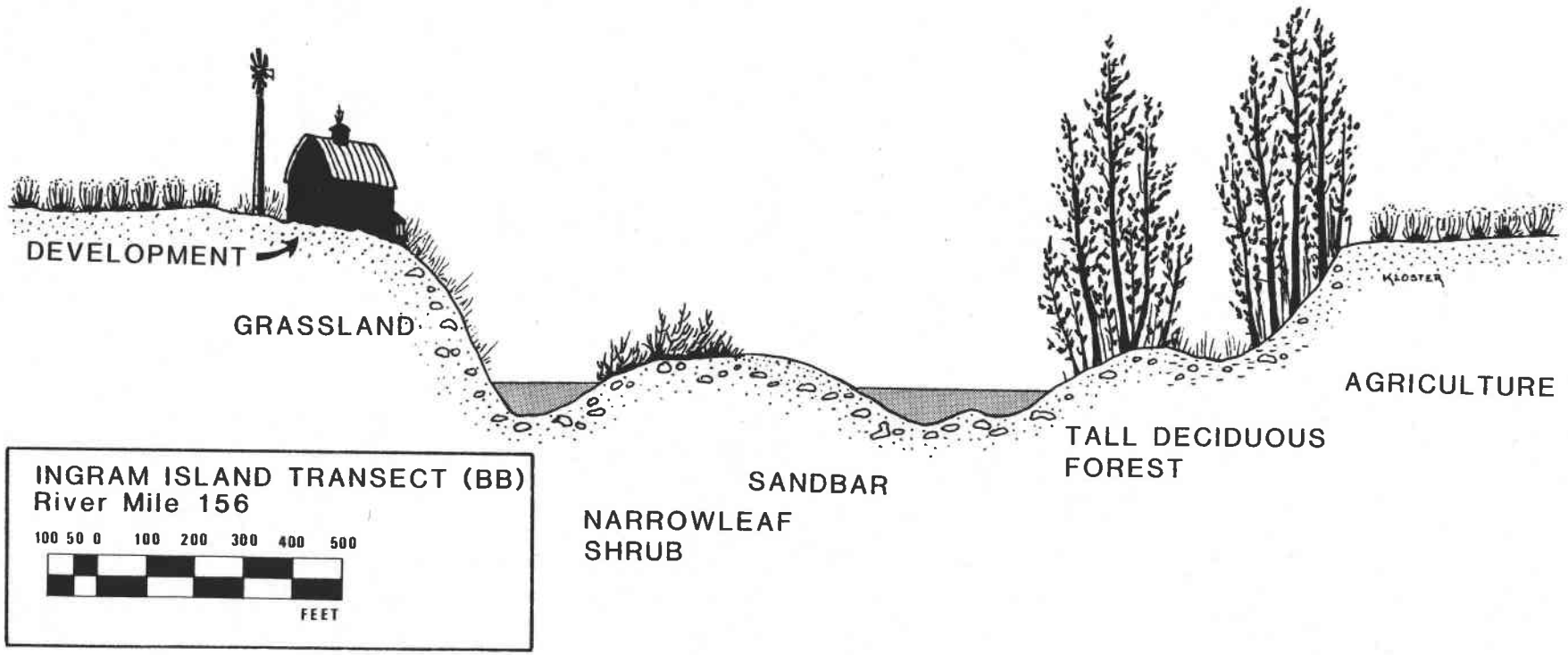


Figure 4. Ingram Island transect at River Mile 156.

until mid-June and, as the water recedes, fresh substrate is exposed to annual plant colonization. Among the numerous sprawling herbs were Mexican tea (Chenopodium ambrosioides), white goosefoot (C. album), dog fennel (Anthemis cotula), white sweet-clover (Melilotus alba), ribwort plantain (Plantago lanceolata), and heartweed (Polygonum persicaria). This type represented freshly formed low bars and strands, which were essentially unstabilized in contrast to the more stabilized, higher narrowleaf shrubs dominated by willow.

### Agricultural Cover

Mostly in the form of cropped or plowed fields, agricultural use and associated tile drainage were clearly interpretable on all imagery. There were relatively few orchards and caneberry farms. When a farmstead was associated with agricultural field or pasture, the area was mapped agricultural, not development. Agricultural land was mostly on higher land and occasionally approached the river edge on undercut slopes (outside of a meander bend) or where the river channel was incised as can be seen in the Ingram Island transect (Figure 4).

### Development

Developed land was relatively minor in the Greenway. Most developments were sand and gravel operations which occurred at all elevations and involved much vegetation removal, deposition of material in excavated ponds, roads, piles of sorted and unsorted sand and gravel, and occasional structures and machinery.

## Vegetation and Land Cover Change

### Cover Changes

Vegetation and land cover change from 1972 to 1981 within the Benton and Linn County sections of the Willamette River Greenway are mapped on 29 sheets, each covering about two river miles (Appendix 1). These changes are summarized by county in Figure 5 and Table 4.

In 1972 within the study area, aggregated vegetation (comprising coniferous forest, tall deciduous forest, low deciduous forest, narrowleaf shrub, broadleaf

Table 4. Area in acres of selected cover types and cover-type change, 1972 to 1981 in the Willamette River Greenway in Benton and Linn Counties.

| Year/County | | Cover Type | | | | |
|---|---|---|---|---|---|---|
| | | Agriculture | Sand & Gravel Operations | Other Development | Total Development | Aggregated Vegetation |
| 1972 | Benton | 1,001 | 215 | 227 | 442 | 2,559 |
| | Linn | 1,942 | 123 | 168 | 291 | 3,205 |
| | Total | 2,943 | 338 | 395 | 733 | 5,764 |
| 1981 | Benton | 1,371 | 281 | 227 | 508 | 2,123 |
| | Linn | 2,139 | 183 | 201 | 384 | 2,915 |
| | Total | 3,510 | 464 | 428 | 892 | 5,038 |
| Loss | Benton | 0 | 0 | 0 | 0 | 436 |
| | Linn | 0 | 0 | 0 | 0 | 290 |
| | Total | 0 | 0 | 0 | 0 | 726 |
| Gain | Benton | 370 | 66 | | 66 | 0 |
| | Linn | 197 | 60 | 33 | 93 | 0 |
| | Total | 567 | 126 | 33 | 159 | 0 |

shrub and grassland) occupied 5,764 acres; agriculture 2,932 acres, development 734 acres (Table 4). From 1972 to 1981, area of aggregated riparian vegetation in both counties was diminished at the expense of gain in both agricultural cover and development. A total of 726 acres of riparian vegetation was lost, 436 acres in Benton County and 290 acres in Linn County. Of the total loss, 567 acres was encroached upon by agricultural land use and 159 acres by development, mostly by sand and gravel operations (126 acres).

Differences exist between Benton and Linn Counties in terms of riparian vegetation lost. Of the total Greenway riparian vegetation area lost in the two counties, 60 percent was lost in Benton County (436 acres) which constituted 8 percent of the County Greenway area. Of this loss, 85 percent was converted to agriculture (370 acres) and 15 percent to sand and gravel operations (66 acres). For Linn County, 290 acres of riparian vegetation were lost accounting for 4 percent of the County Greenway area. Of this loss, 68 percent (197 acres) was cleared for agriculture, 21 percent for sand and gravel operations, and 11 percent for other developments.

If one discounts the substantial area of water in the Greenway of 3,039 acres in both counties, total conversion of aggregated riparian vegetation to non-riparian cover of 726 acres constituted 7.4 percent of the Greenway land area. For Benton County a conversion of 436 acres represented 10.4 percent of the County Greenway land area and for Linn County a loss of 290 acres represented 5.2 percent of the County Greenway land area.

Changes were tallied in each county by river mile and appear in Table 5 and Figure 6. Most changes in Benton County were between River Mile 127 and 141. Corvallis is located at River Mile 131.5. Most of the loss of riparian vegetation took place to the south of Corvallis. For Linn County, most losses of Greenway vegetation occurred between River Mile 122 and 126. Albany is located at River Mile 119. In addition to these losses immediately south of Albany, a major Linn County loss in vegetation occurred at River Mile 138. Alienation of Greenway vegetation therefore appears correlated with proximity to urban centers but a correlation relationship was not developed in this report.

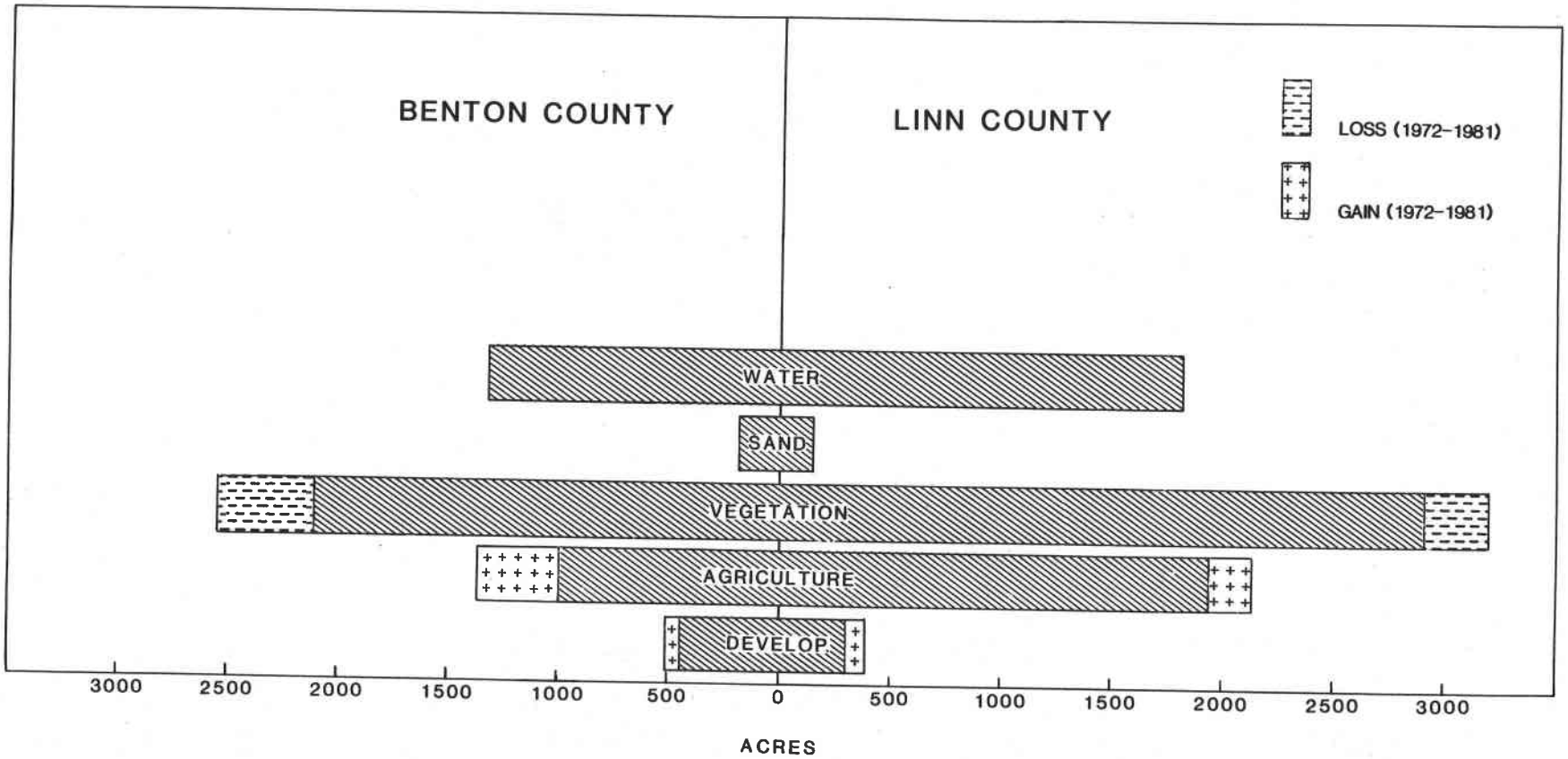


Figure 5. Major land cover and cover changes in the Willamette River Greenway in Benton and Linn Counties from 1972 to 1981.

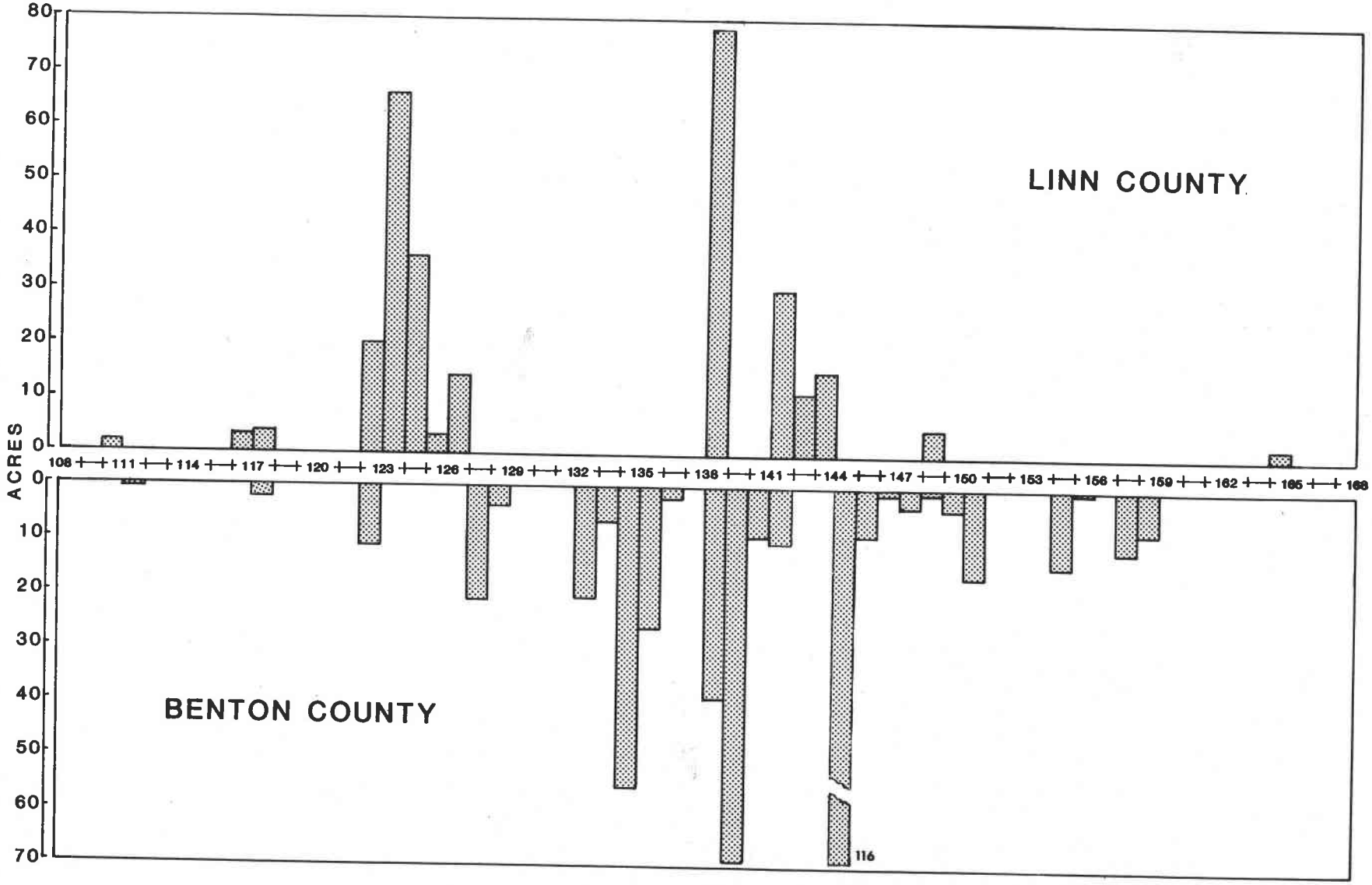


Figure 6. Losses of aggregated vegetation to agriculture and development by approximate River Mile in the Willamette River Greenway from 1972 to 1981 in Benton and Linn Counties.

Table 5. Area in acres by River Mile of aggregated riparian vegetation in 1972 and 1981 and area of vegetation converted to agriculture and development from 1972 to 1981 in the Willamette River Greenway in Benton and Linn Counties.

| | | Benton County | | | Linn County | | |
|---|---|---|---|---|---|---|---|
| Map No.[a] | Approx. River Mile | 1972 | 1981 | Change | 1972 | 1981 | Change |
| 58 | 109-110 | - | - | - | 126.7 | 126.7 | 0 |
| 59 | 110-111 | 40.0 | 39.1 | 0.9 | 78.1 | 77.0 | 1.1 |
| 60 | 112-113 | 12.2 | 12.2 | 0 | 35.6 | 35.6 | 0 |
| 61 | 113-115 | 91.2 | 91.2 | 0 | 49.5 | 49.5 | 0 |
| 62 | 114-116 | 64.1 | 64.2 | 0 | 44.5 | 41.3 | 3.2 |
| 63 | 117-118 | 126.3 | 123.8 | 2.5 | 74.8 | 70.8 | 4.0 |
| 64 | 118-119 | 50.4 | 50.4 | 0 | 17.2 | 17.2 | 0 |
| 65 | 120-121 | 55.8 | 55.8 | 0 | 53.5 | 53.5 | 0 |
| 66 | 122-124 | 58.3 | 48.8 | 9.5 | 544.1 | 437.3 | 106.8 |
| 68 | 124-126 | 71.2 | 71.2 | 0 | 156.9 | 142.3 | 14.6 |
| 69 | 126-128 | 242.4 | 220.7 | 21.7 | 85.7 | 73.4 | 12.3 |
| 70 | 128-130 | 35.4 | 34.3 | 1.1 | 56.8 | 56.8 | 0 |
| 71 | 130-132 | 35.3 | 35.3 | 0 | 68.0 | 68.0 | 0 |
| 71a | 133-134 | 102.3 | 81.7 | 20.6 | 9.0 | 9.0 | 0 |
| 73 | 133-135 | 317.8 | 231.3 | 86.5 | - | - | - |
| 74 | 136-138 | 59.2 | 54.9 | 4.3 | 25.8 | 25.8 | 0 |
| 75 | 138-140 | 184.9 | 73.6 | 111.3 | 186.7 | 110.0 | 76.7 |
| 76 | 140-141 | 54.0 | 34.5 | 19.5 | 42.9 | 42.1 | 0.8 |
| 78 | 142-145 | 296.0 | 192.8 | 103.2 | 294.6 | 243.9 | 50.7 |
| 79 | 145-147 | 98.7 | 89.1 | 9.6 | 97.2 | 97.2 | 0 |
| 81 | 147-150 | 210.4 | 190.6 | 19.8 | 171.6 | 167.2 | 4.4 |
| 83 | 151-153 | 125.8 | 121.0 | 4.8 | 199.6 | 199.6 | 0 |
| 84 | 153-155 | 98.7 | 96.9 | 1.8 | 123.3 | 109.8 | 13.5 |
| 85 | 155-157 | 33.8 | 33.8 | 0 | 96.8 | 96.8 | 0 |
| 86 | 157-159 | 103.9 | 85.2 | 18.7 | 121.0 | 121.0 | 0 |
| 87 | 159-161 | - | - | - | 66.2 | 66.2 | 0 |
| 88 | 161-163 | - | - | - | 101.2 | 101.2 | 0 |
| 89 | 163-165 | - | - | - | 162.9 | 160.3 | 2.6 |
| 90 | 166-168 | - | - | - | 124.5 | 124.5 | 0 |
| Total | | 2568.1 | 2132.4 | 435.8 | 3214.7 | 2924.0 | 290.7 |

[a] Refers to map number in "A Proposal for the Willamette River Greenway, Book 3" (Oregon Department of Transportation 1976).

The changes mapped and measured were major alterations of the Greenway vegetation. Many situations were observed where Greenway vegetation was degraded but not eliminated during the study period. For example, an area in Linn County near River Mile 131 was altered by clearing but complete conversion was not achieved and therefore this area was not mapped as a loss. Most common in this respect, was selective removal of large trees (black poplar, Oregon ash and bigleaf maple). The estimates of vegetation removal in the Willamette River Greenway in this report are therefore conservative.

## SUMMARY

Changes in vegetation and land cover for 1972 to 1981 in the Benton and Linn County portions of the Willamette River Greenway were studied by examining a time series of aerial photographs. Selected field checking verified vegetation and land cover and change.

Riparian vegetation and land cover was classified into ten cover types: Coniferous Forest, Tall Deciduous Forest, Low Deciduous Forest, Narrowleaf Shrub, Broadleaf Shrub, Grassland, Sand bar, Agriculture, Development, and Water. These types were mapped based on a set of natural color imagery (scale 1:12,000) taken in 1976 and a set of color infrared imagery taken in 1981 (scale 1:48,000). A resulting series of 29 vegetation and land cover maps are given in Appendix 1. These ten cover types were also used in the interpretation, analysis, and mapping of cover change from 1972 to 1981.

Vegetation and land cover change maps were developed by sequential mapping. Five categories of cover were interpreted and delineated based on 1972 black and white imagery (scale 1:48,000) and 1981 color infrared positive transparency imagery (scale 1:48,000). The five mapping categories were: (1) aggregated vegetation cover (coniferous forest, tall deciduous forest, low deciduous forest, narrowleaf shrub, broadleaf shrub, and grassland); (2) agriculture; (3) development (including sand and gravel operations); (4) sand bar (including cobble, gravel and sand); and (5) water. Two sets of interim maps of 29 sheets each were prepared independently for 1972 and 1981 on ozalid base maps. Areas of the above five mapping categories were determined on each sheet by planimeter for 1981. The 1972 and 1981 interim maps were then superimposed on a light table

and change in the five mapping categories displayed on a third set of base maps. This set of 29 vegetation and land cover change maps appears in Appendix 1 matched with vegetation and land cover maps. Area of vegetation and land cover change from 1972-1981 was measured by planimeter.

The total Greenway area studied encompassed 12,813 acres with 5,505 acres in Benton County and 7,308 acres in Linn County. For both counties from 1972 to 1981, 726 acres of aggregated riparian vegetation was converted to agriculture and development. More than 60 percent of this loss was in Benton County. About 78 percent of the converted riparian vegetation area in both counties was encroached upon by agriculture; 370 acres in Benton County and 197 acres in Linn County being changed to agricultural use over the study period. A total 159 acres was altered by development most of which was sand and gravel operations.

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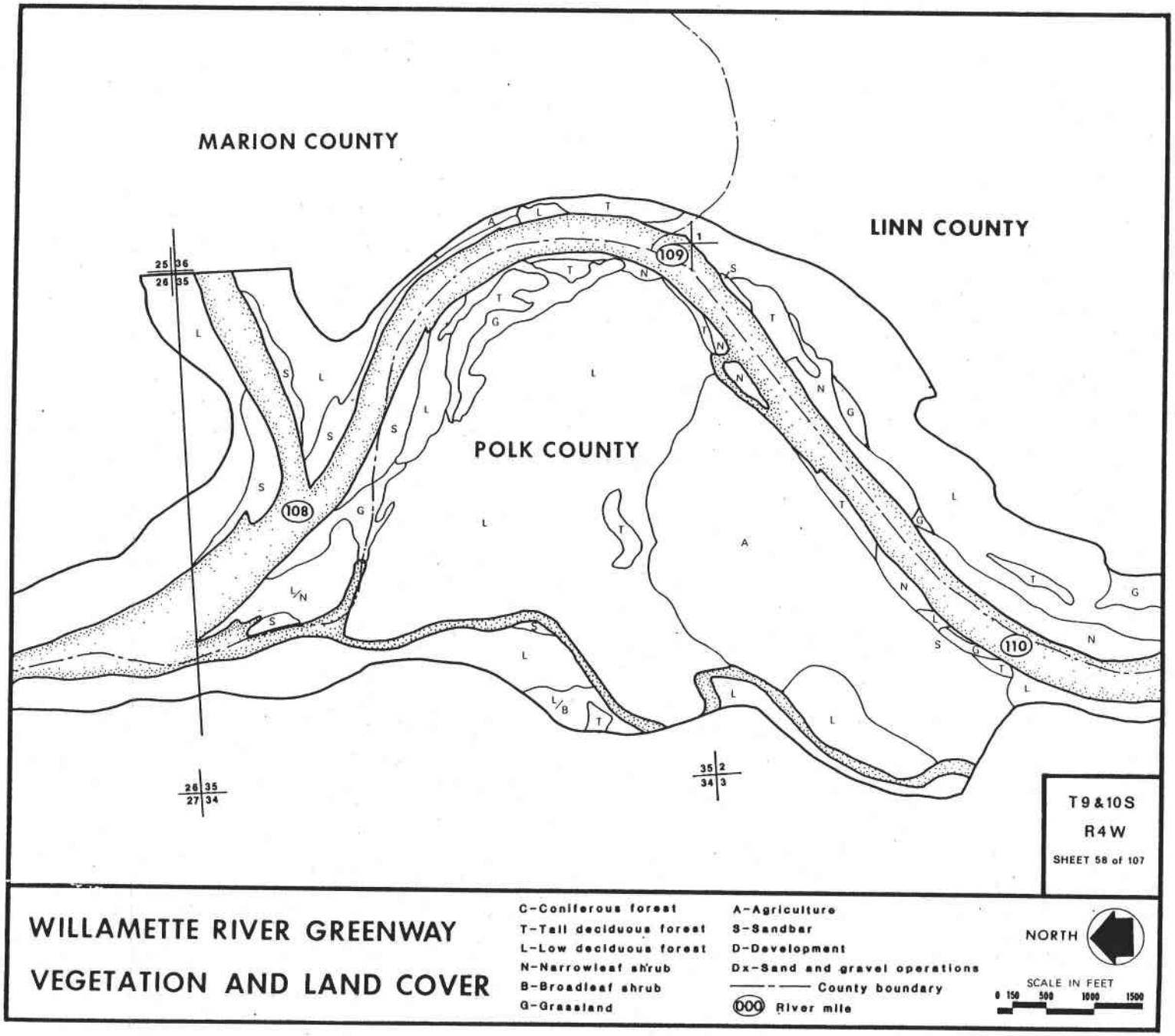
# APPENDIX 1

Willamette River Greenway Vegetation and Land Cover: 1976

and

Willamette River Greenway Vegetation Change: 1972-1981

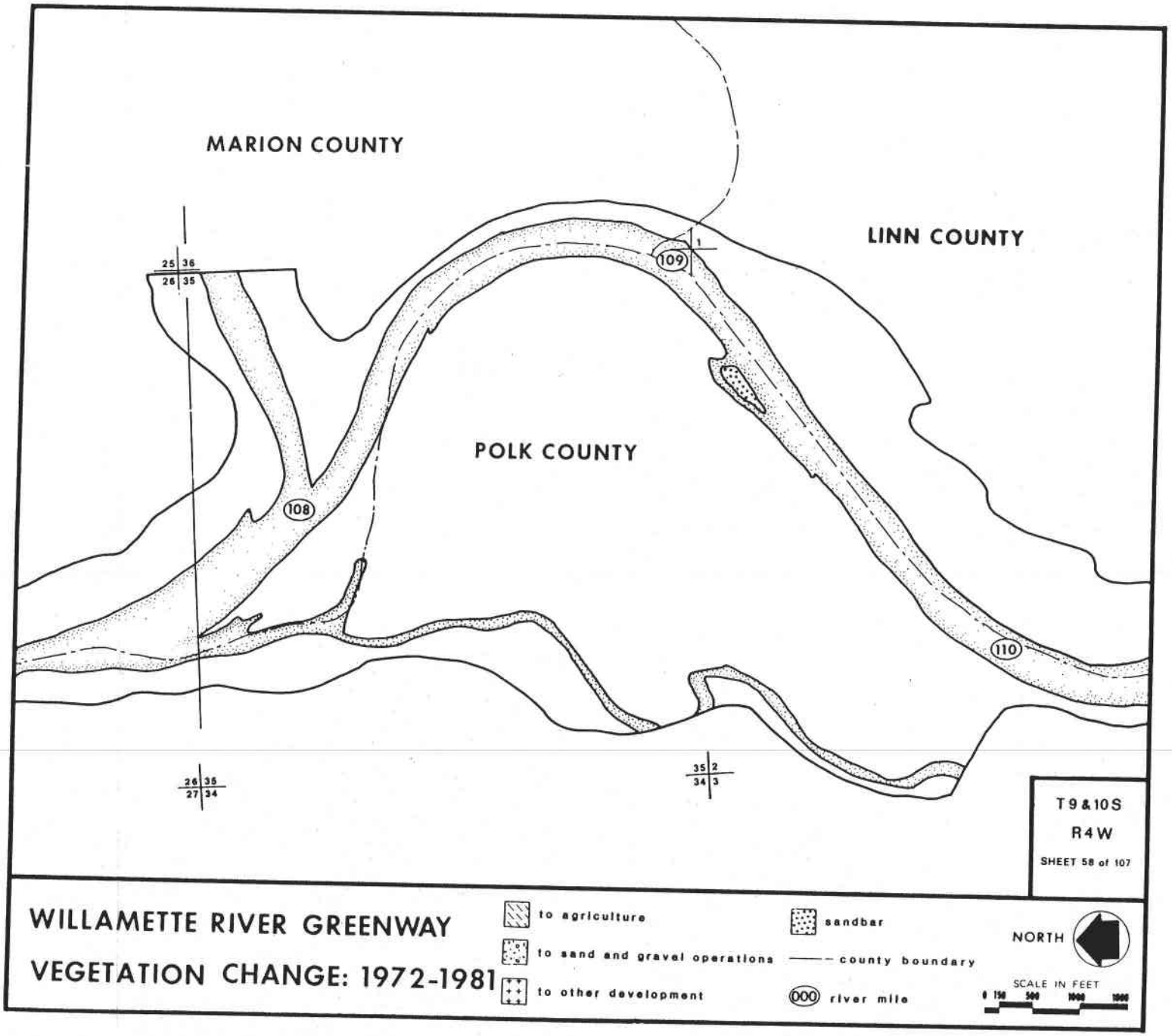
(A set of 29 map pairs)

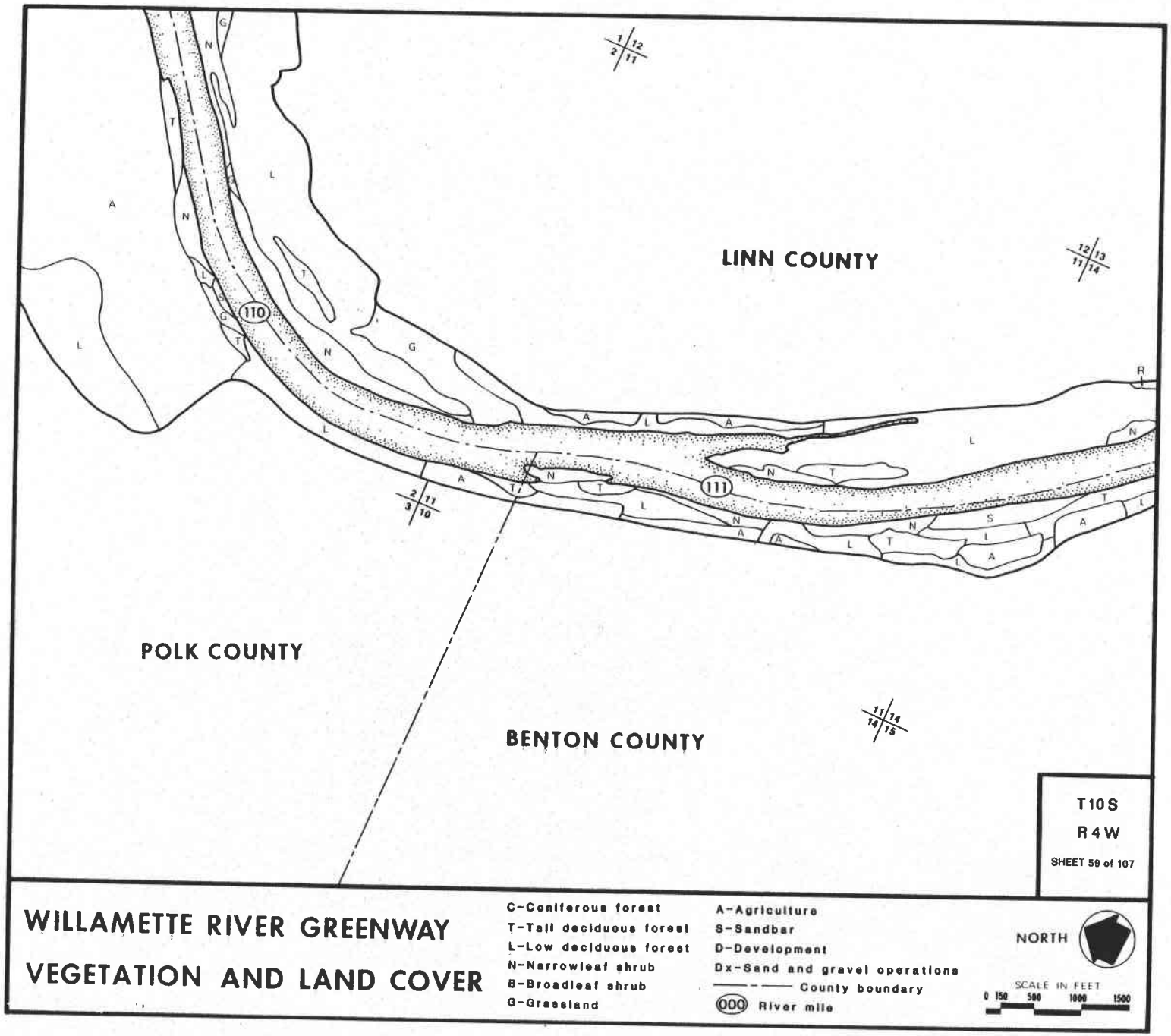



# WILLAMETTE RIVER GREENWAY VEGETATION AND LAND COVER

C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland

A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile


MARION COUNTY
LINN COUNTY
POLK COUNTY
25 36
26 35
108
109
110
1
26 35
27 34
35 2
34 3
T9&10S
R4W
SHEET 58 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET

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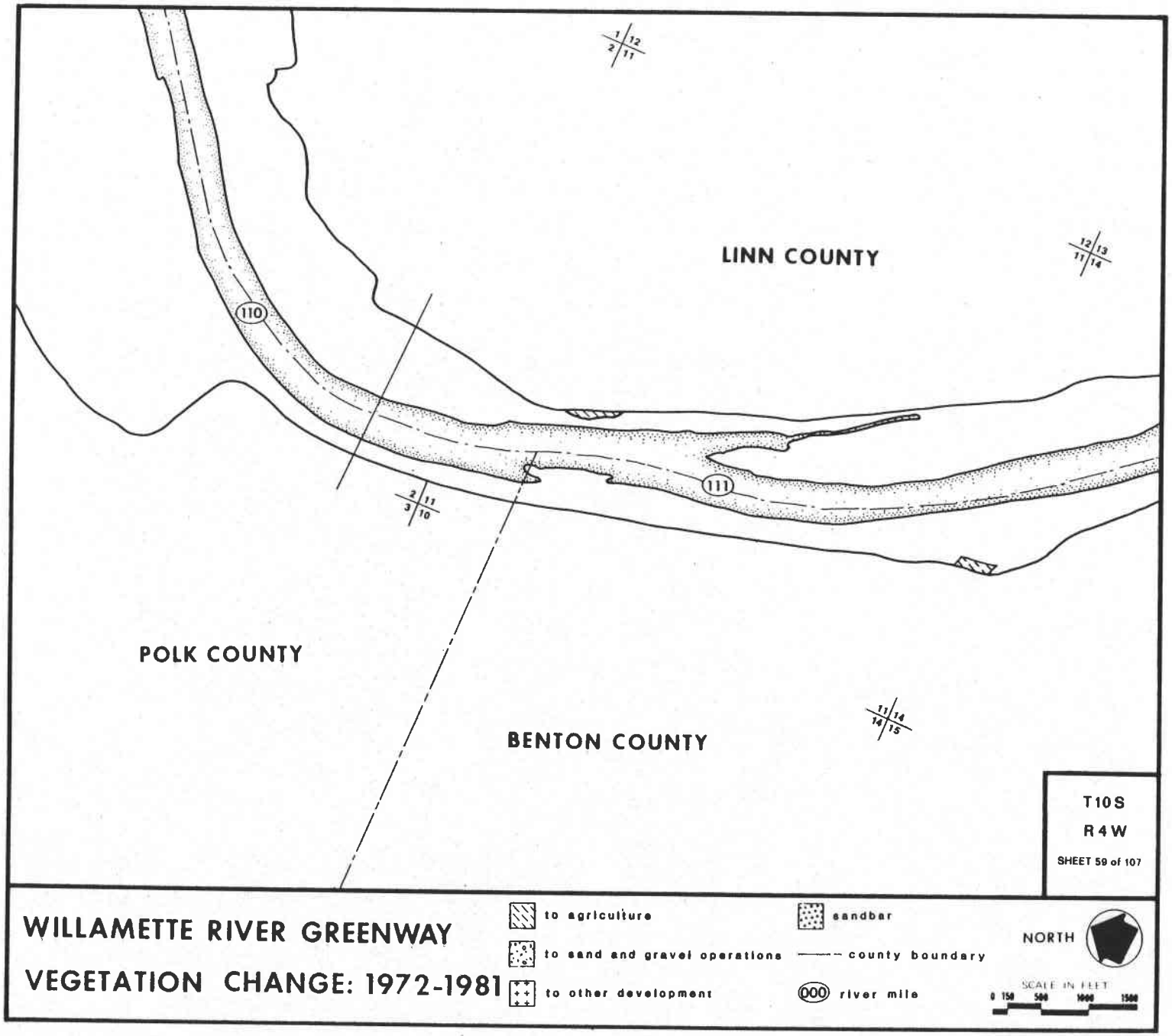
County boundary
(000) River mile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BENTON COUNTY
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R4W
SHEET 59 of 107
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to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
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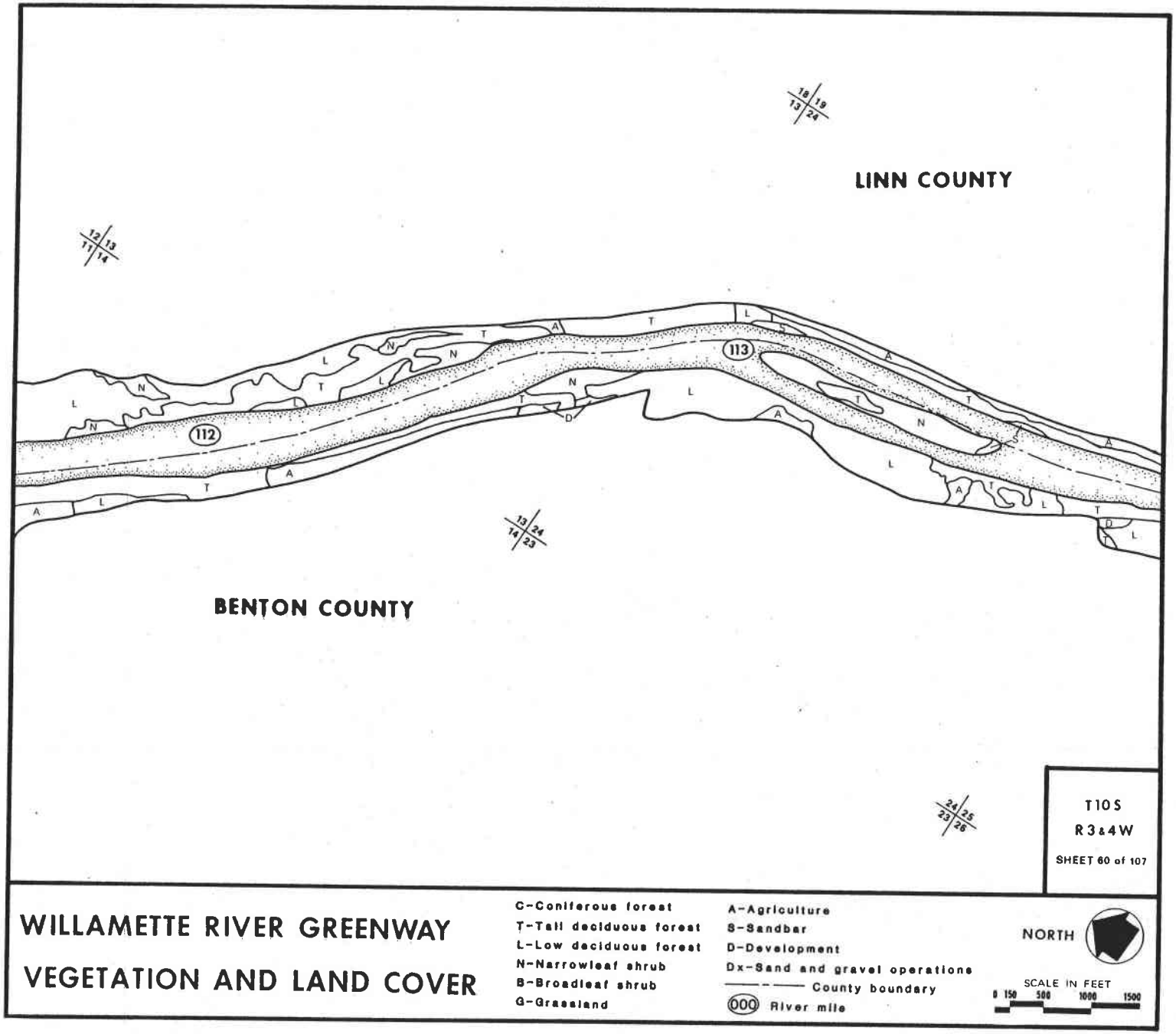
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SHEET 60 of 107
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C-Coniferous forest
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County boundary
River mile
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SCALE IN FEET
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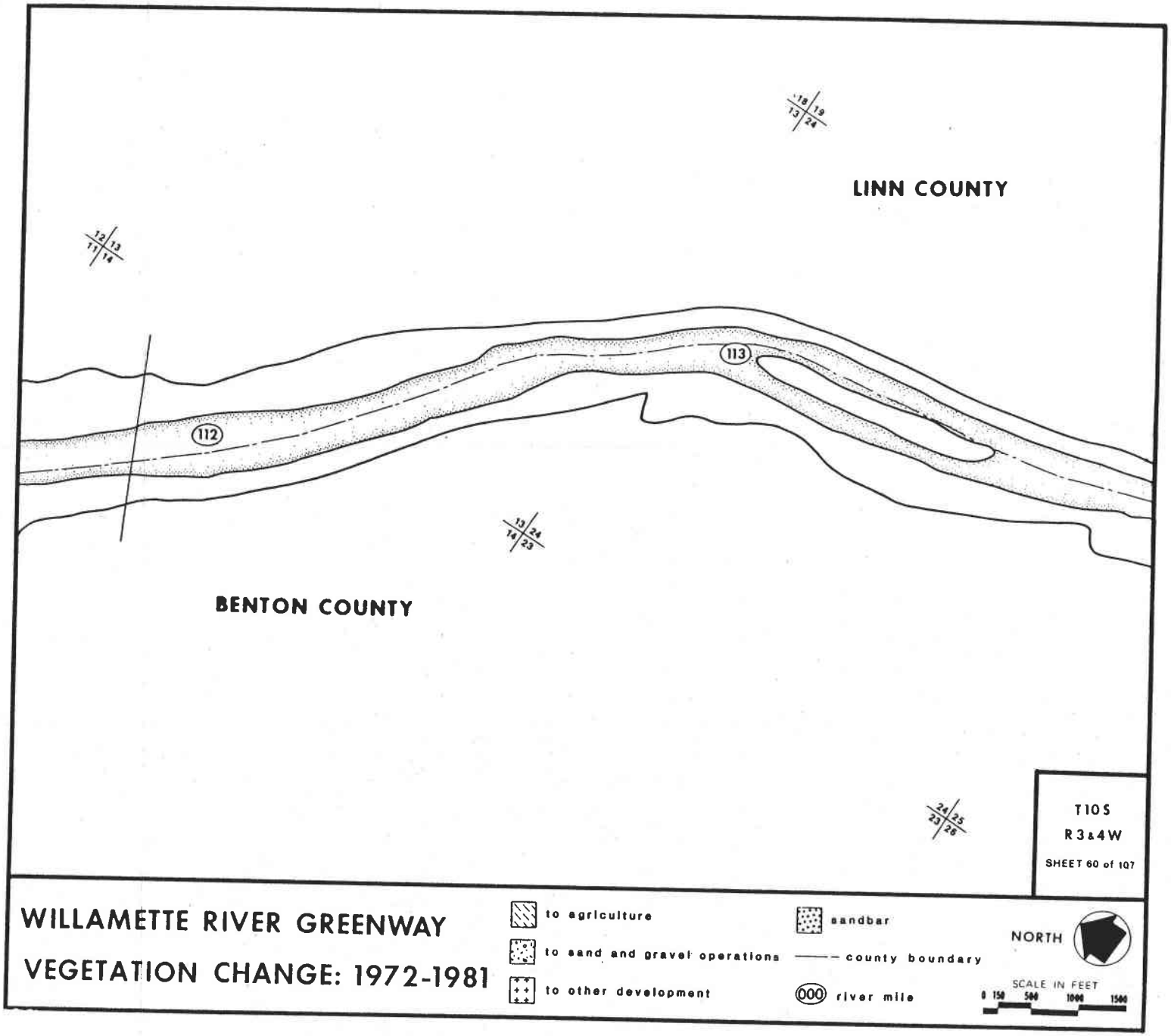
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SHEET 60 of 107
WILLAMETTE RIVER GREENWAY
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to agriculture
to sand and gravel operations
to other development
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county boundary
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SCALE IN FEET
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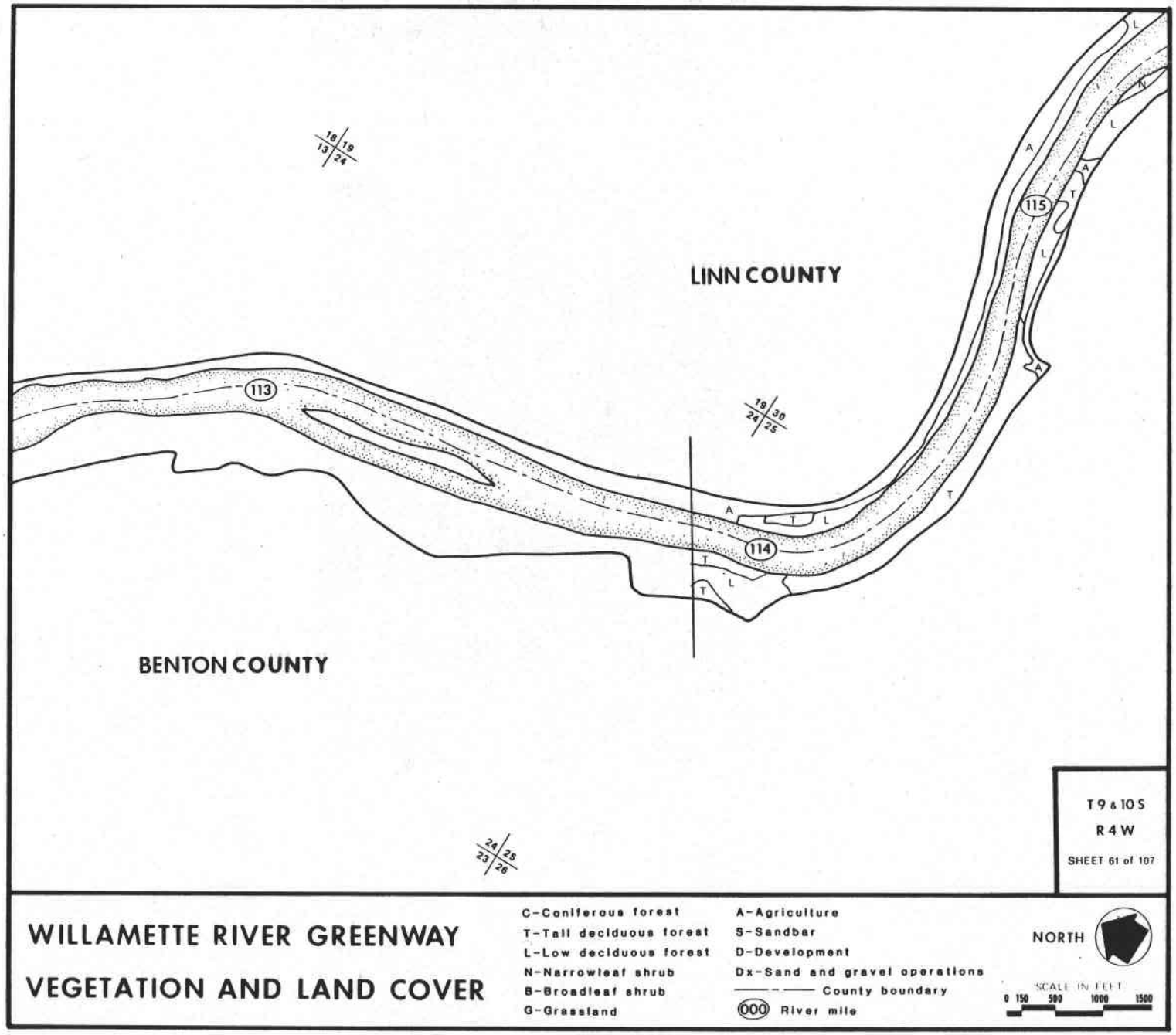


# WILLAMETTE RIVER GREENWAY
# VEGETATION AND LAND COVER

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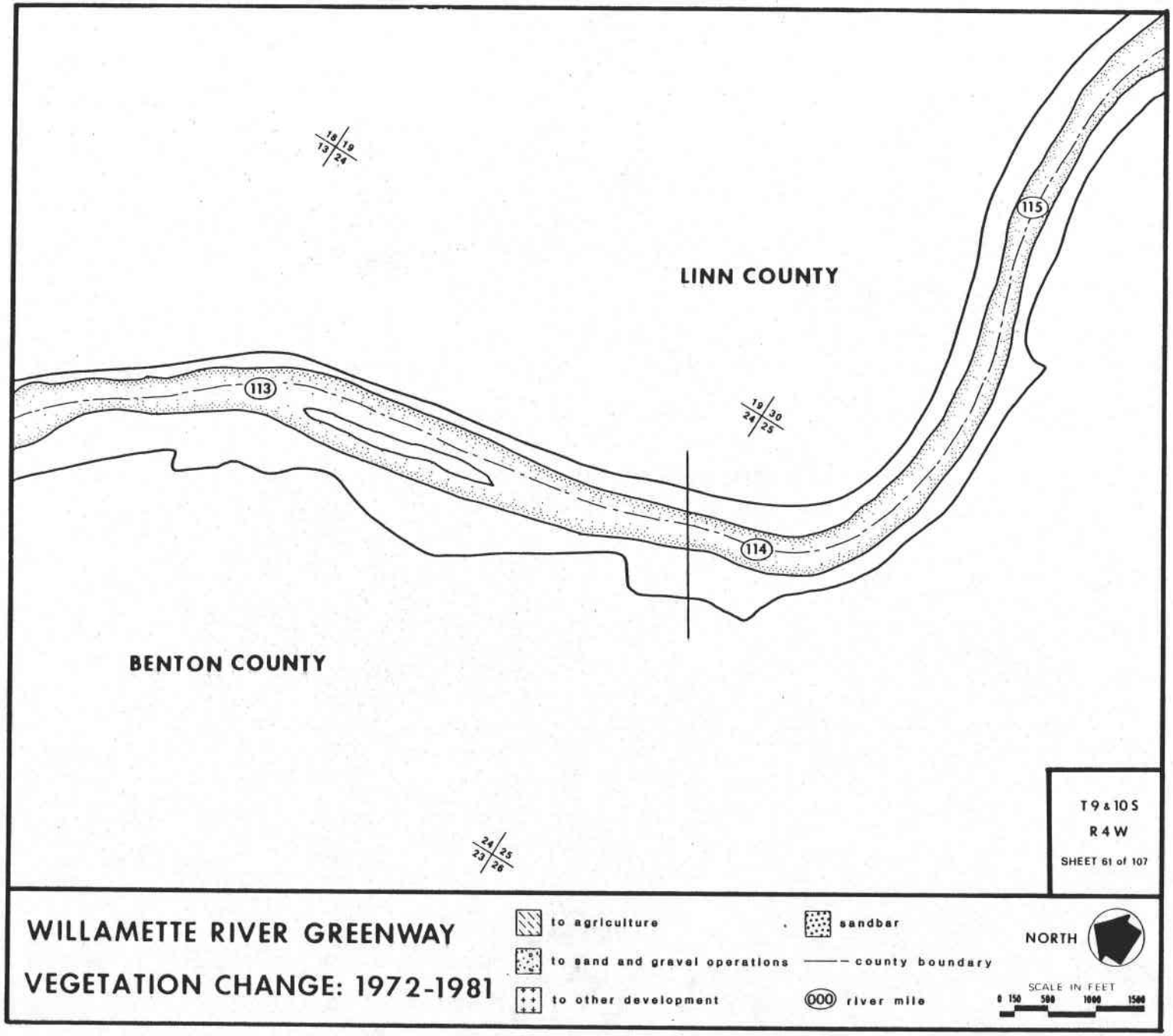
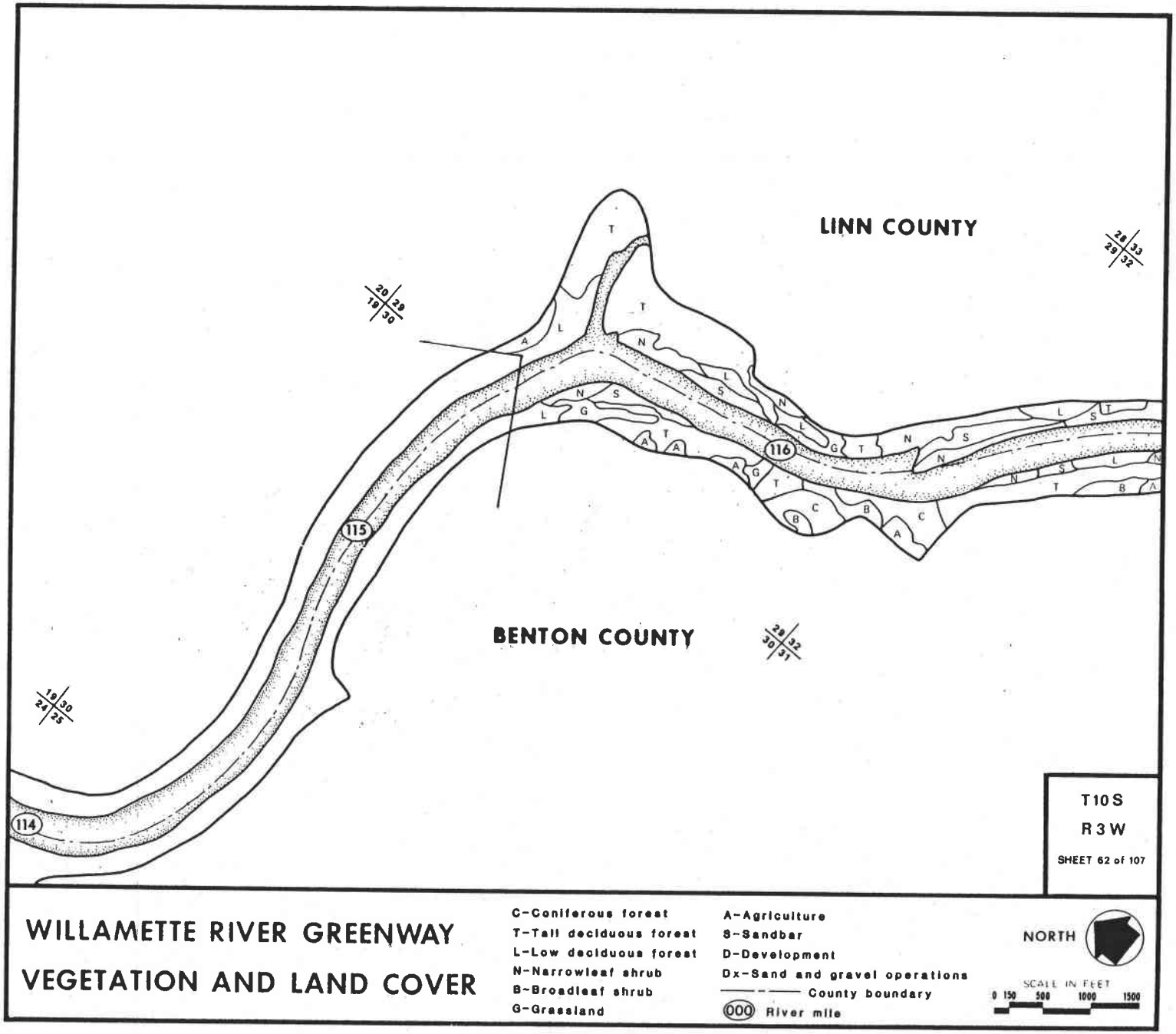
County boundary
(000) River mile


LINN COUNTY
BENTON COUNTY
113
114
115
18 19 13 24
19 30 24 25
24 25 23 26
T9 & 10 S
R 4 W
SHEET 61 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500



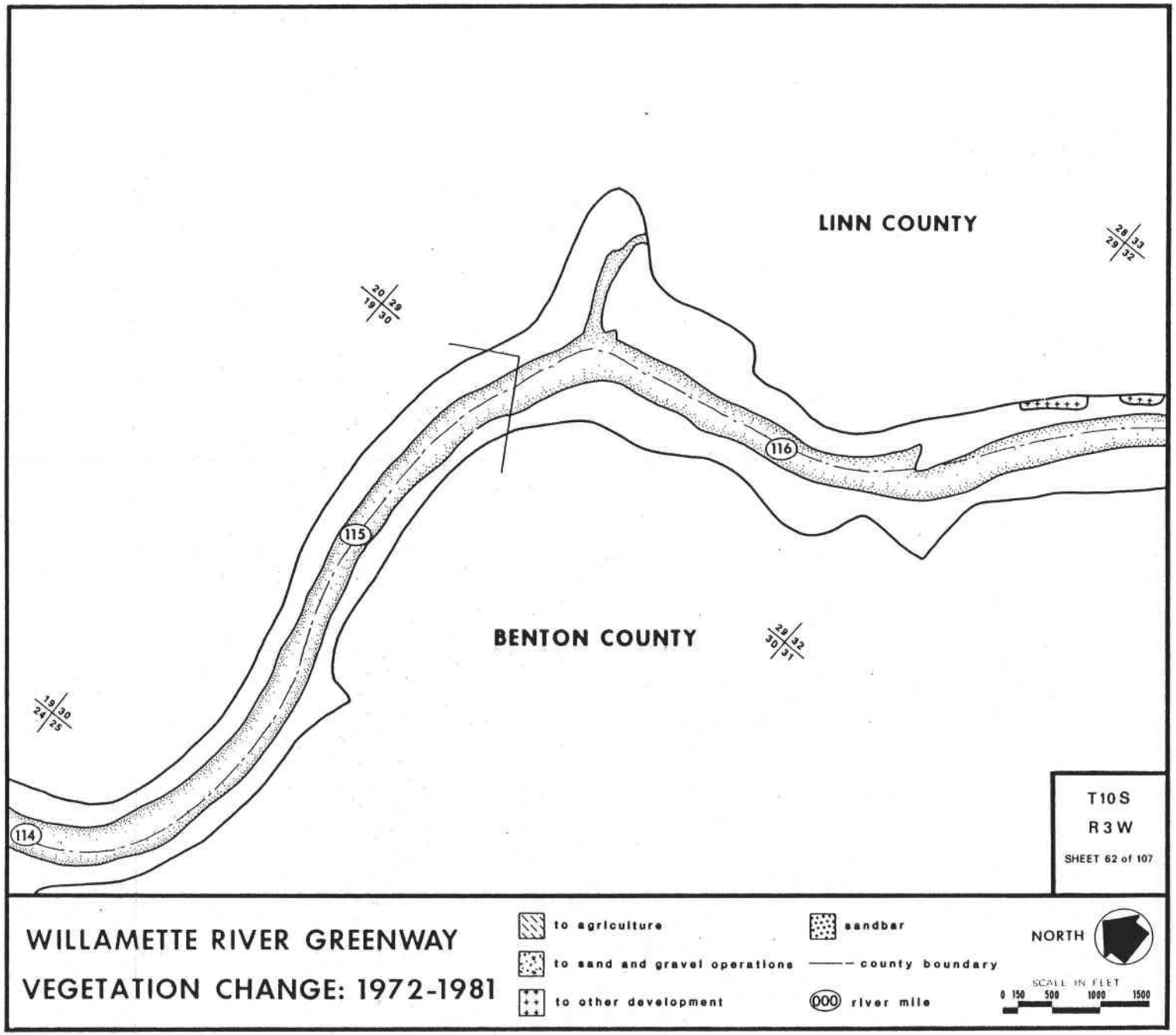

# WILLAMETTE RIVER GREENWAY
# VEGETATION AND LAND COVER

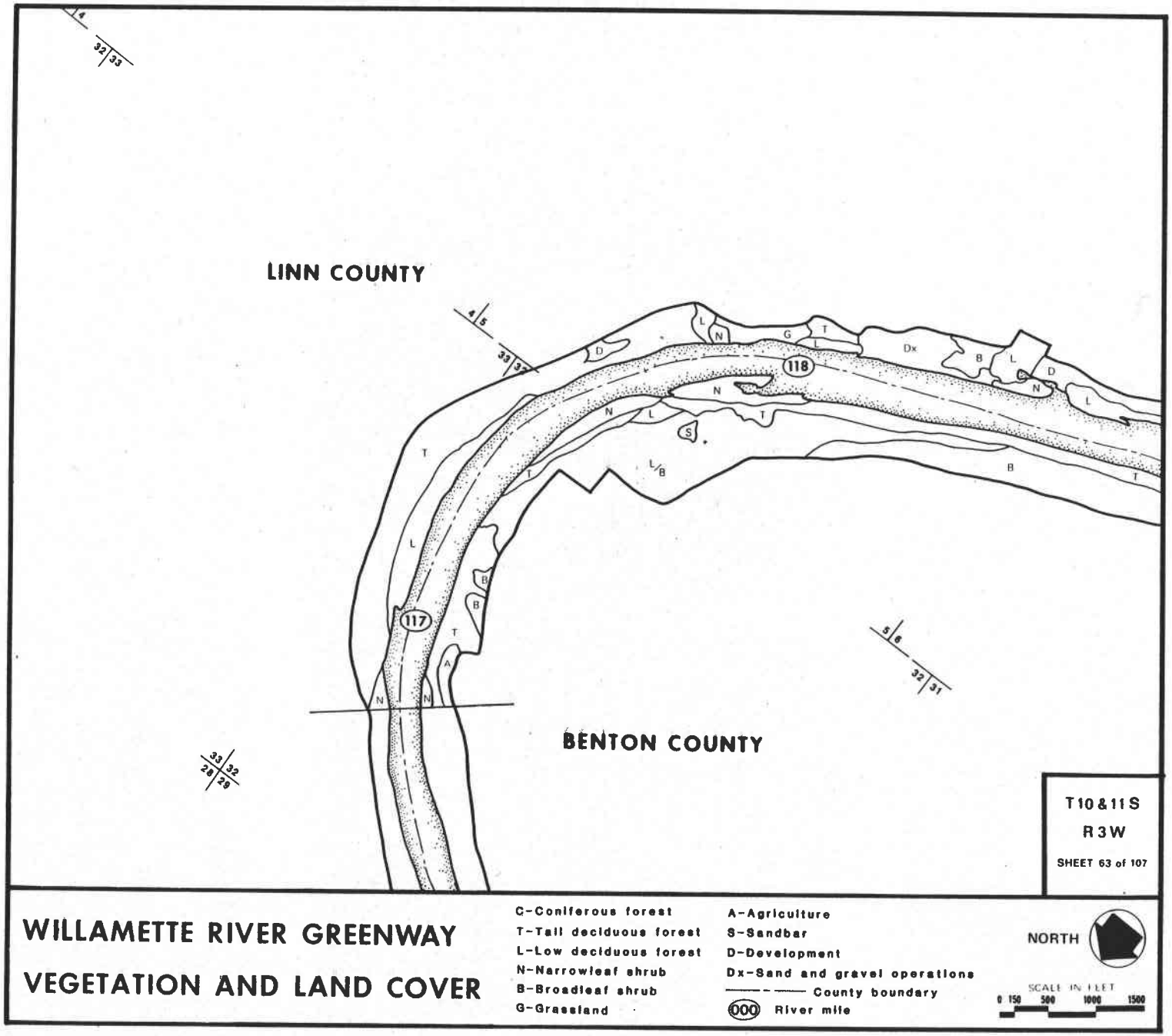
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland

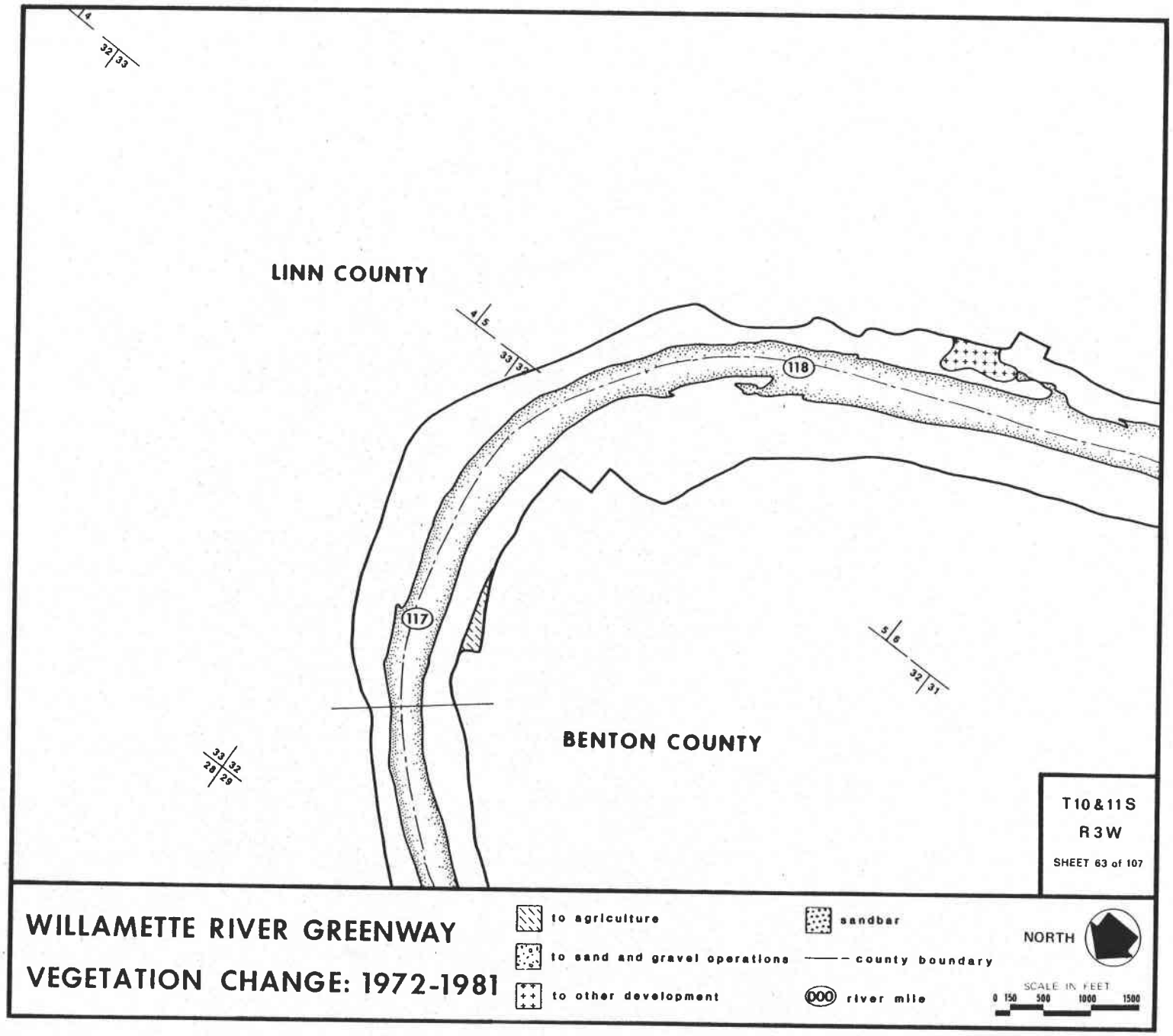
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile

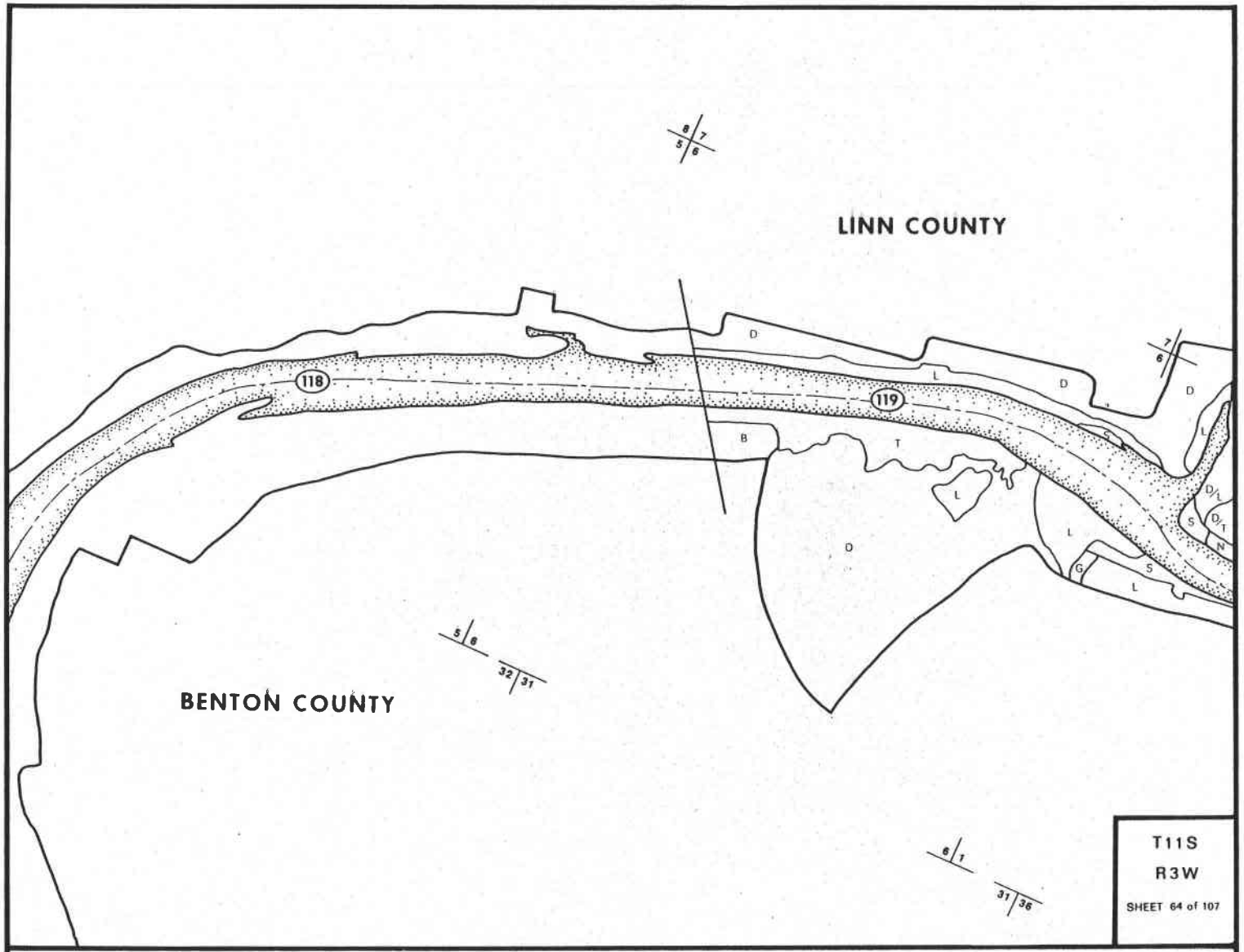
NORTH

SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
116
115
114
T10S
R3W
SHEET 62 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
118
117
T10&11S
R3W
SHEET 63 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
118
117
T10&11S
R3W
SHEET 63 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




# WILLAMETTE RIVER GREENWAY
# VEGETATION AND LAND COVER

C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
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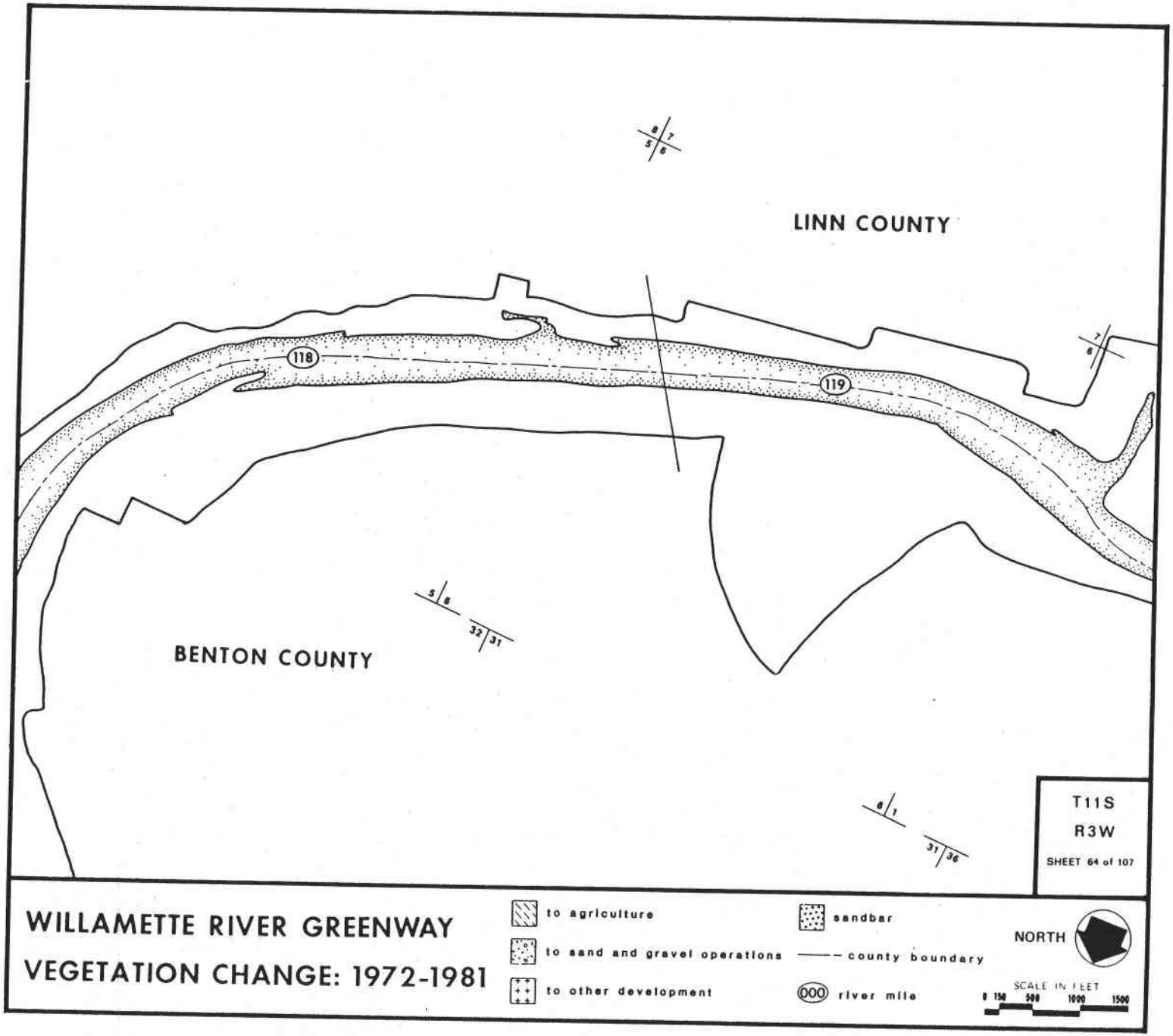
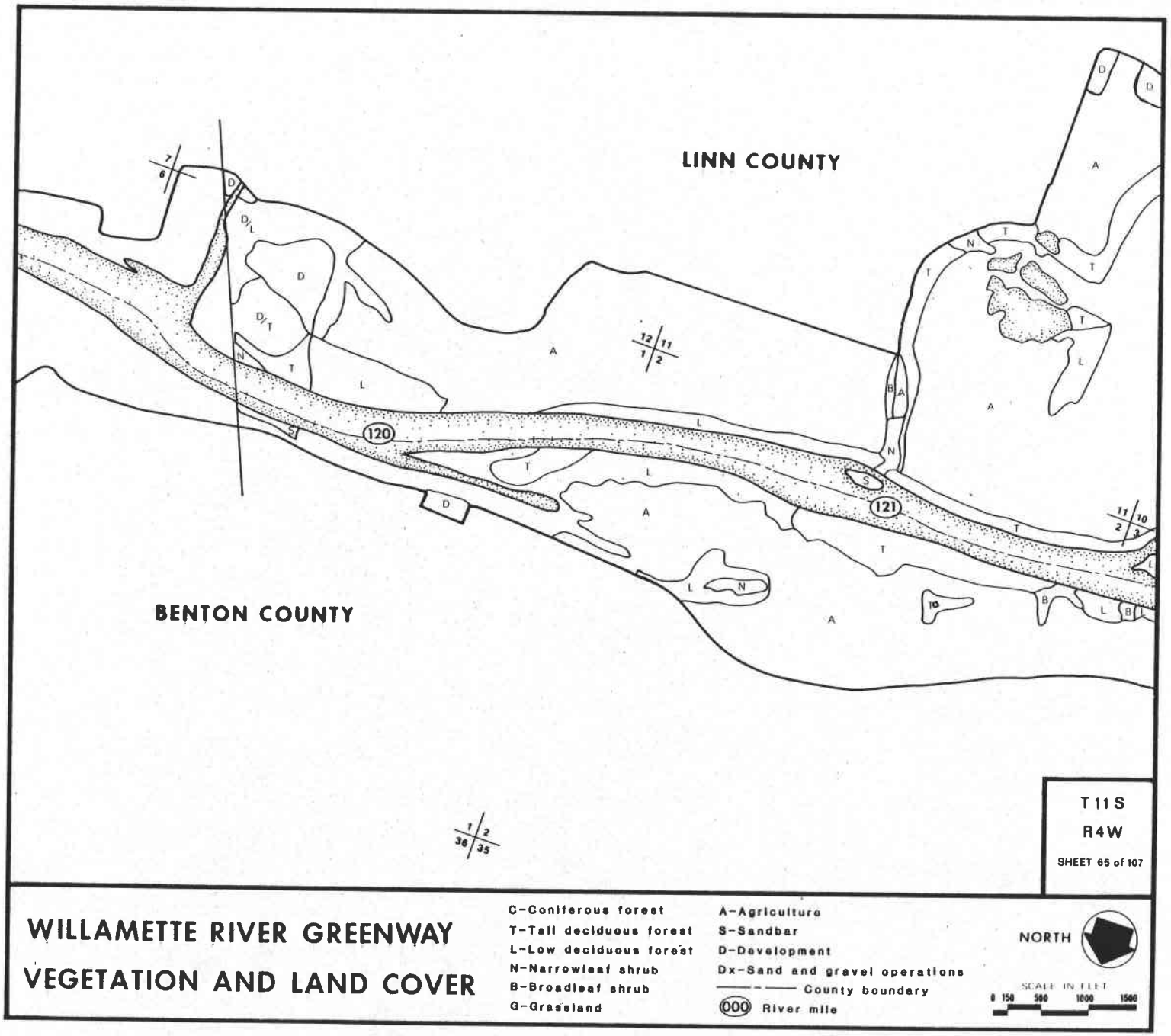
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile

NORTH

SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
118
119
T11S
R3W
SHEET 64 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




# WILLAMETTE RIVER GREENWAY VEGETATION AND LAND COVER

C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
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B-Broadleaf shrub
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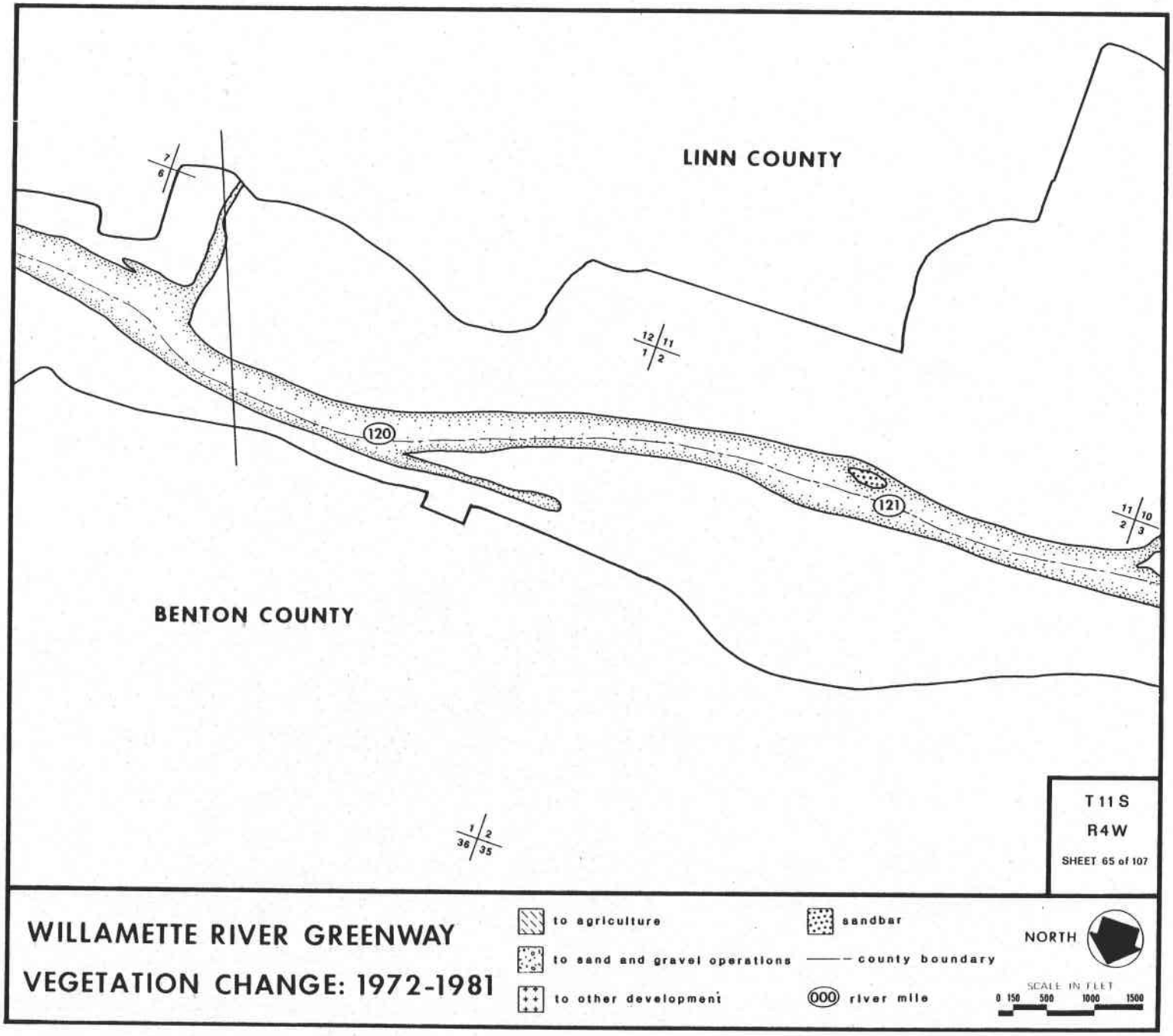
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile


LINN COUNTY
BENTON COUNTY
120
121
7
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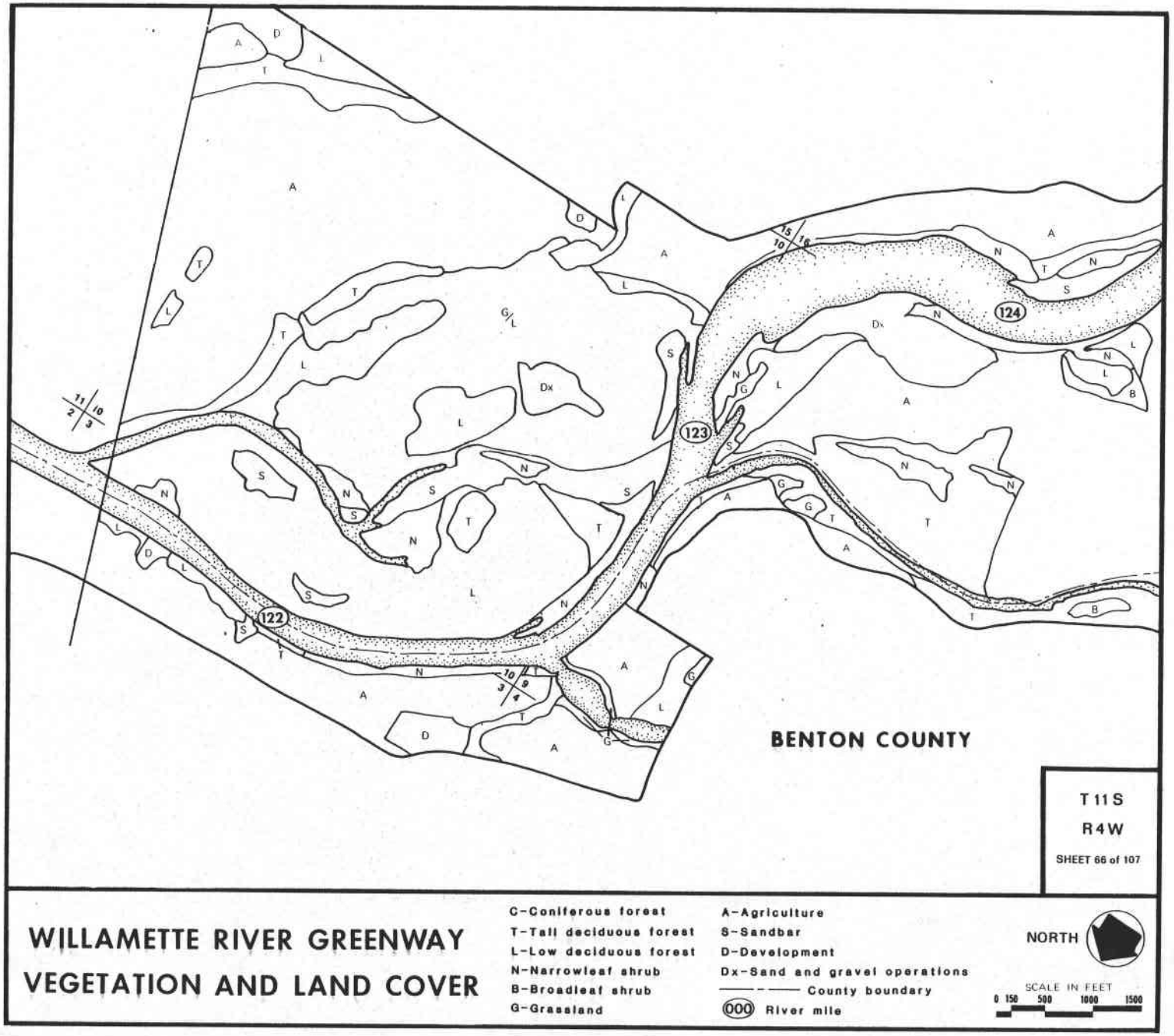
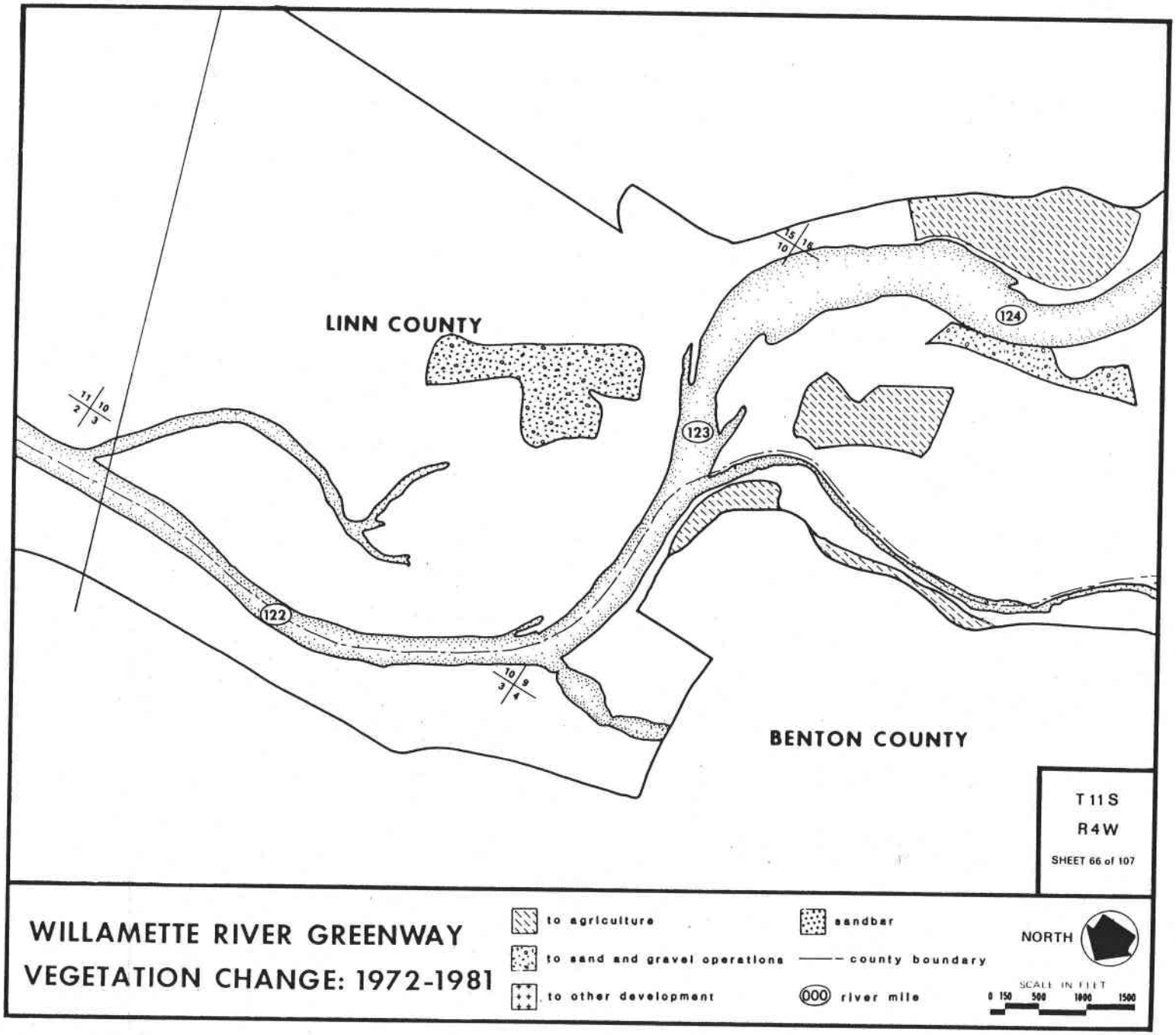
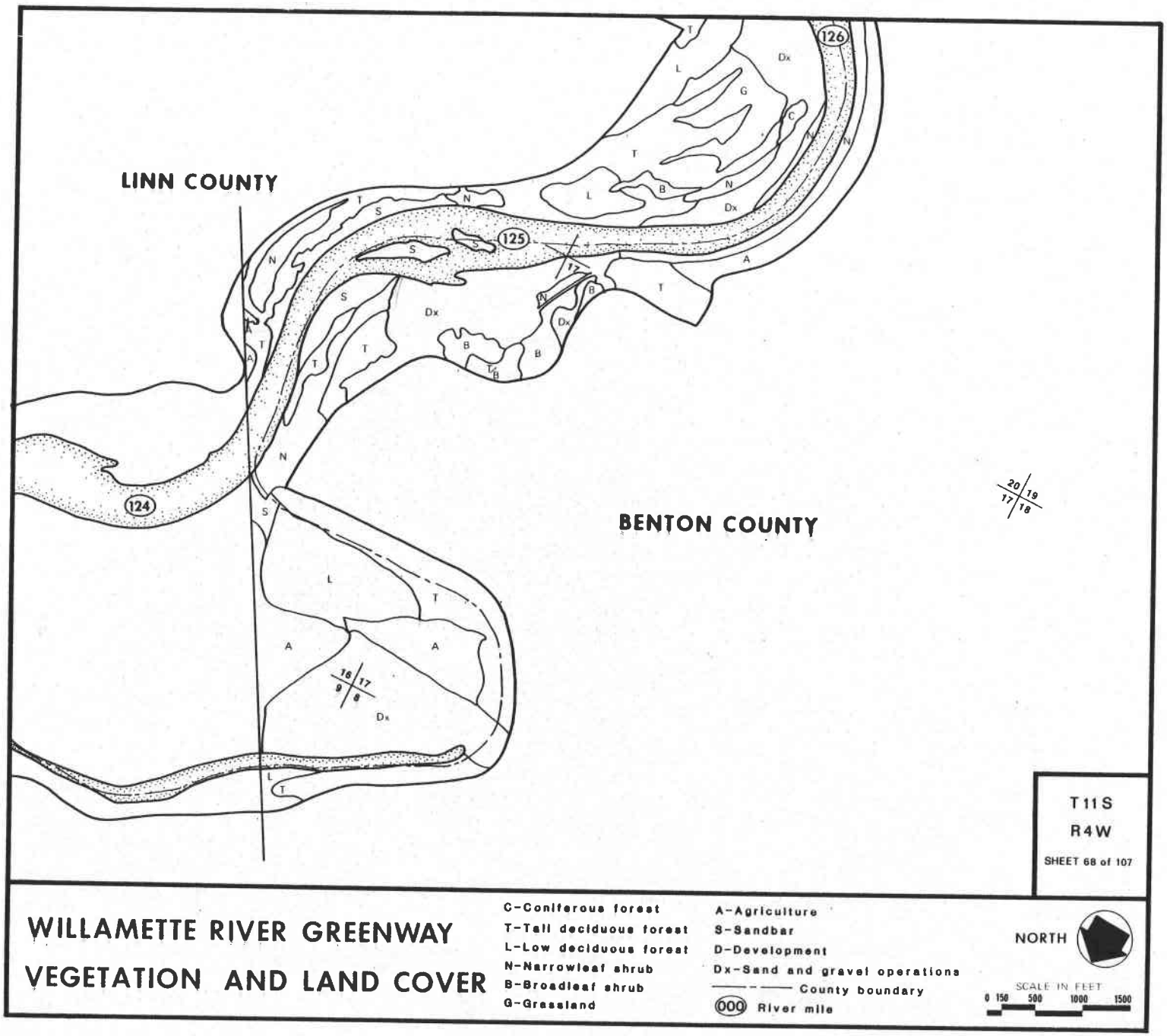
2
36
35
T 11 S
R 4 W
SHEET 65 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

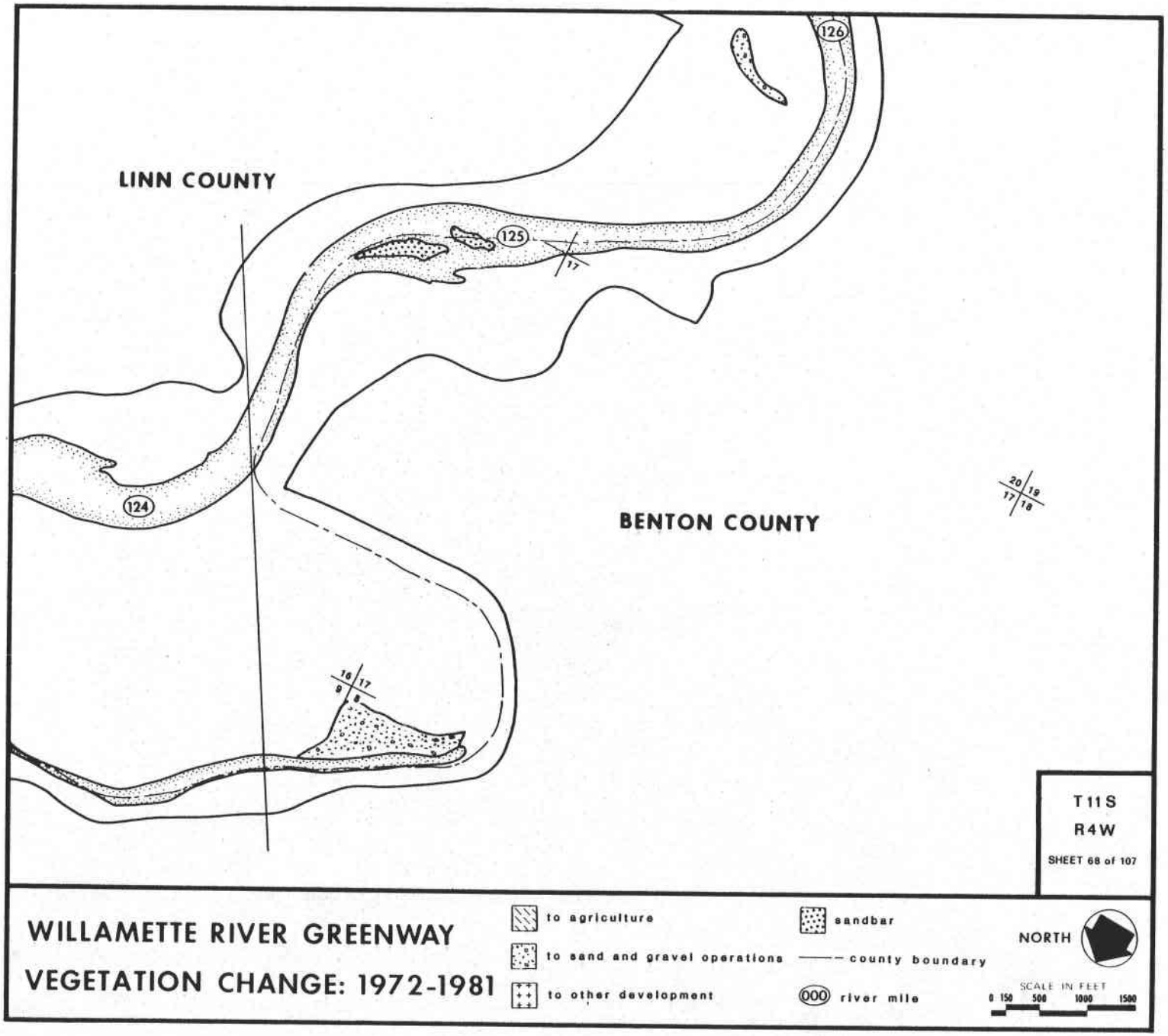



# WILLAMETTE RIVER GREENWAY VEGETATION AND LAND COVER


LINN COUNTY
BENTON COUNTY
122
123
124
T 11 S
R 4 W
SHEET 66 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER


LINN COUNTY
BENTON COUNTY
126
125
124
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18
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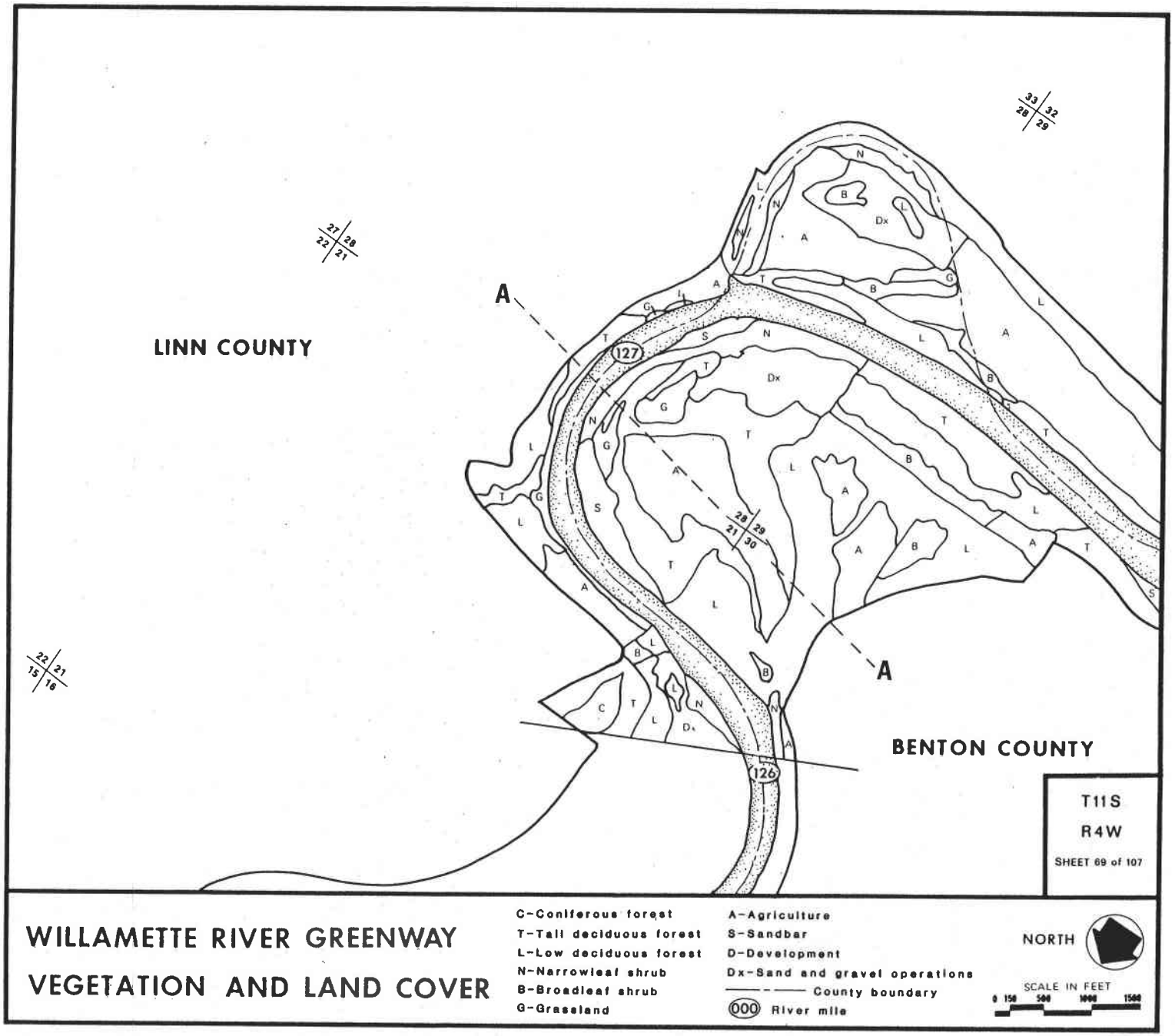
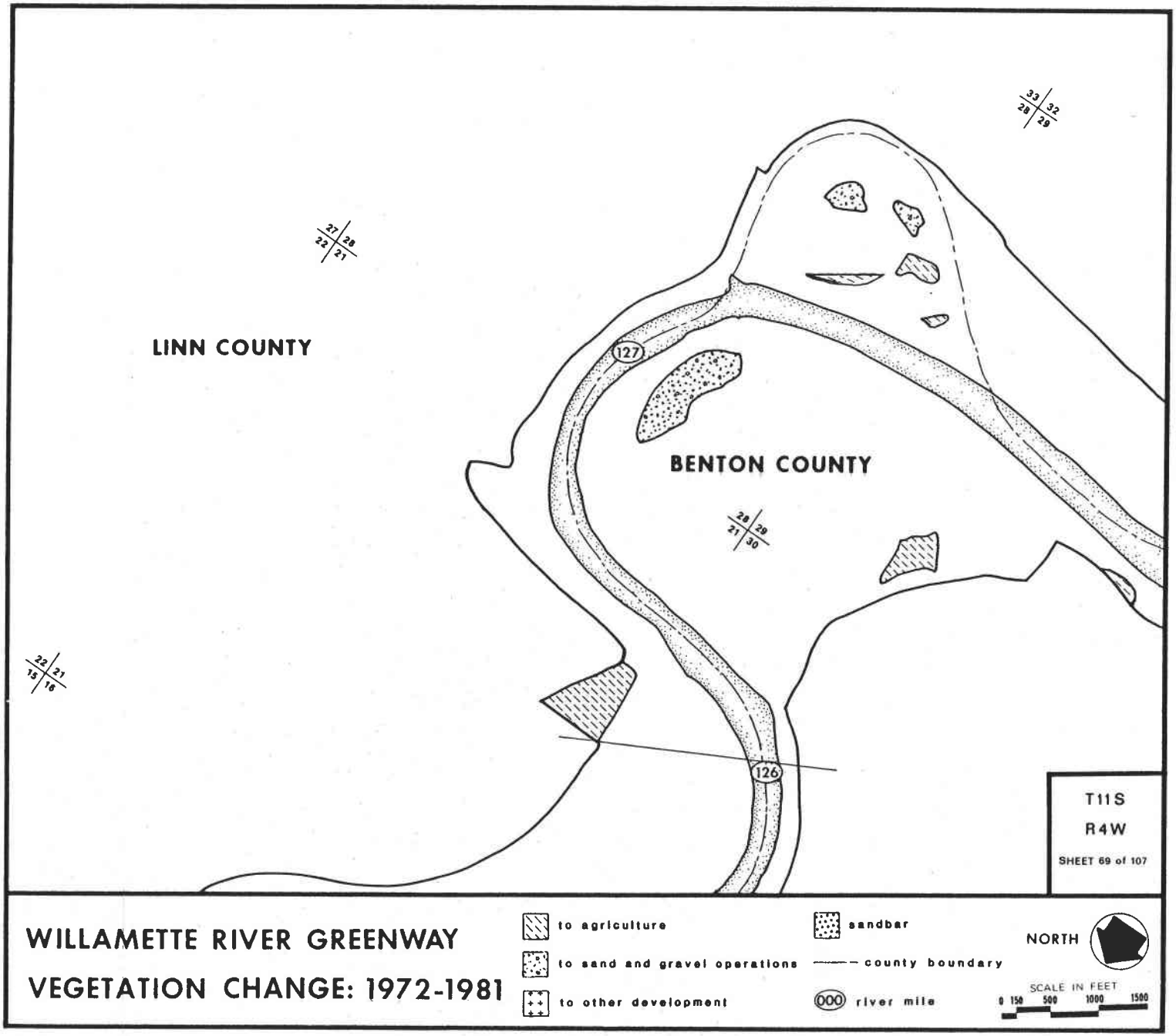
8
T11S
R4W
SHEET 68 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

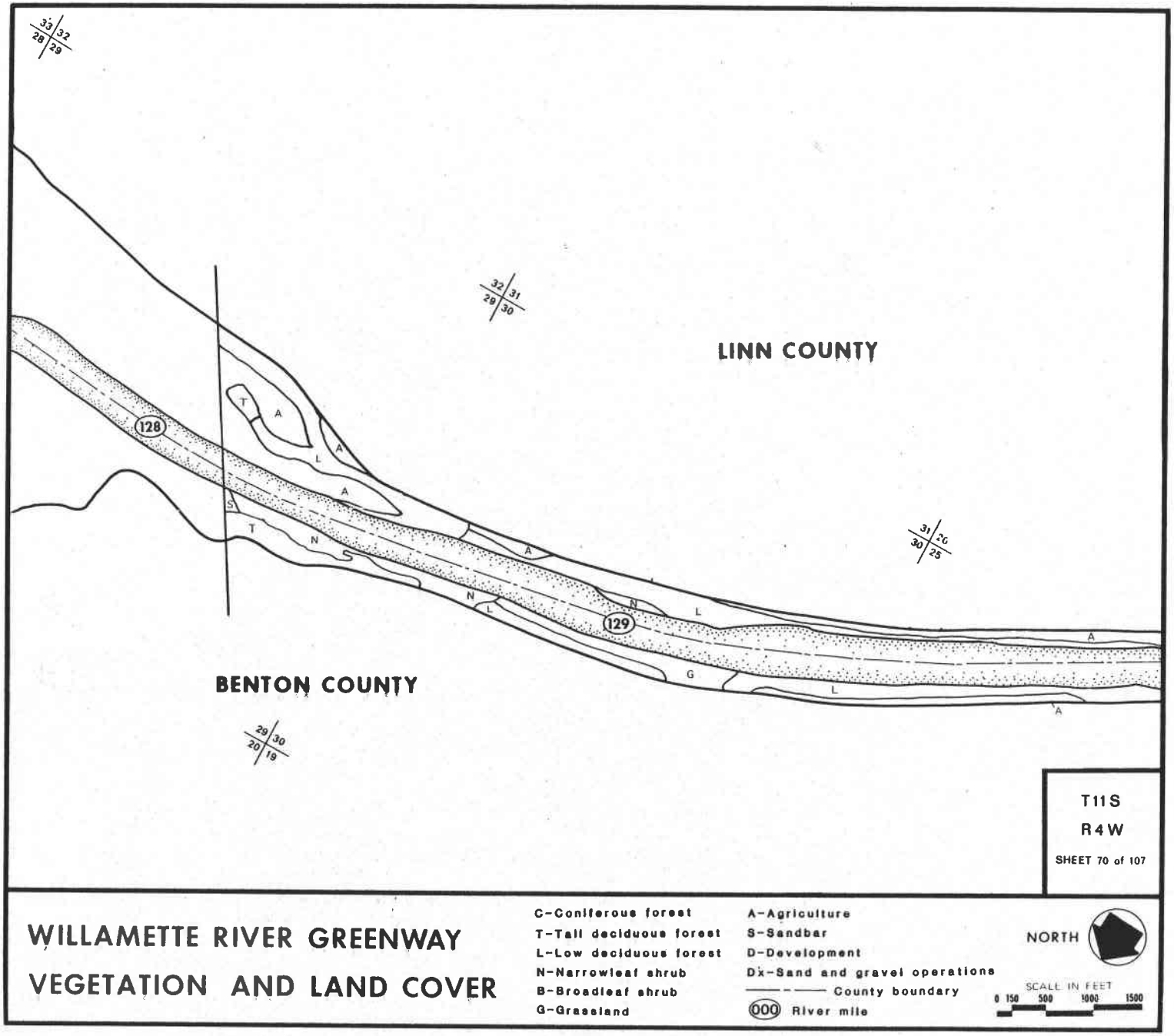



# WILLAMETTE RIVER GREENWAY VEGETATION AND LAND COVER

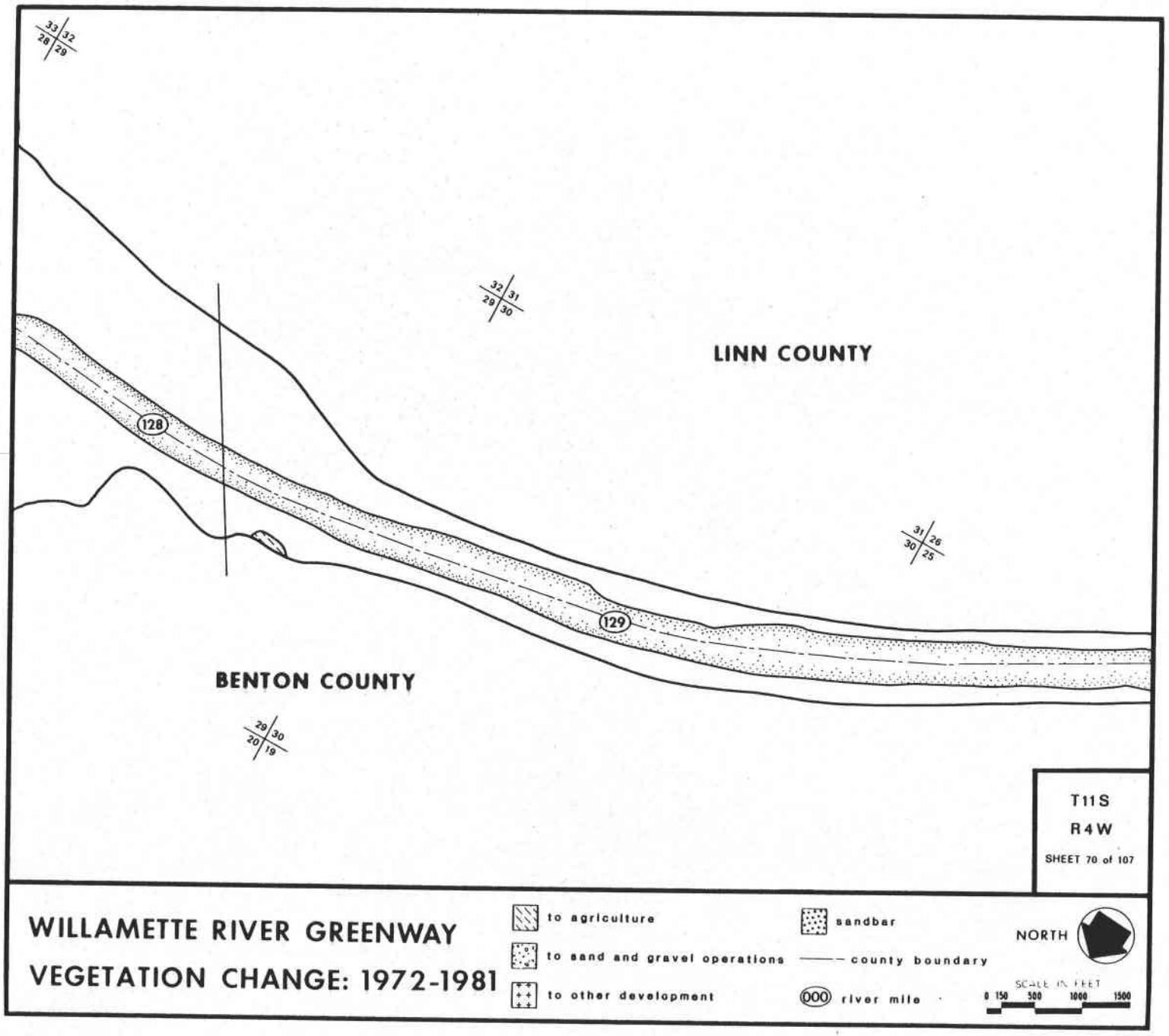
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland

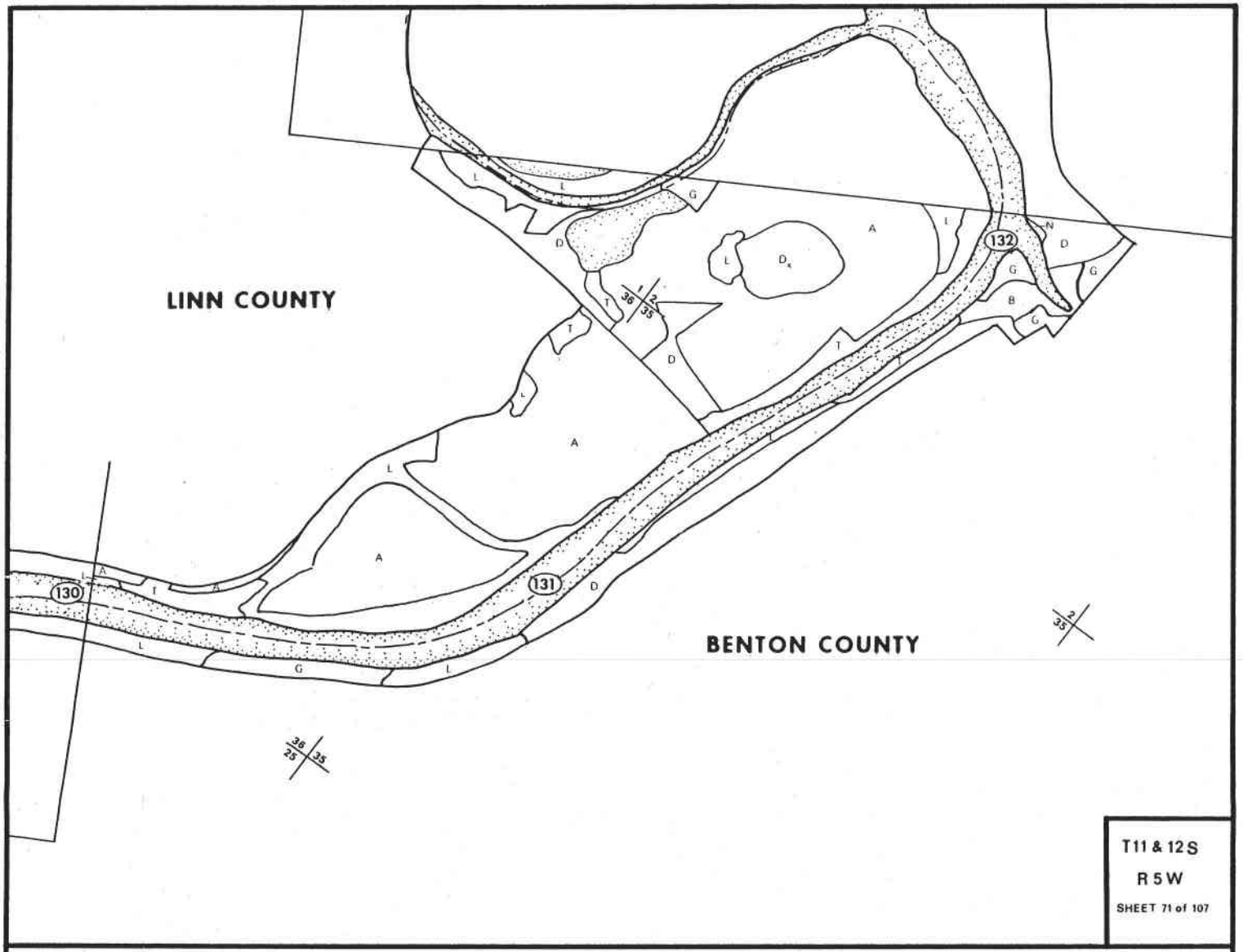
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile


LINN COUNTY
BENTON COUNTY
127
126
T11S
R4W
SHEET 69 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER


33 32
28 29
32 31
29 30
LINN COUNTY
128
31 26
30 25
129
BENTON COUNTY
29 30
20 19
T11S
R4W
SHEET 70 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500



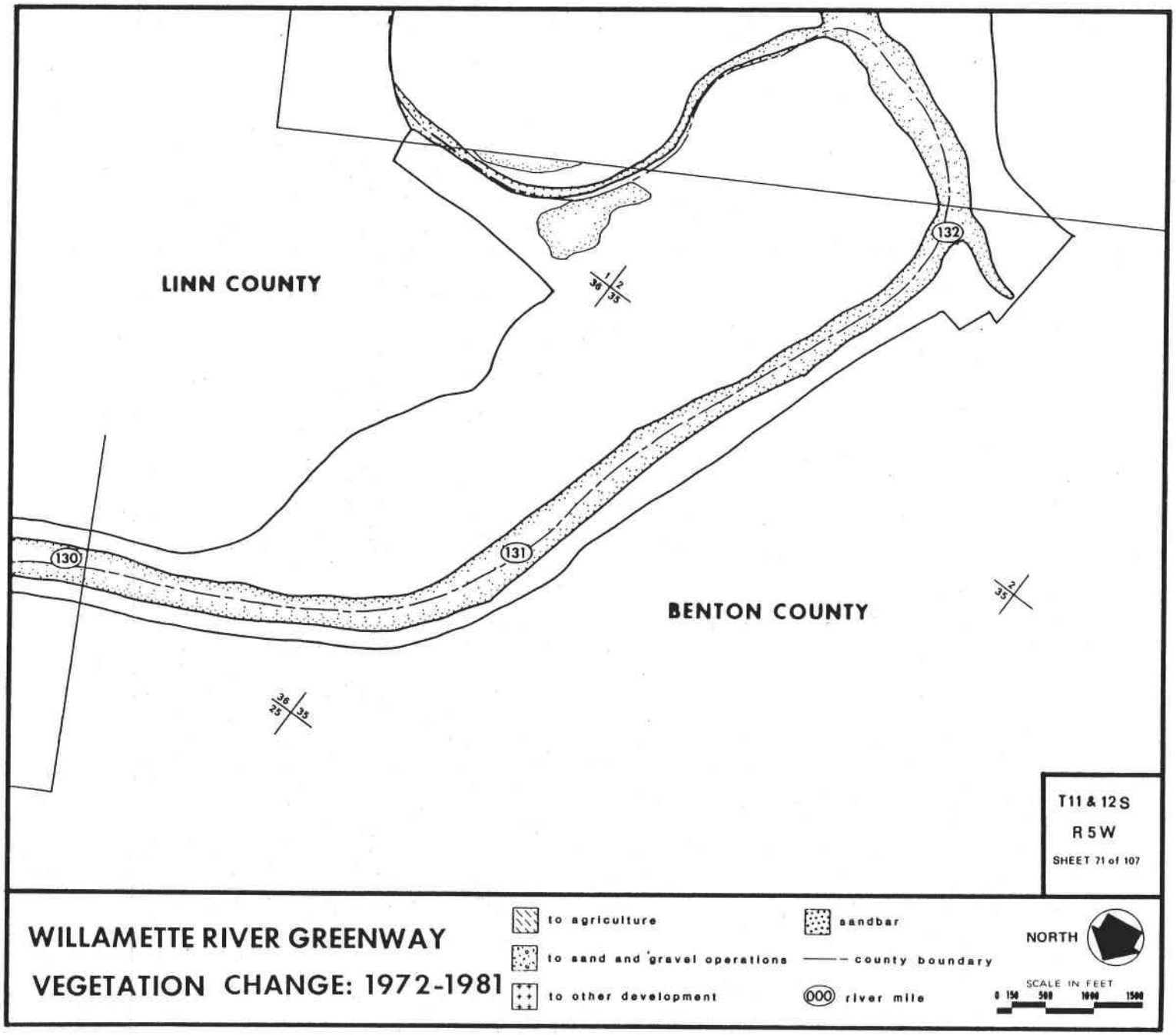

# WILLAMETTE RIVER GREENWAY
# VEGETATION AND LAND COVER

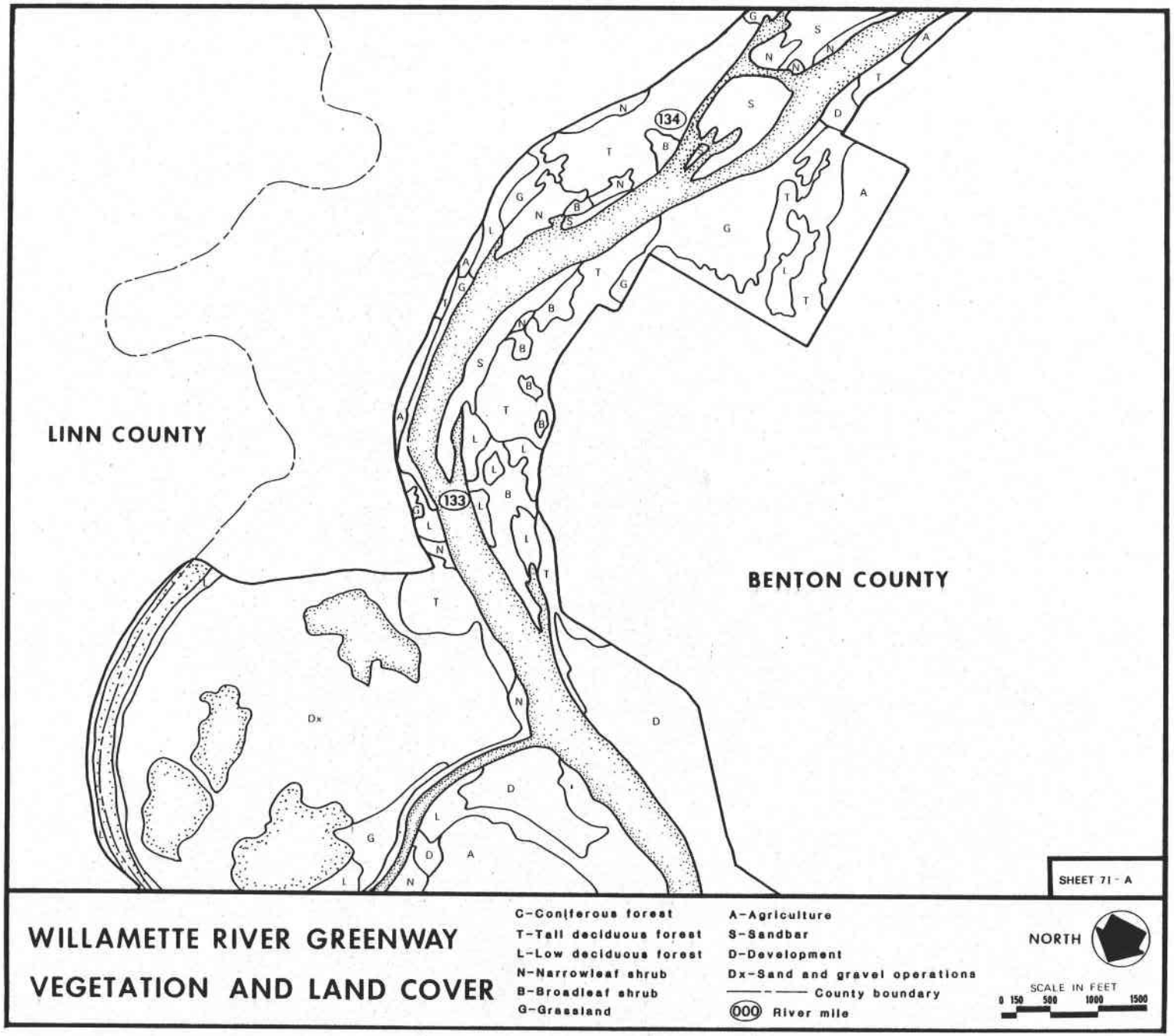
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland

A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile

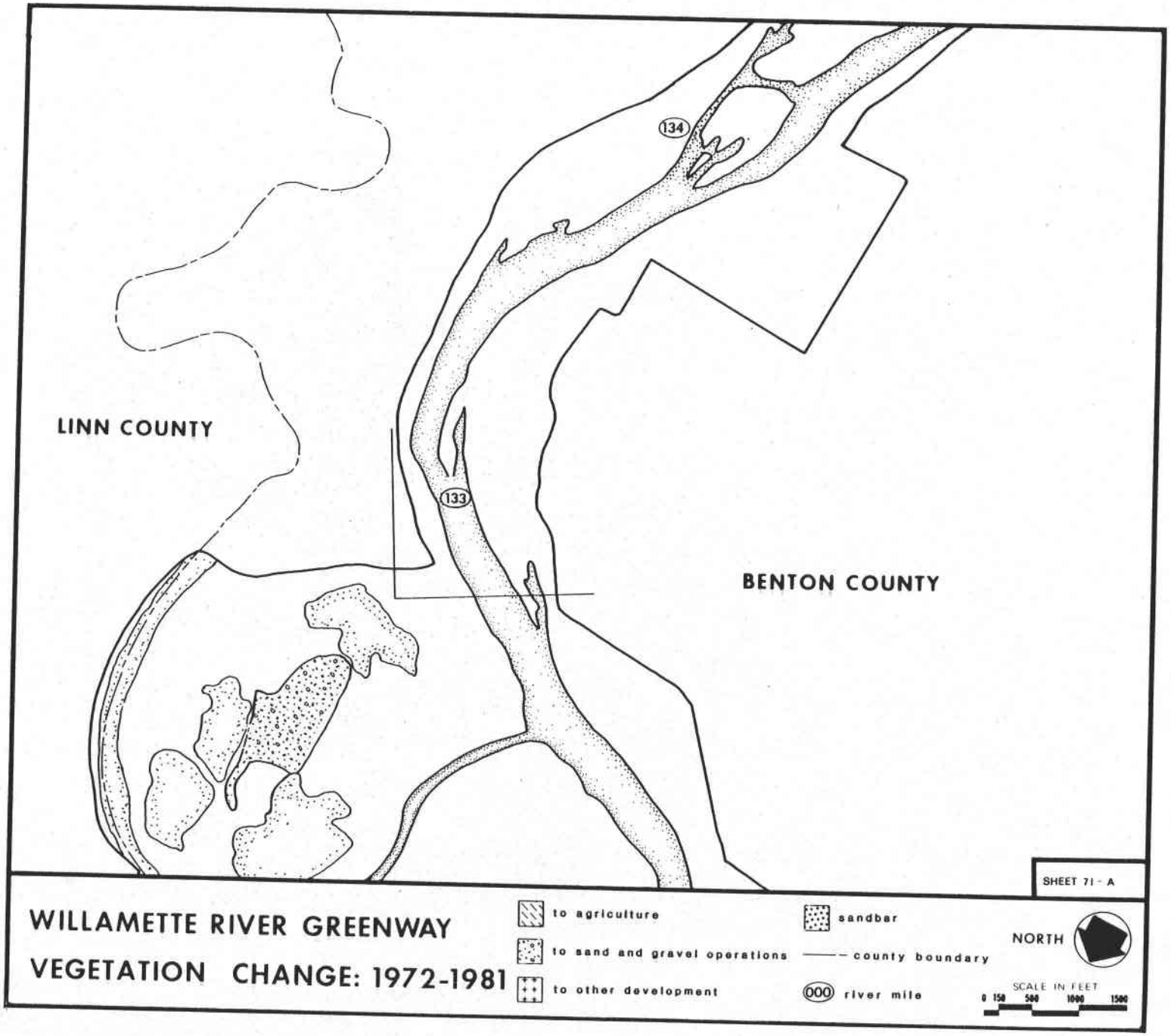
NORTH

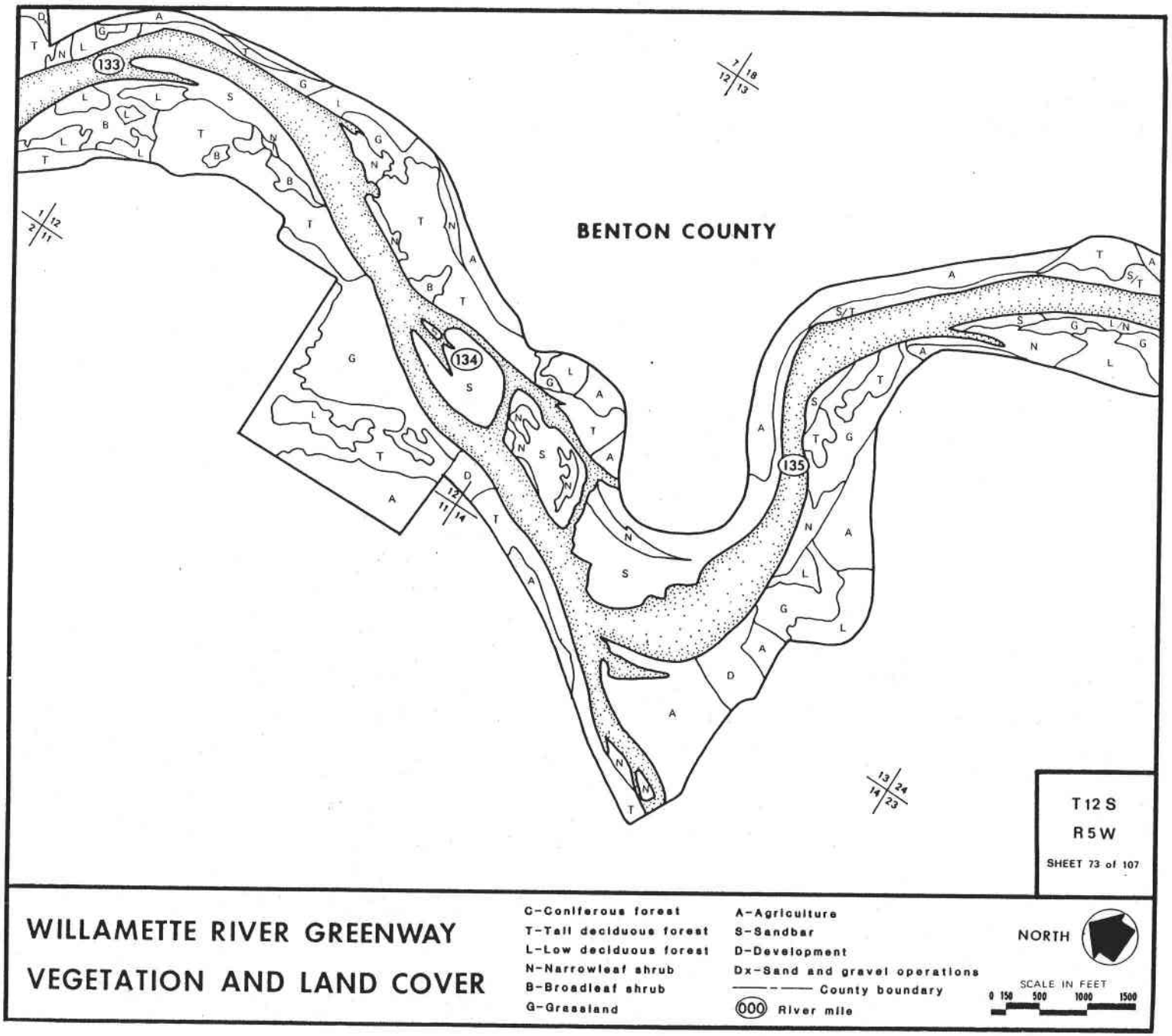
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
130
131
132
T11 & 12S
R5W
SHEET 71 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER

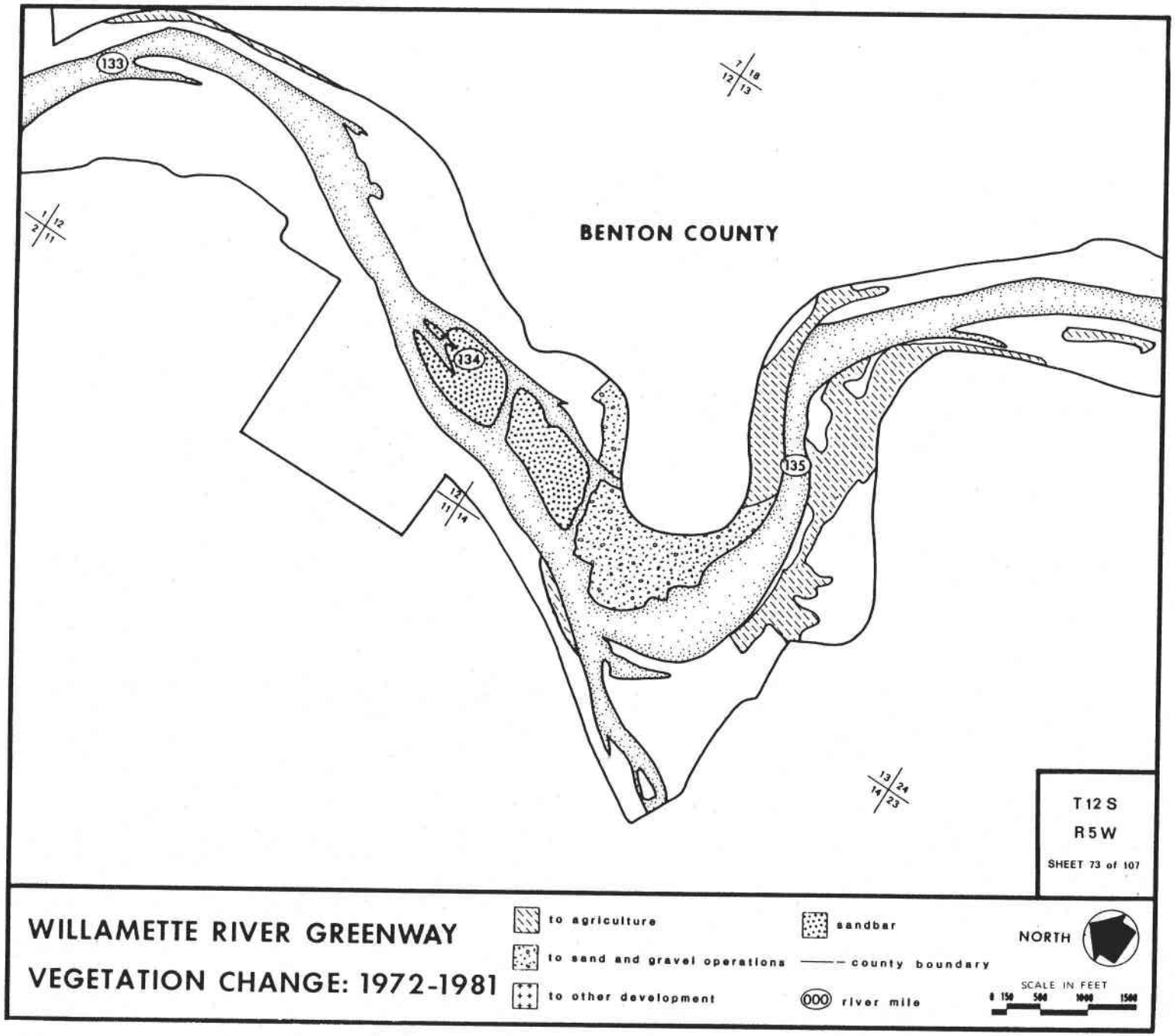

134
133
LINN COUNTY
BENTON COUNTY
SHEET 71 - A
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

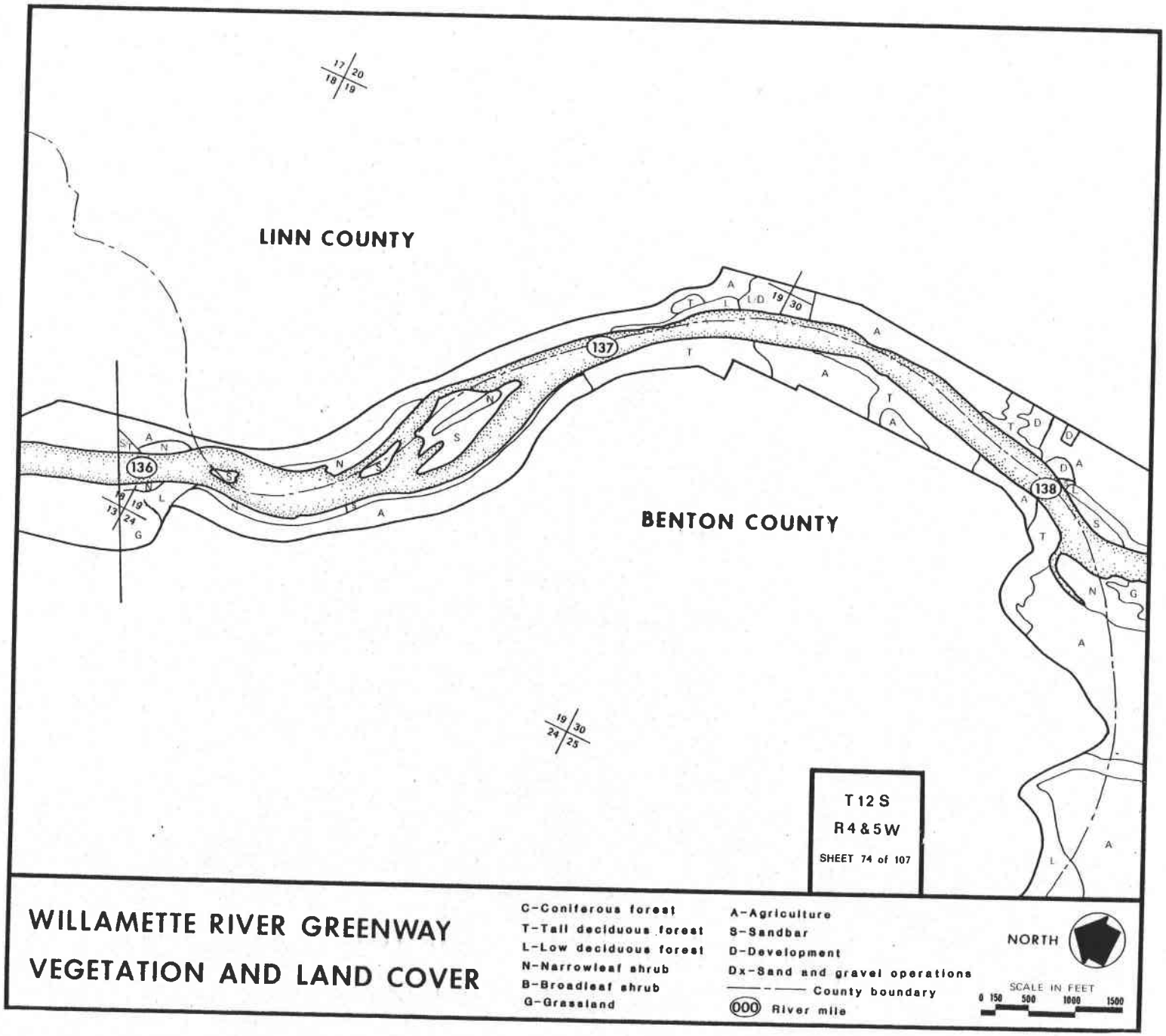



# WILLAMETTE RIVER GREENWAY
# VEGETATION AND LAND COVER

G-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland

A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile


133
134
135
BENTON COUNTY
T 12 S
R 5 W
SHEET 73 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




## WILLAMETTE RIVER GREENWAY
## VEGETATION AND LAND COVER

C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
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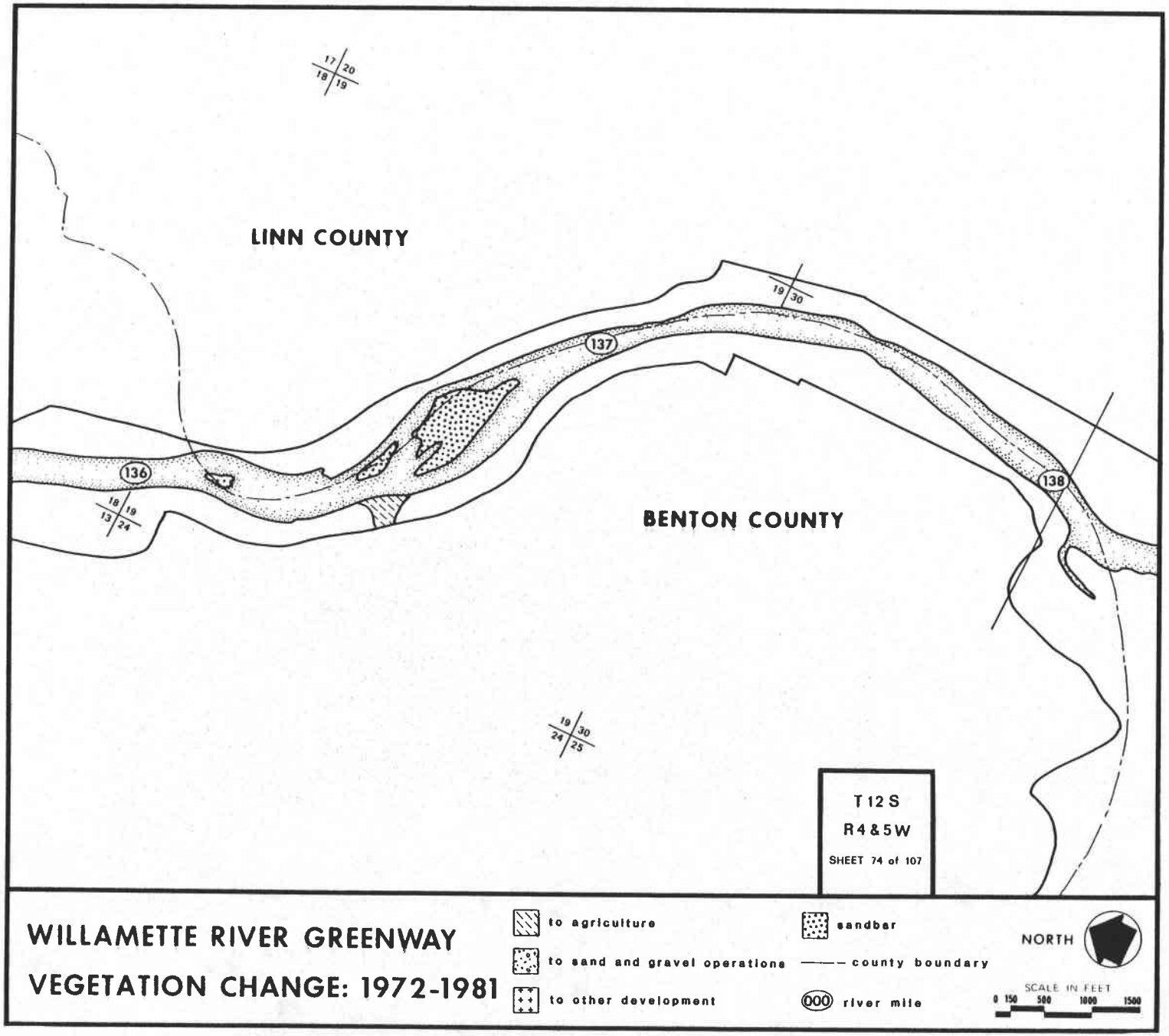
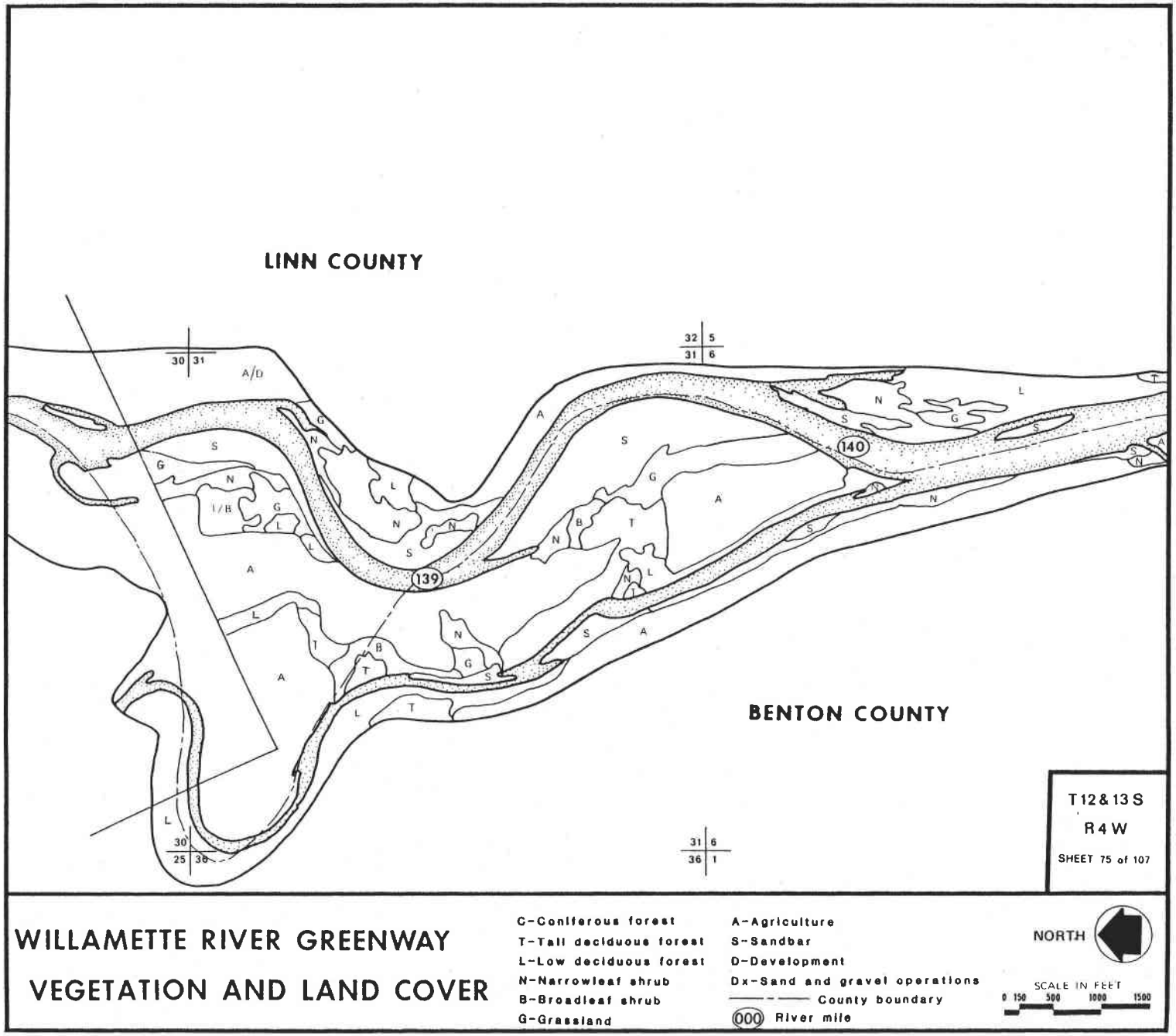
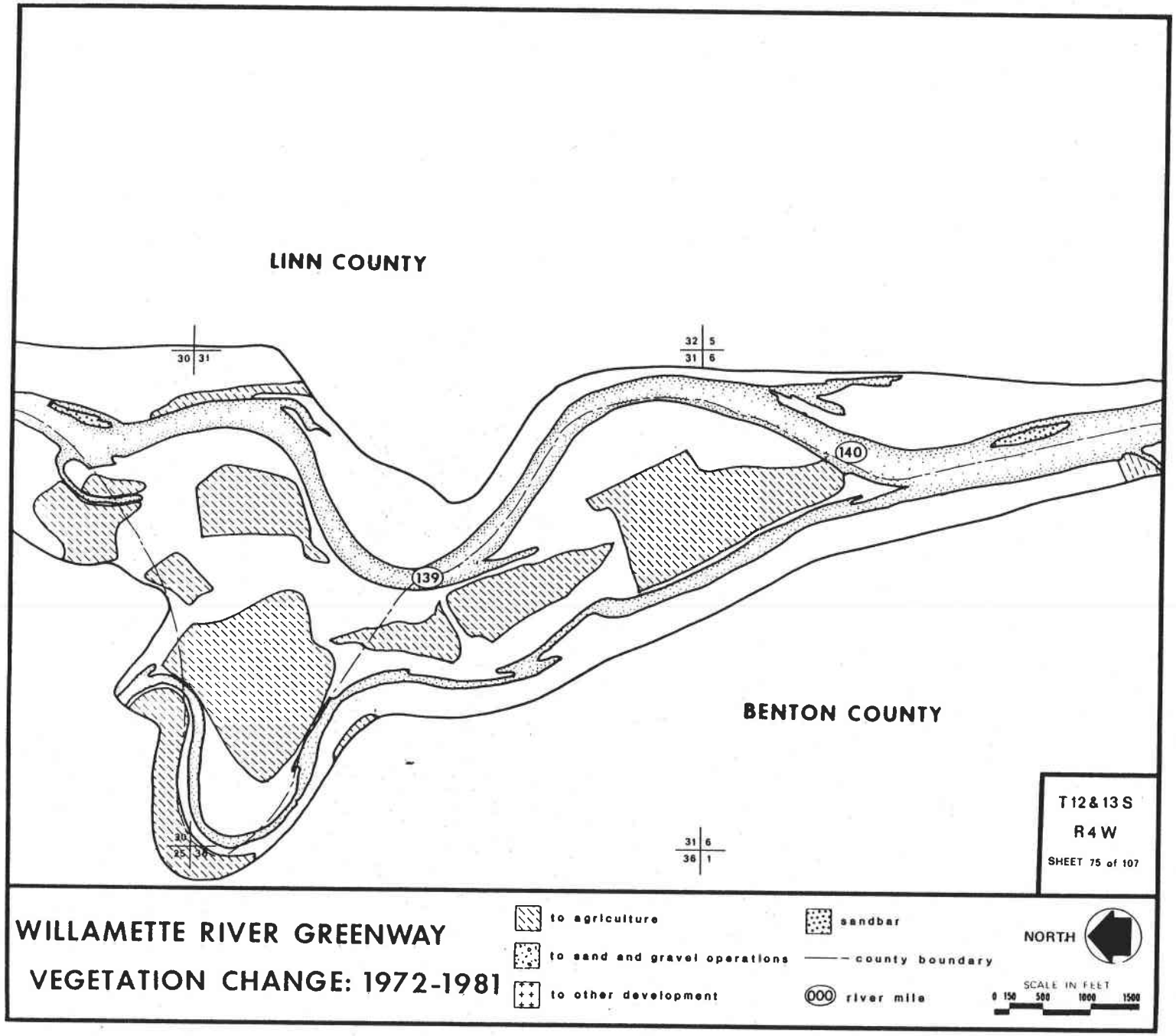
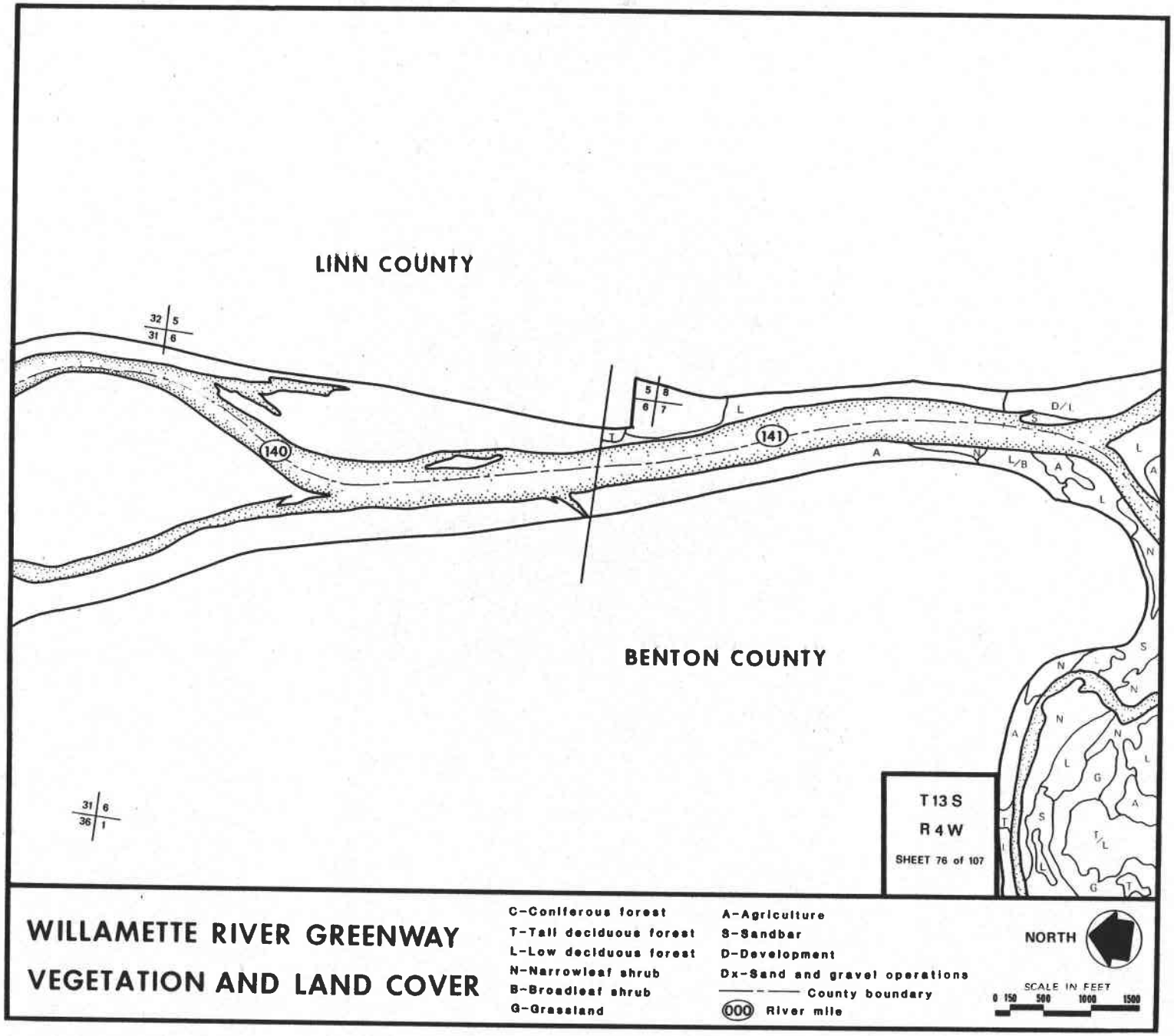
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile

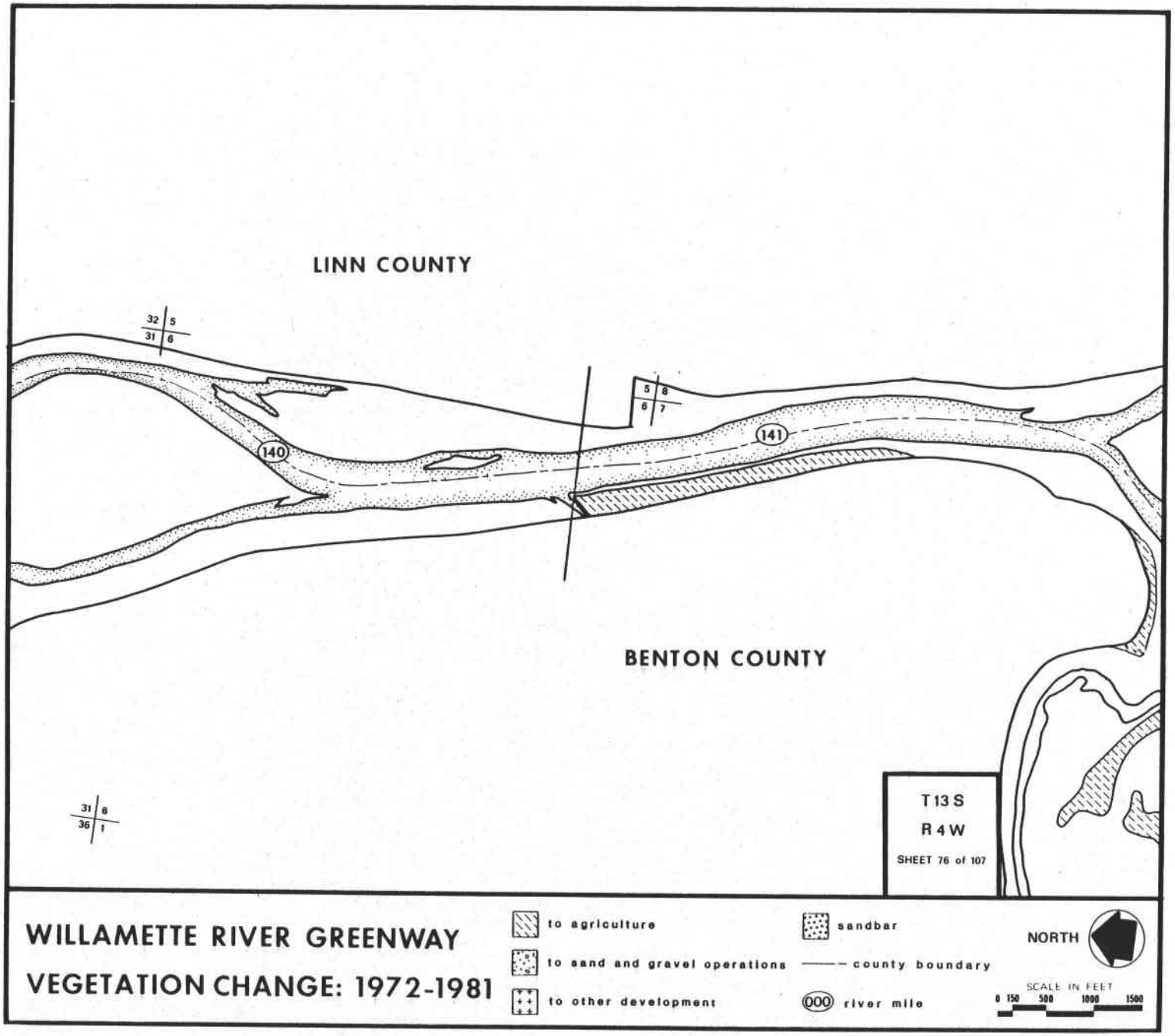

LINN COUNTY
BENTON COUNTY
136
137
138
17 20
18 19
18 19
13 24
19 30
19 30
24 25
T 12 S
R 4 & 5 W
SHEET 74 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER


LINN COUNTY
BENTON COUNTY
30 31
32 5
31 6
139
140
30
25 36
31 6
36 1
T12&13S
R4W
SHEET 75 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
140
141
T13S
R4W
SHEET 76 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
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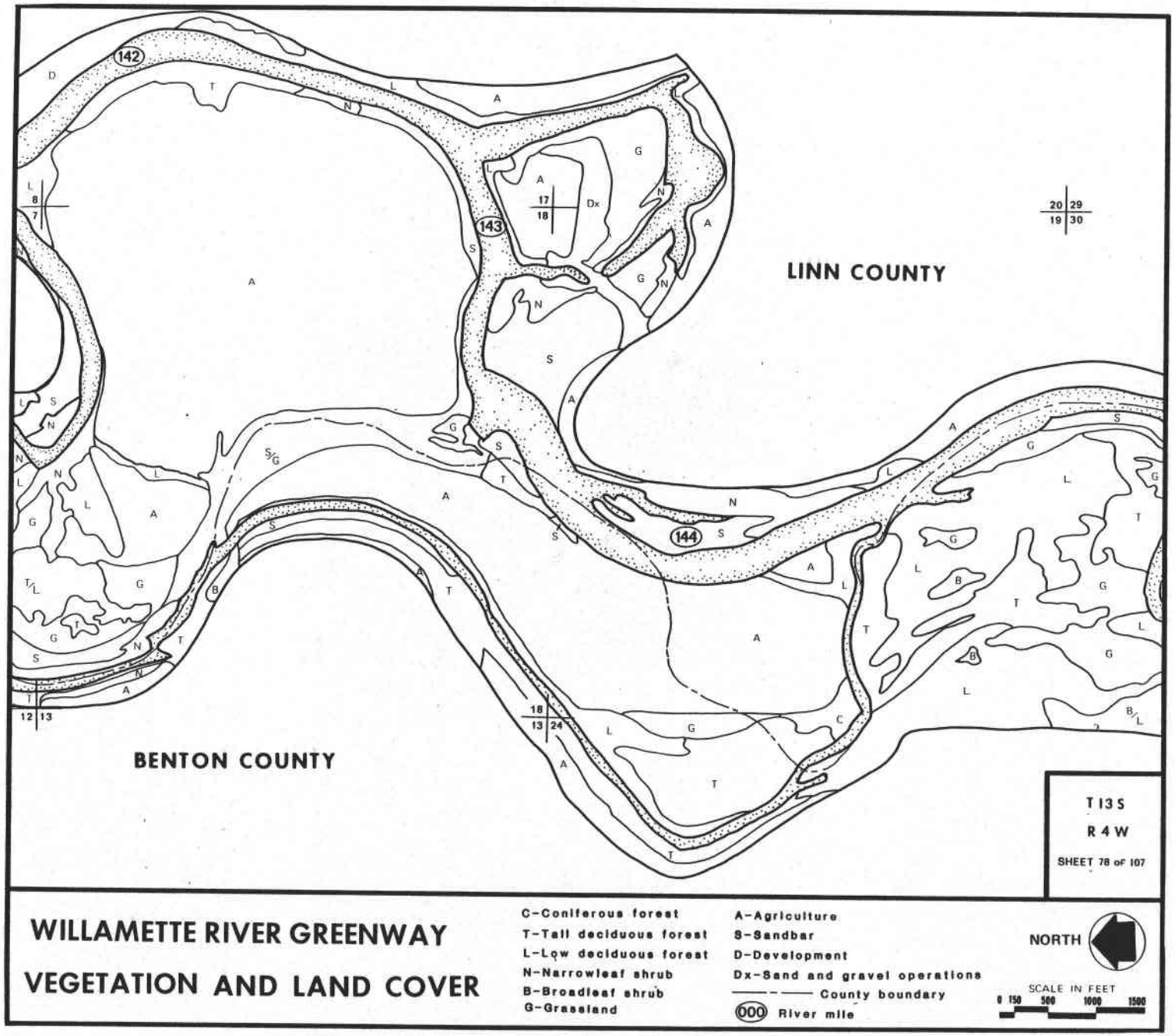
141
32 5
31 6
5 8
6 7
31 6
36 1
T13S
R4W
SHEET 76 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




# WILLAMETTE RIVER GREENWAY
# VEGETATION AND LAND COVER

C-Coniferous forest
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L-Low deciduous forest
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B-Broadleaf shrub
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A-Agriculture
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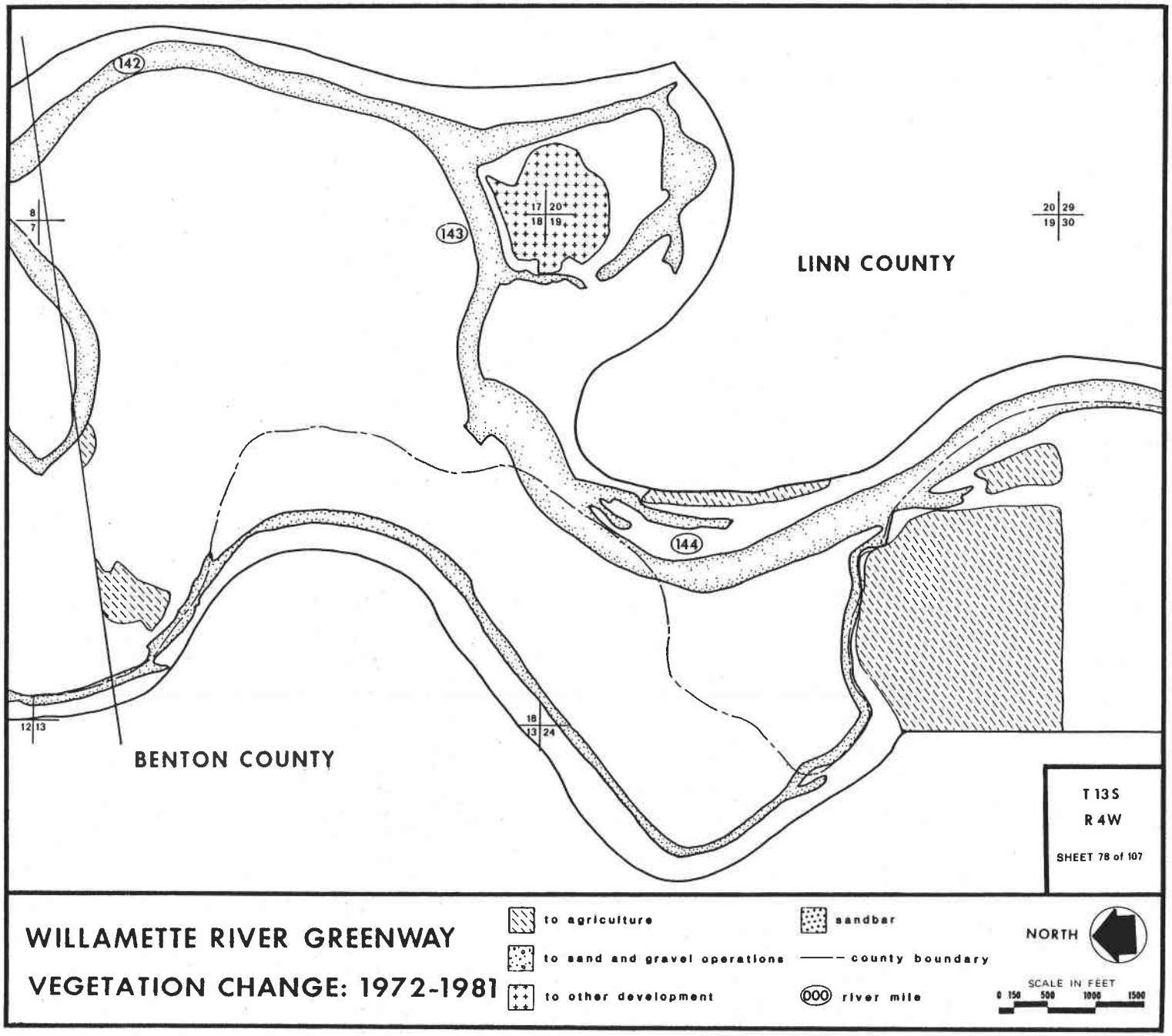
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile


142
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LINN COUNTY
BENTON COUNTY
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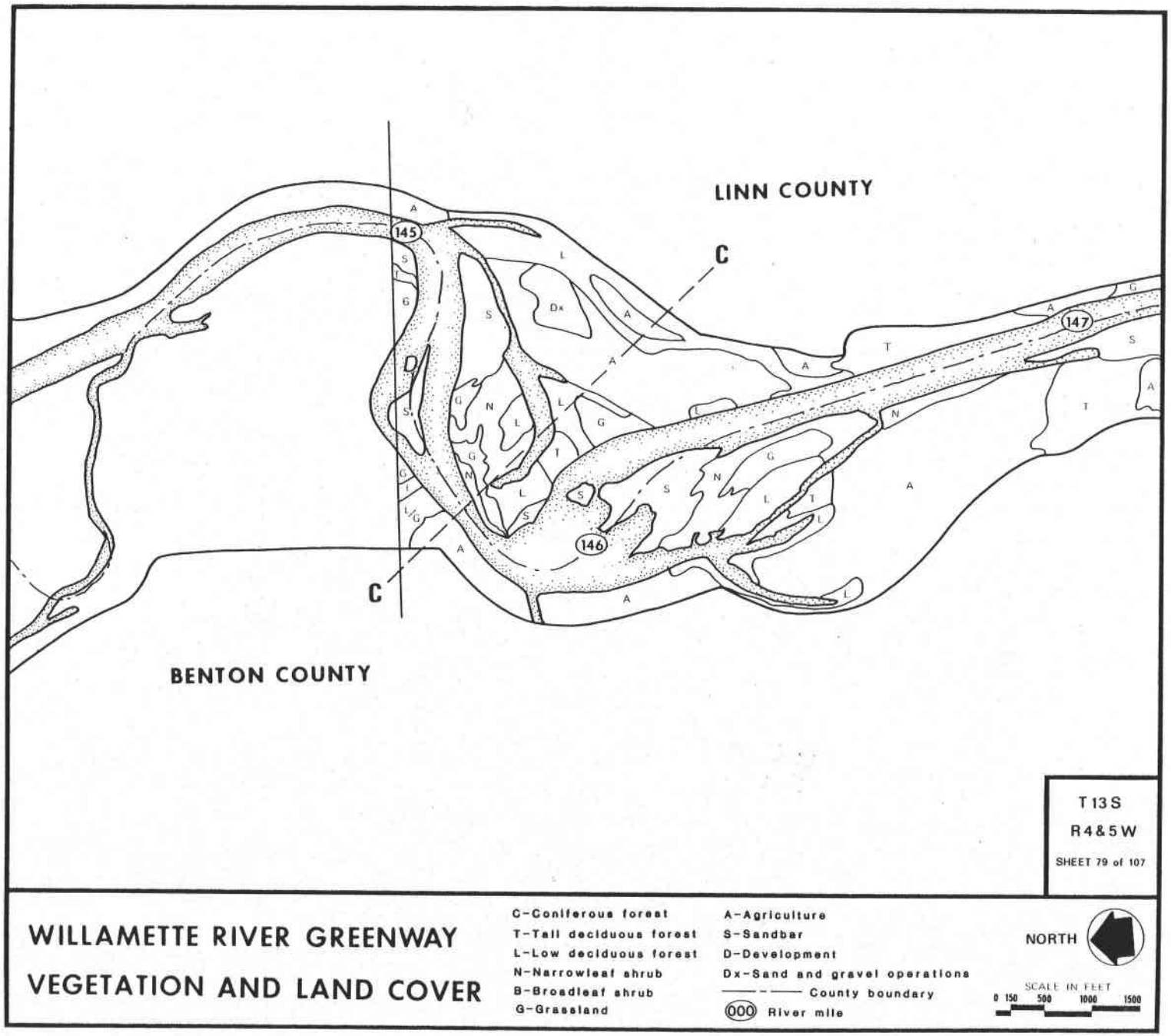
T 13S
R 4W
SHEET 78 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500




# WILLAMETTE RIVER GREENWAY
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D-Development
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County boundary
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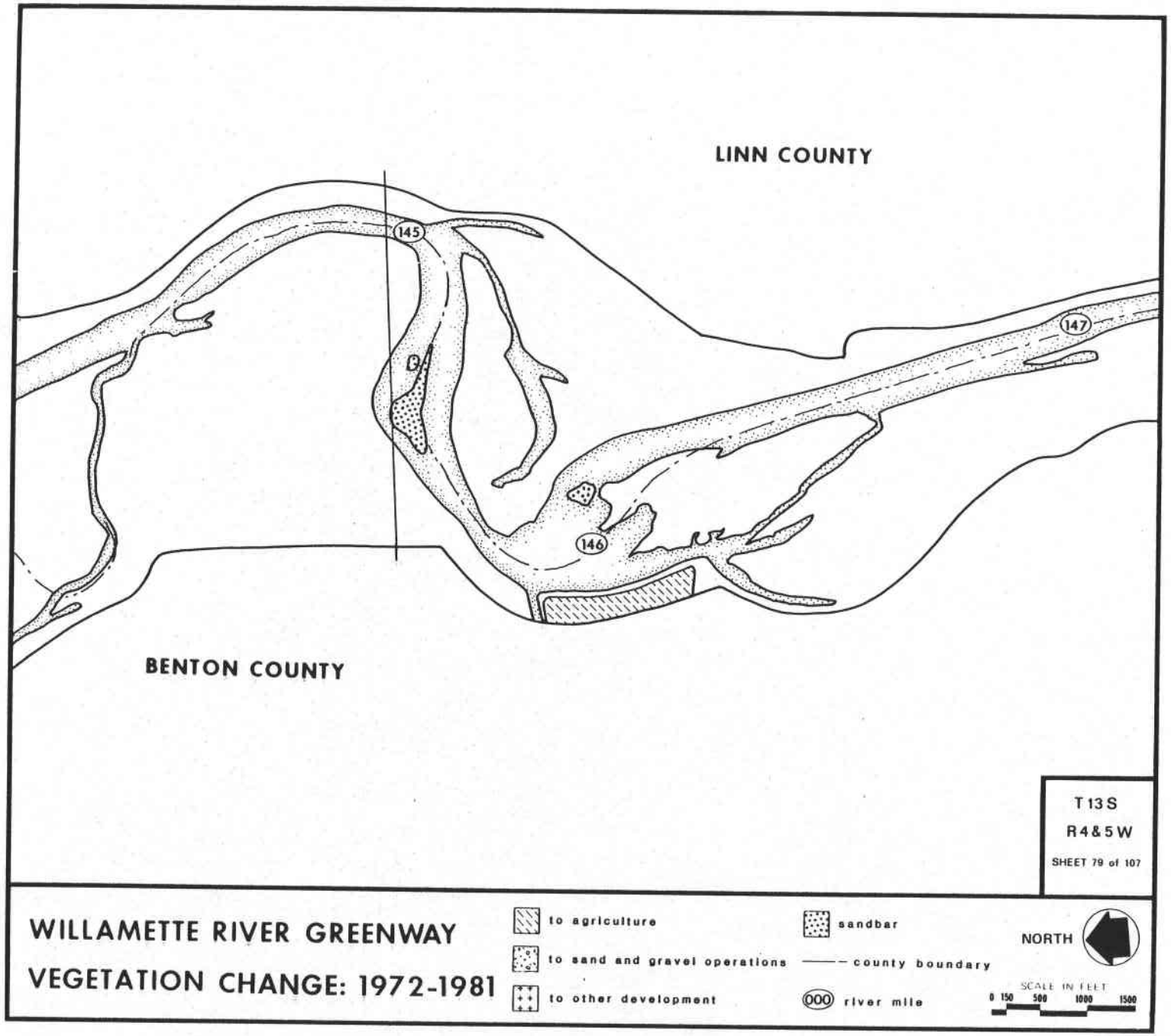
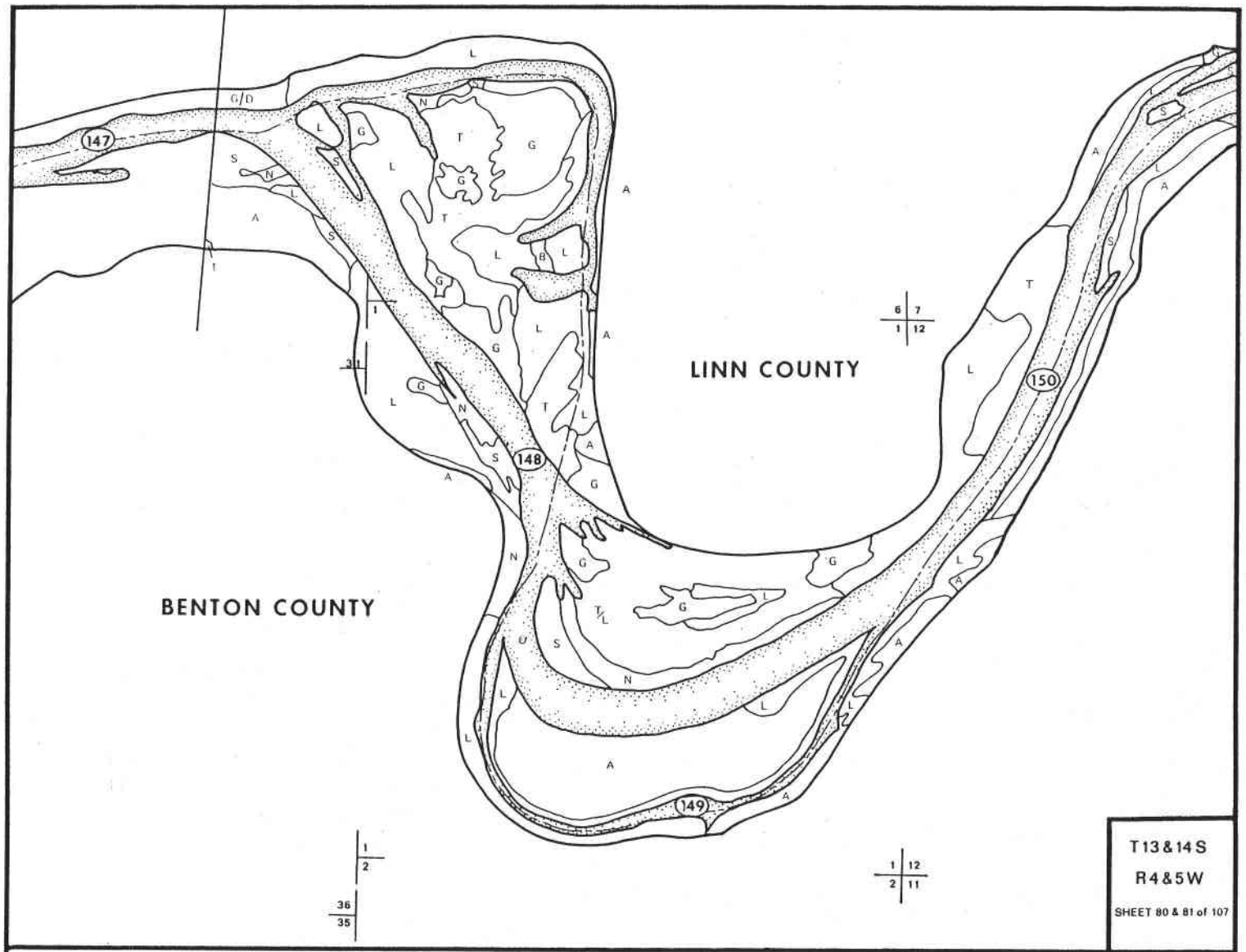

LINN COUNTY
BENTON COUNTY
145
146
147
T13S
R4&5W
SHEET 79 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500



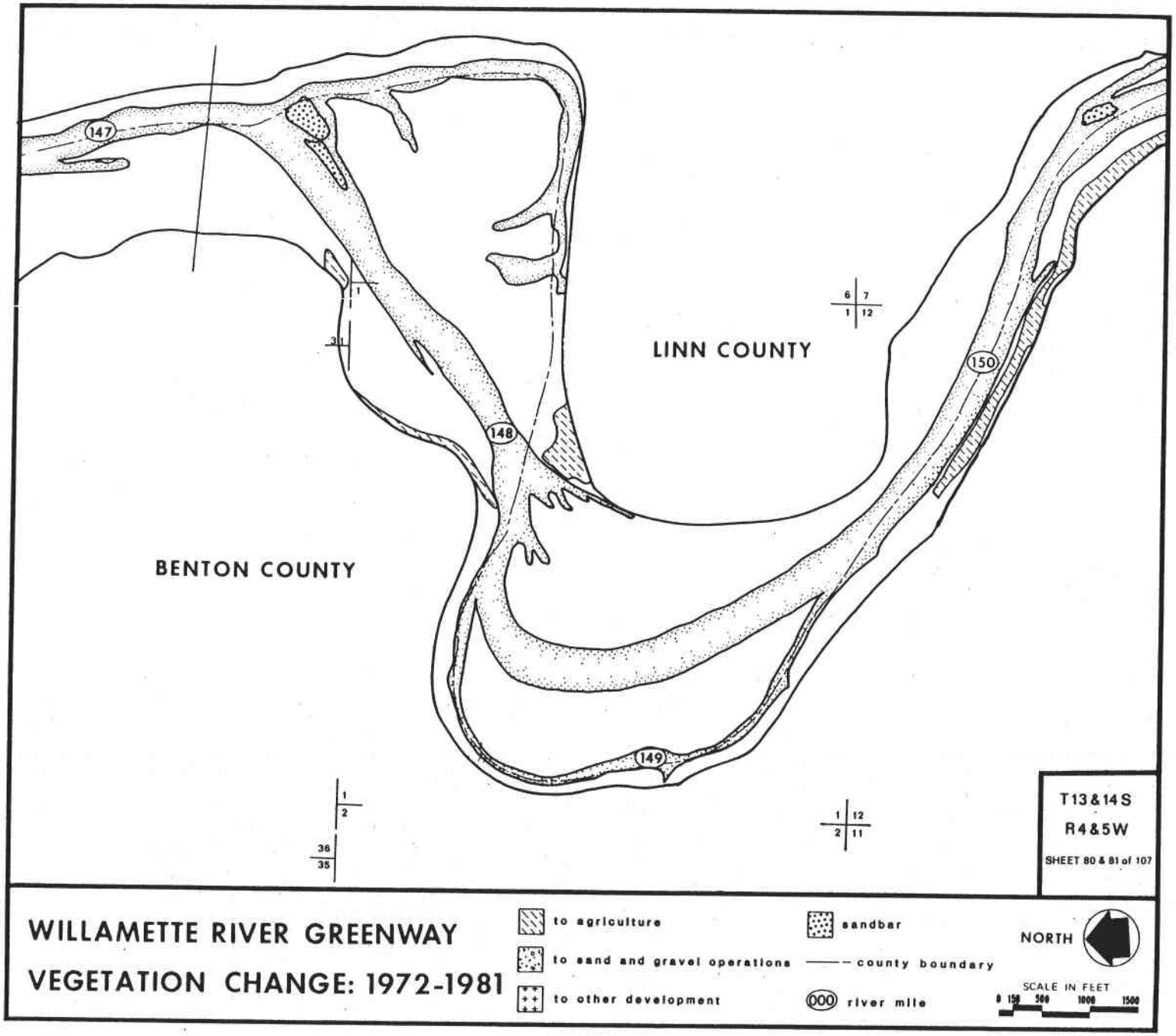

# WILLAMETTE RIVER GREENWAY VEGETATION AND LAND COVER

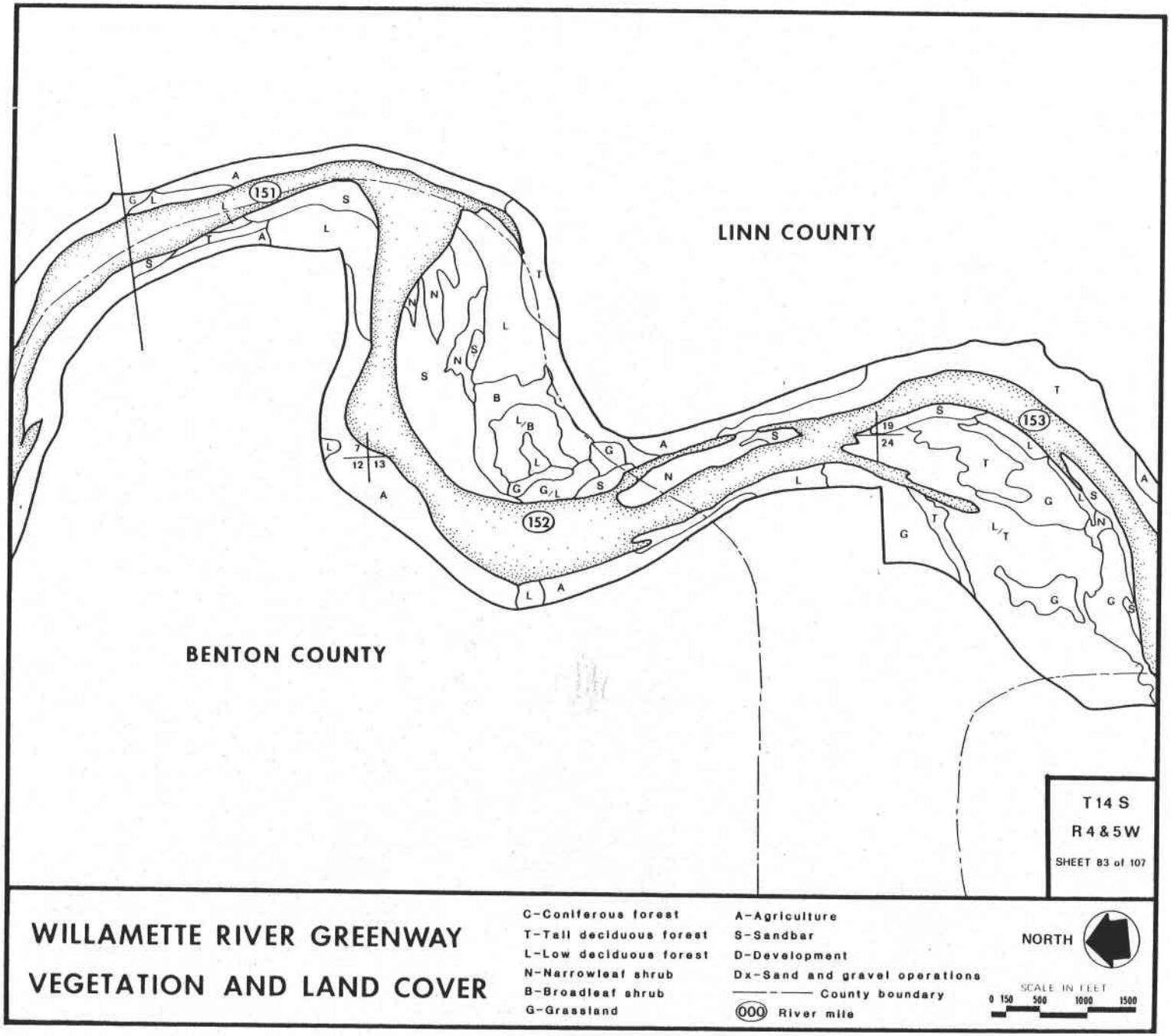
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland

A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile

NORTH

SCALE IN FEET
0 150 500 1000 1500


147
148
149
150
LINN COUNTY
BENTON COUNTY
6 7
1 12
1
31
1
2
36
35
1 12
2 11
T13&14S
R4&5W
SHEET 80 & 81 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
151
152
153
T14 S
R4&5W
SHEET 83 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
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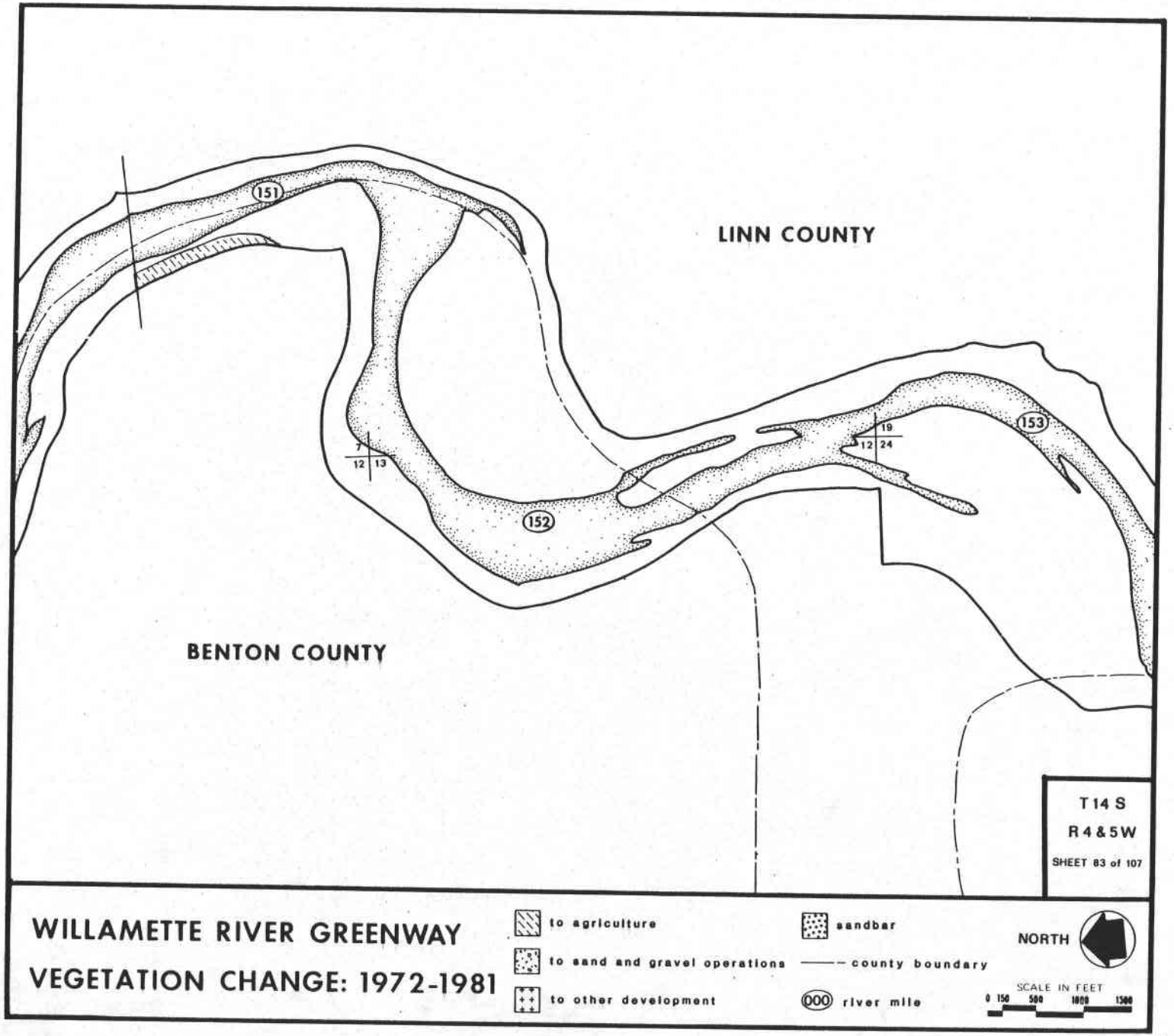
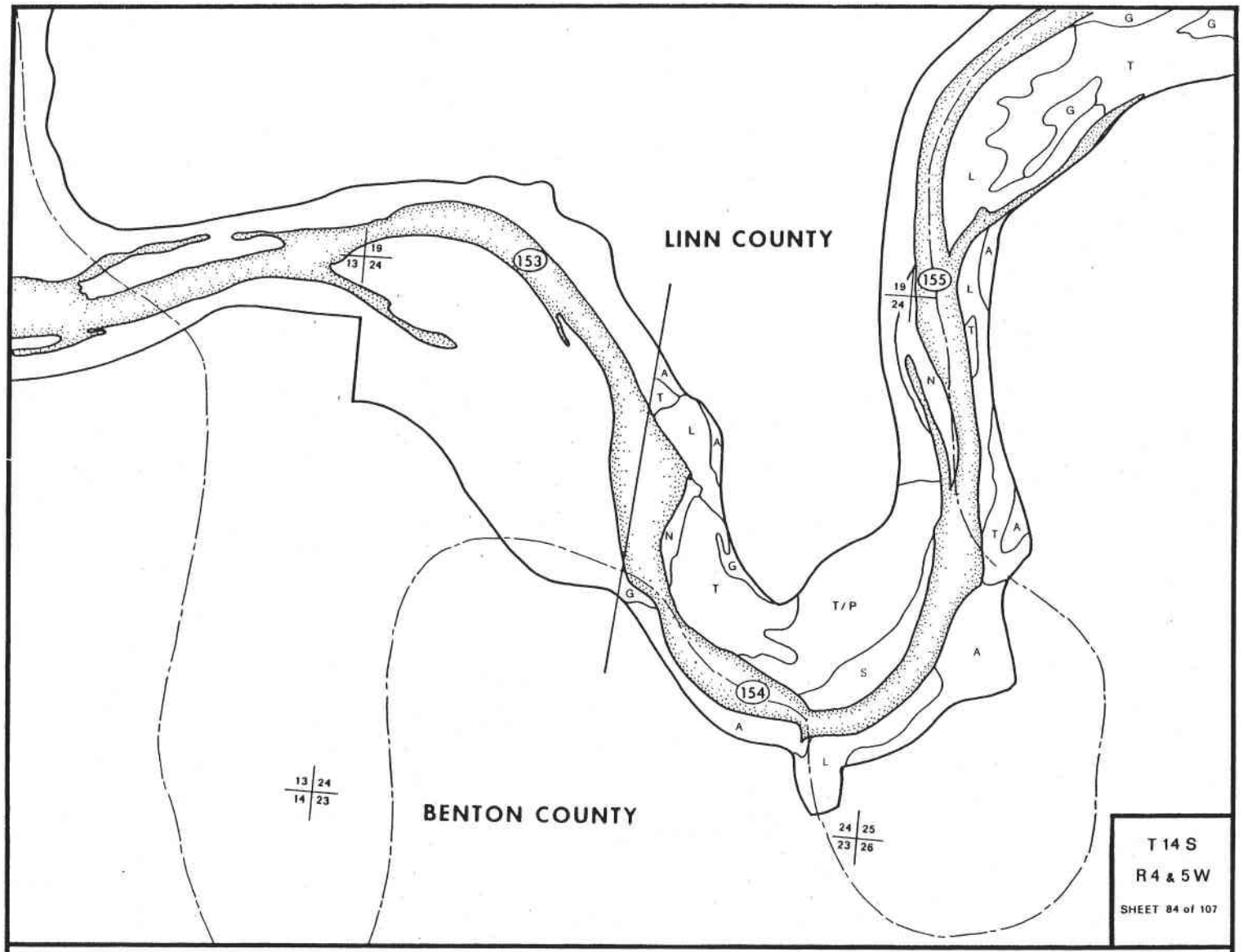
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
151
152
153
7
12
13
19
12
24
T14 S
R4&5W
SHEET 83 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

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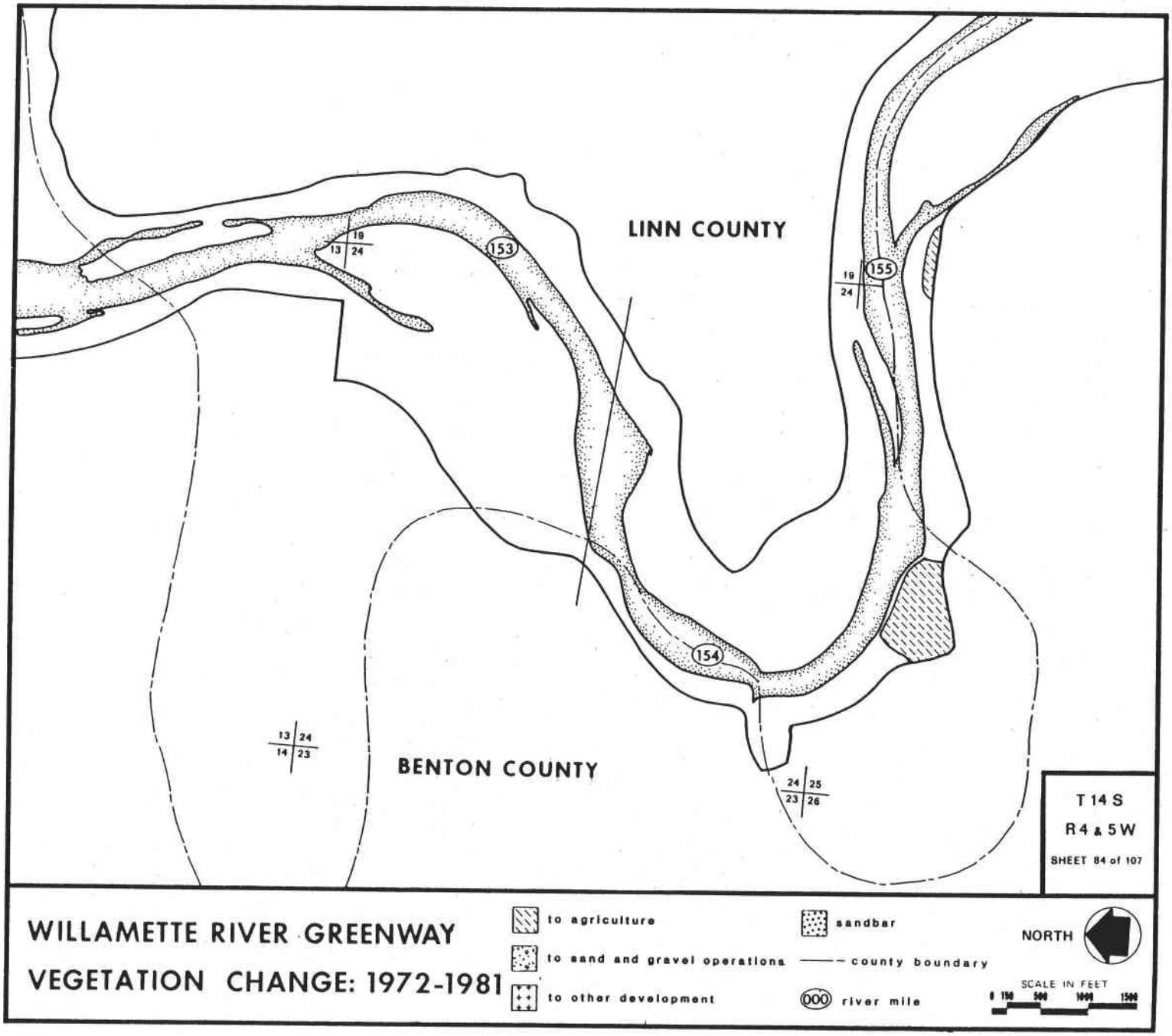
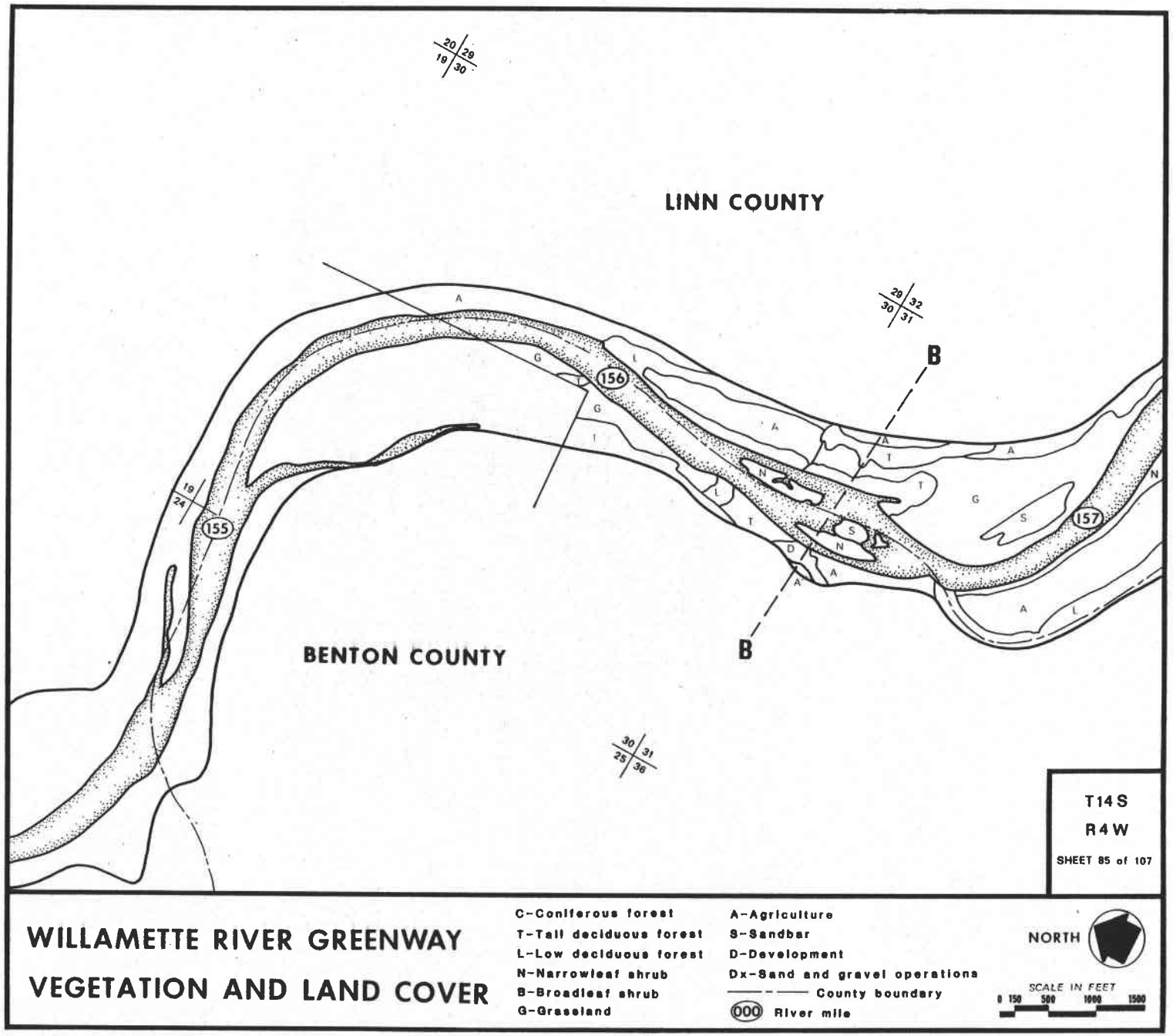
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile

NORTH

SCALE IN FEET
0 150 500 1000 1500


LINN COUNTY
BENTON COUNTY
153
154
155
19
13
24
19
24
13
24
14
23
24
25
23
26
T 14 S
R 4 & 5W
SHEET 84 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 250 500 1000 1500

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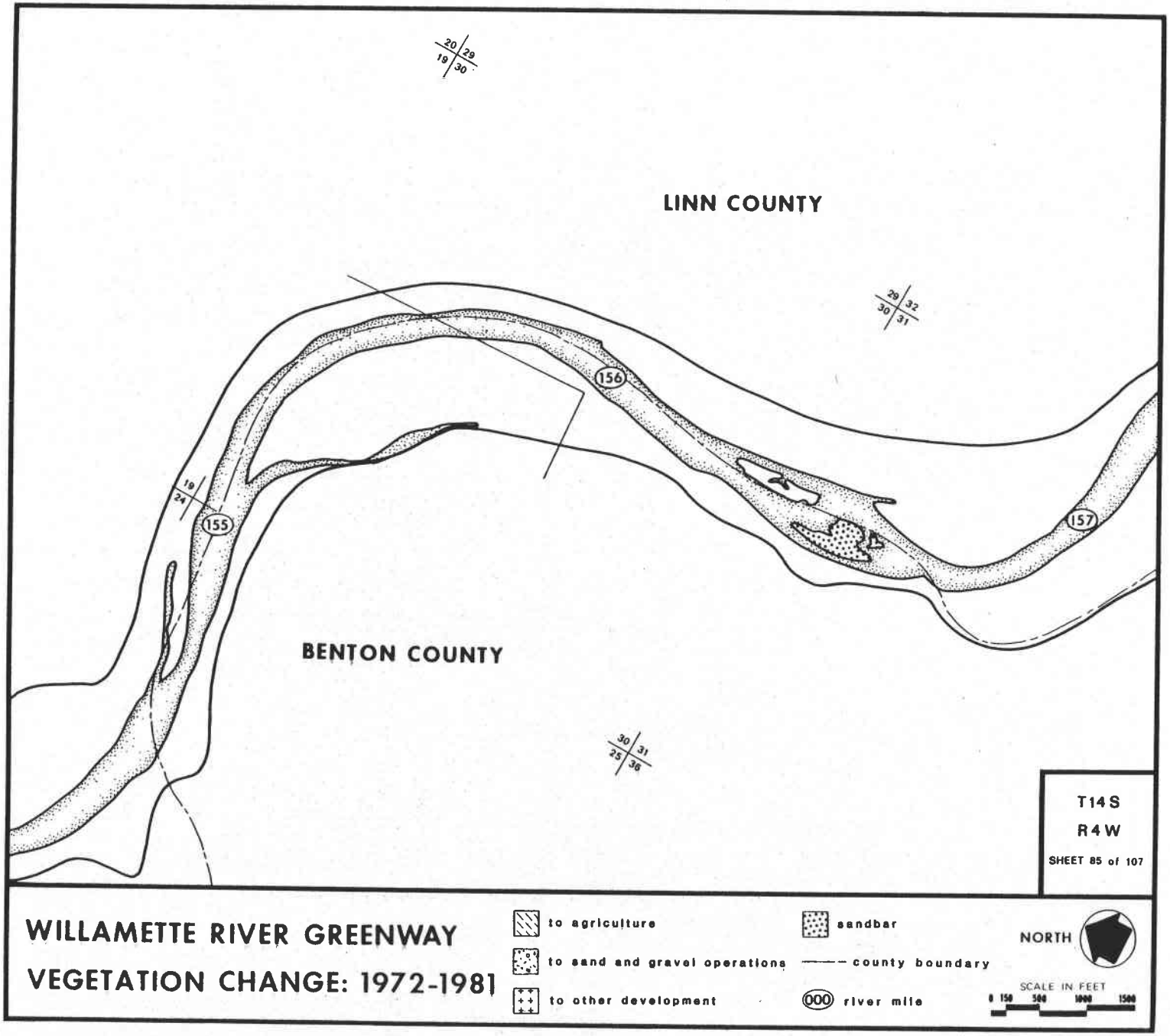
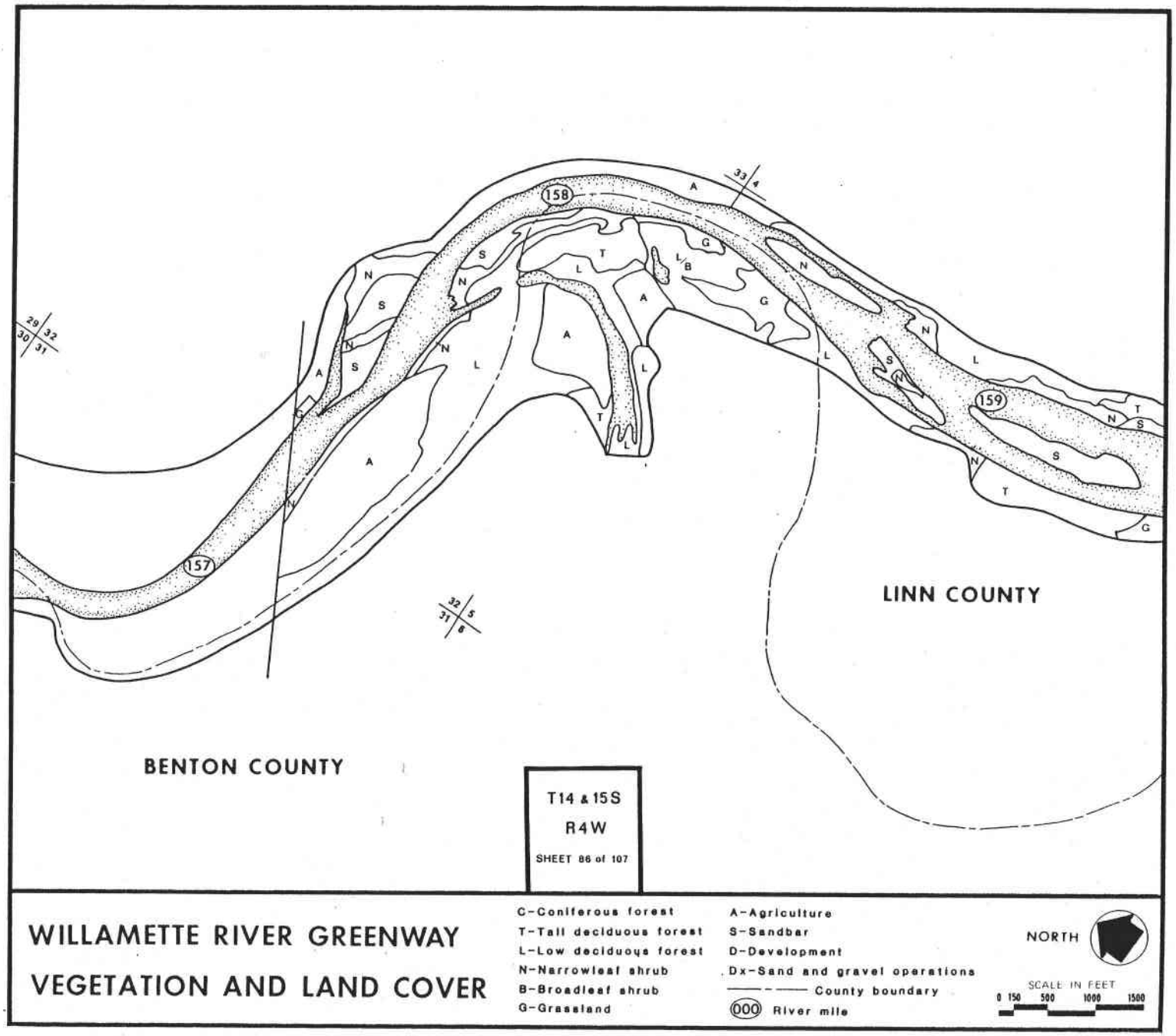
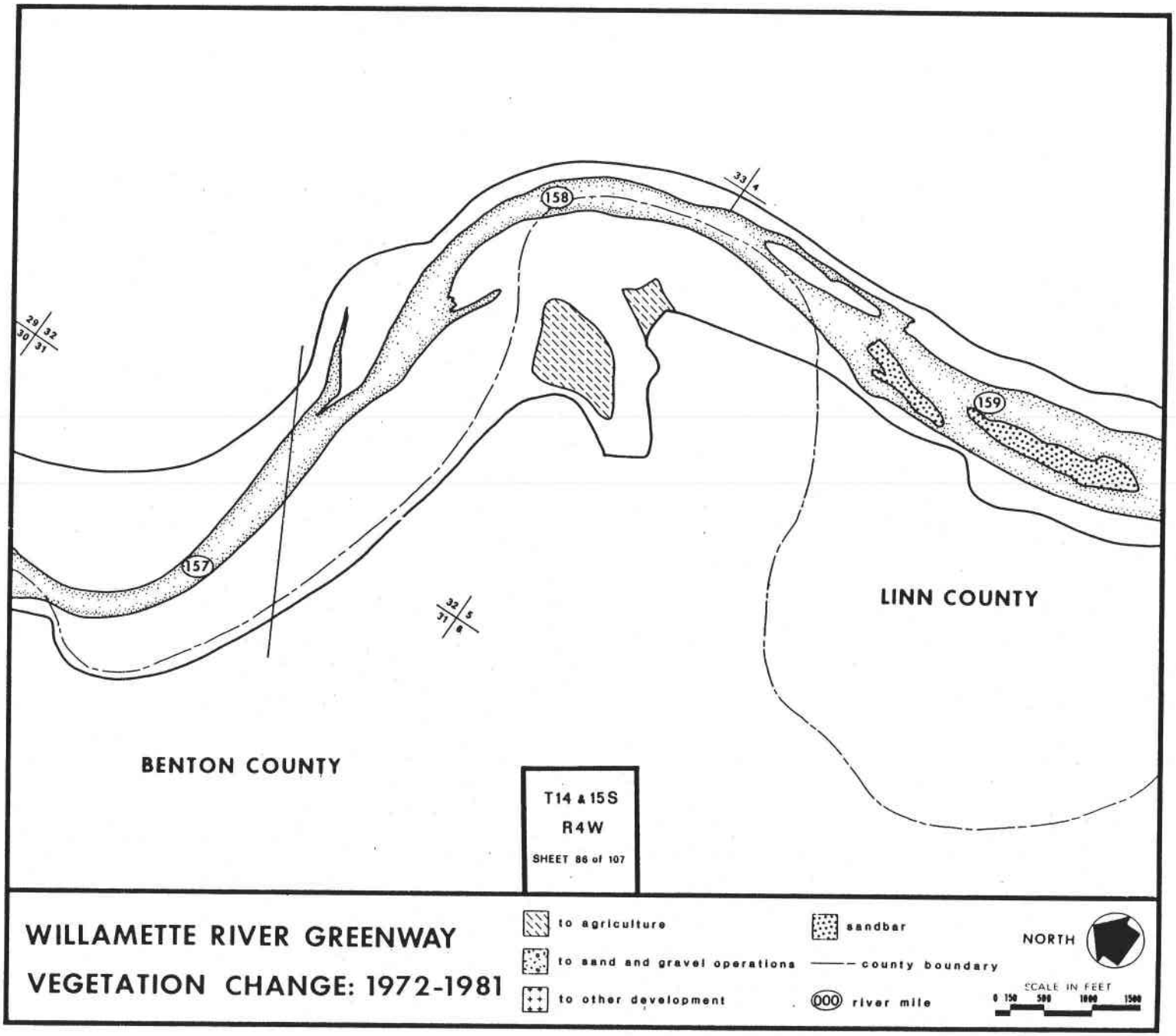
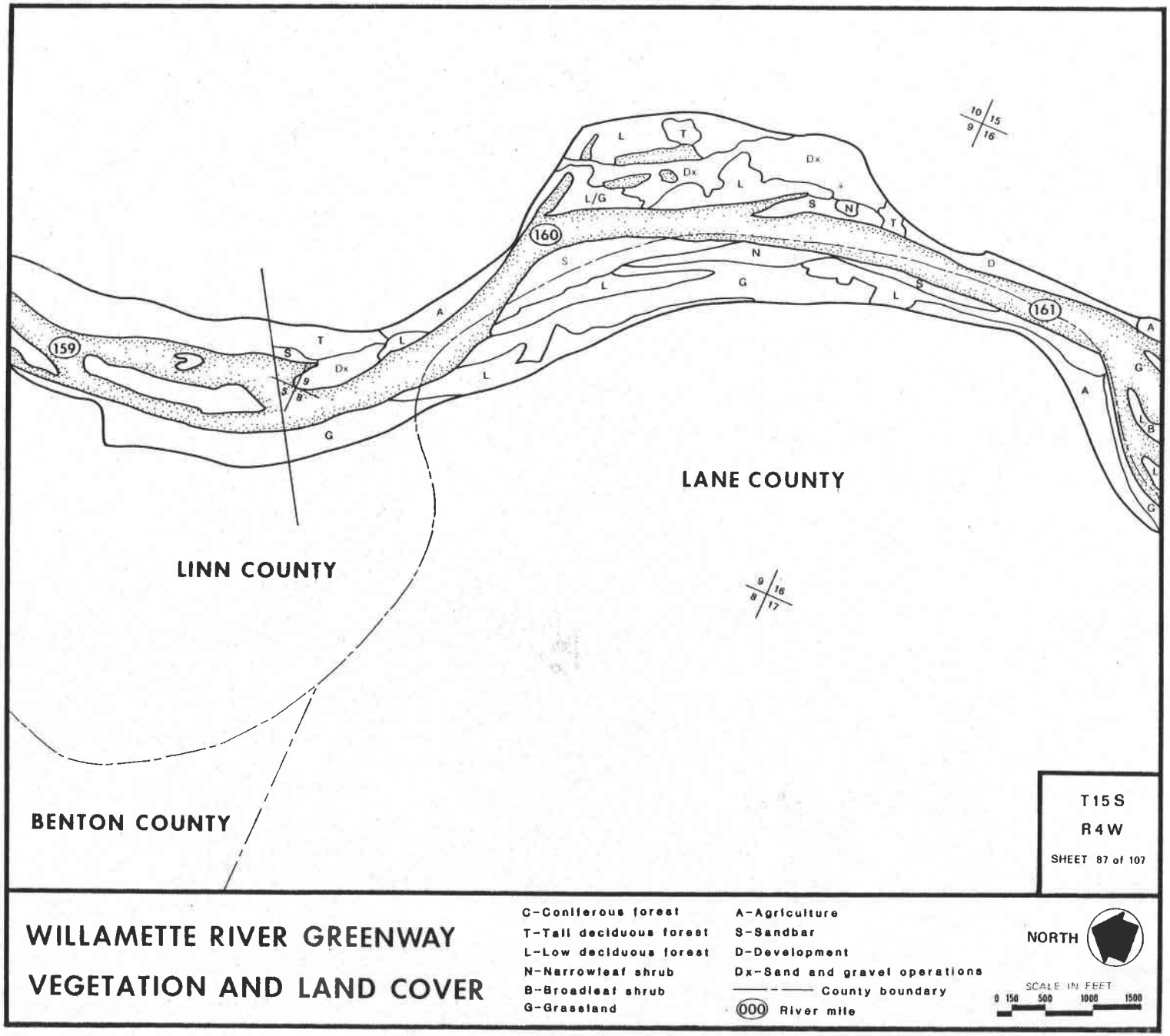
County boundary
River mile


LINN COUNTY
BENTON COUNTY
155
156
157
20 29
19 30
29 32
30 31
19
24
30 31
25 36
T14S
R4W
SHEET 85 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


158
157
159
LINN COUNTY
BENTON COUNTY
T14 & 15S
R4W
SHEET 86 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION AND LAND COVER
C-Coniferous forest
T-Tall deciduous forest
L-Low deciduous forest
N-Narrowleaf shrub
B-Broadleaf shrub
G-Grassland
A-Agriculture
S-Sandbar
D-Development
Dx-Sand and gravel operations
County boundary
River mile
NORTH
SCALE IN FEET
0 150 500 1000 1500


158
159
157
33/4
29/32
30/31
32/5
31/6
LINN COUNTY
BENTON COUNTY
T14 & 15S
R4W
SHEET 86 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
000 river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

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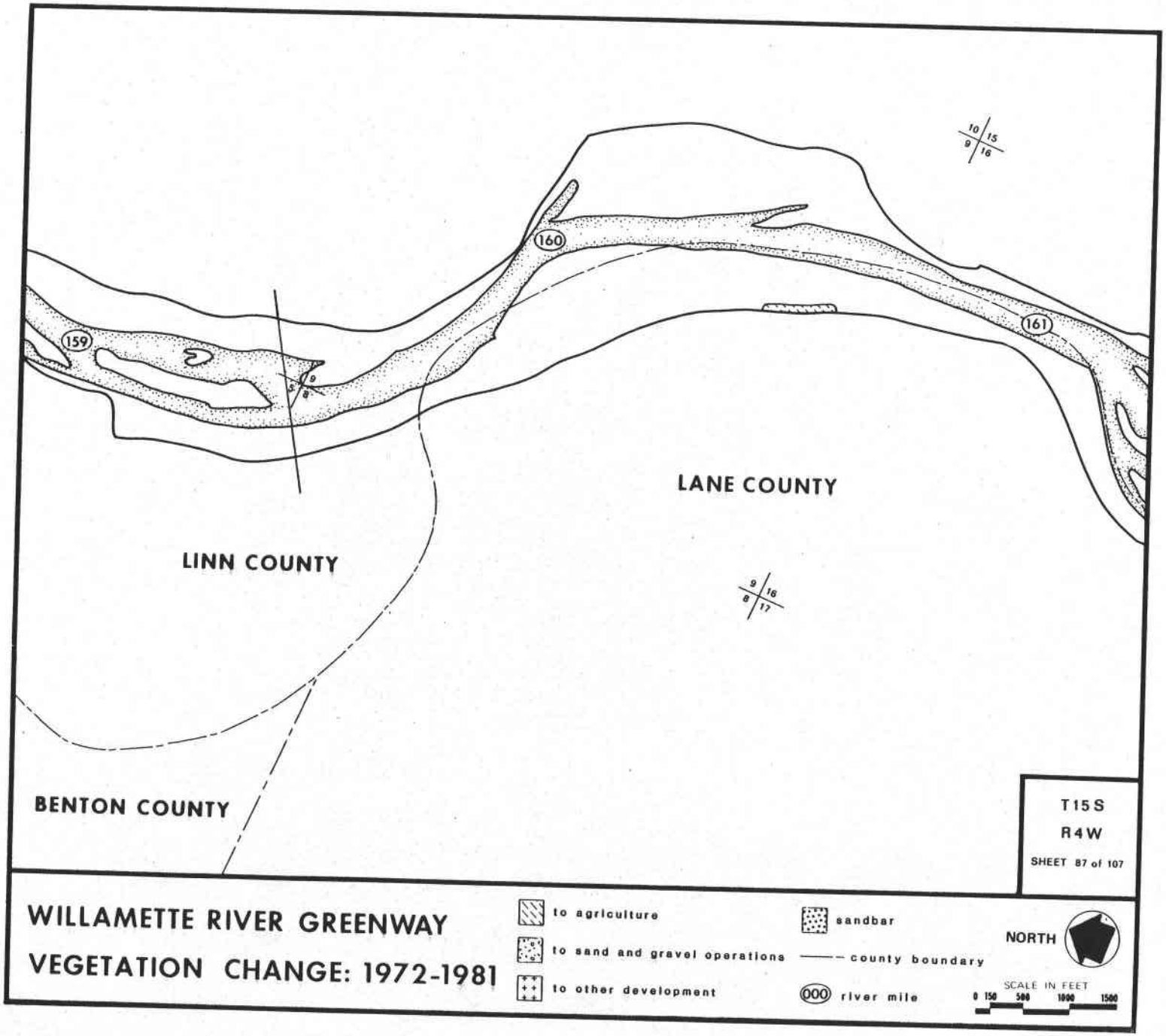
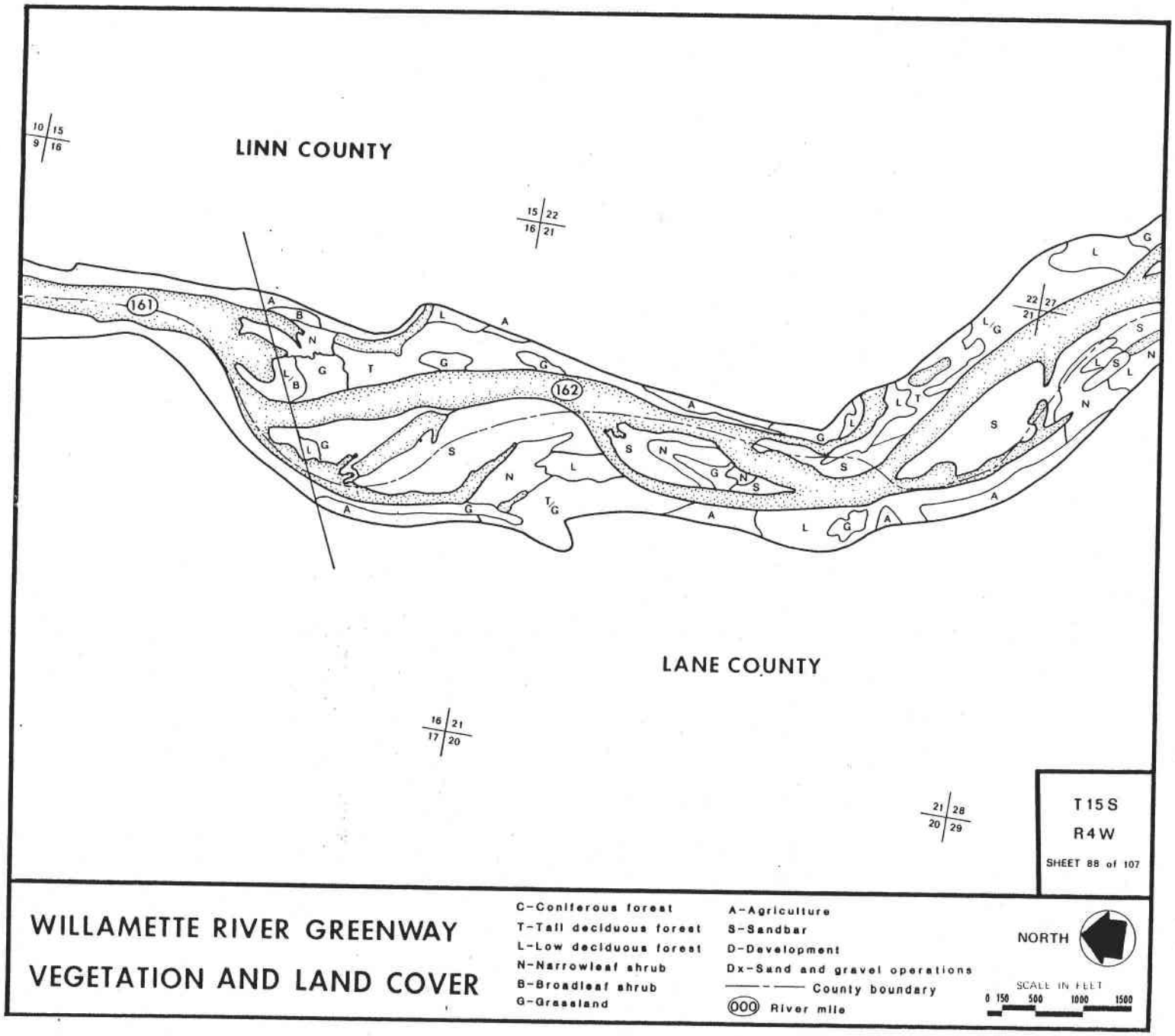
D-Development
Dx-Sand and gravel operations
County boundary
(000) River mile


LANE COUNTY
LINN COUNTY
BENTON COUNTY
159
160
161
10 15
9 16
9 16
8 17
T15S
R4W
SHEET 87 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

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D-Development
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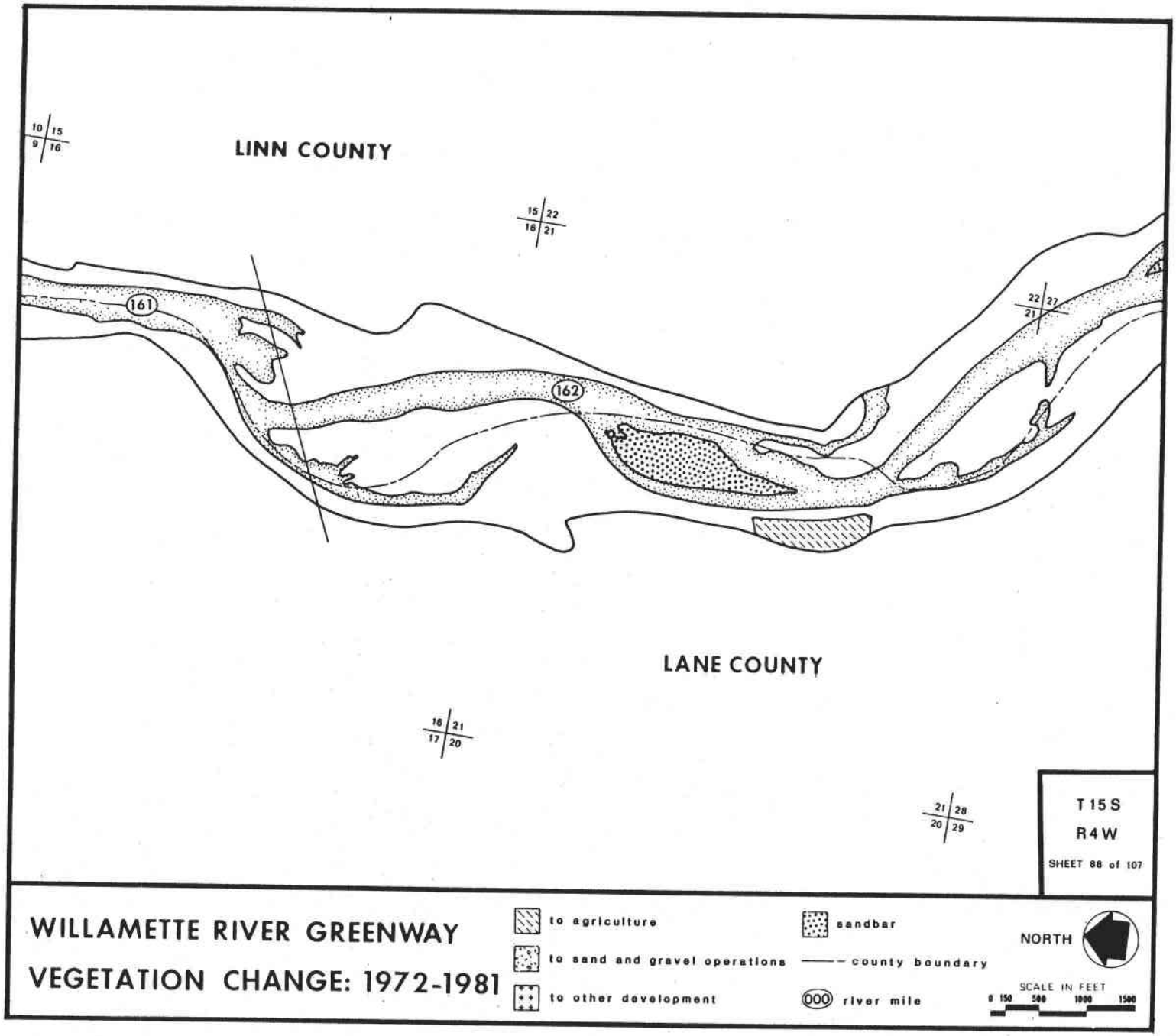
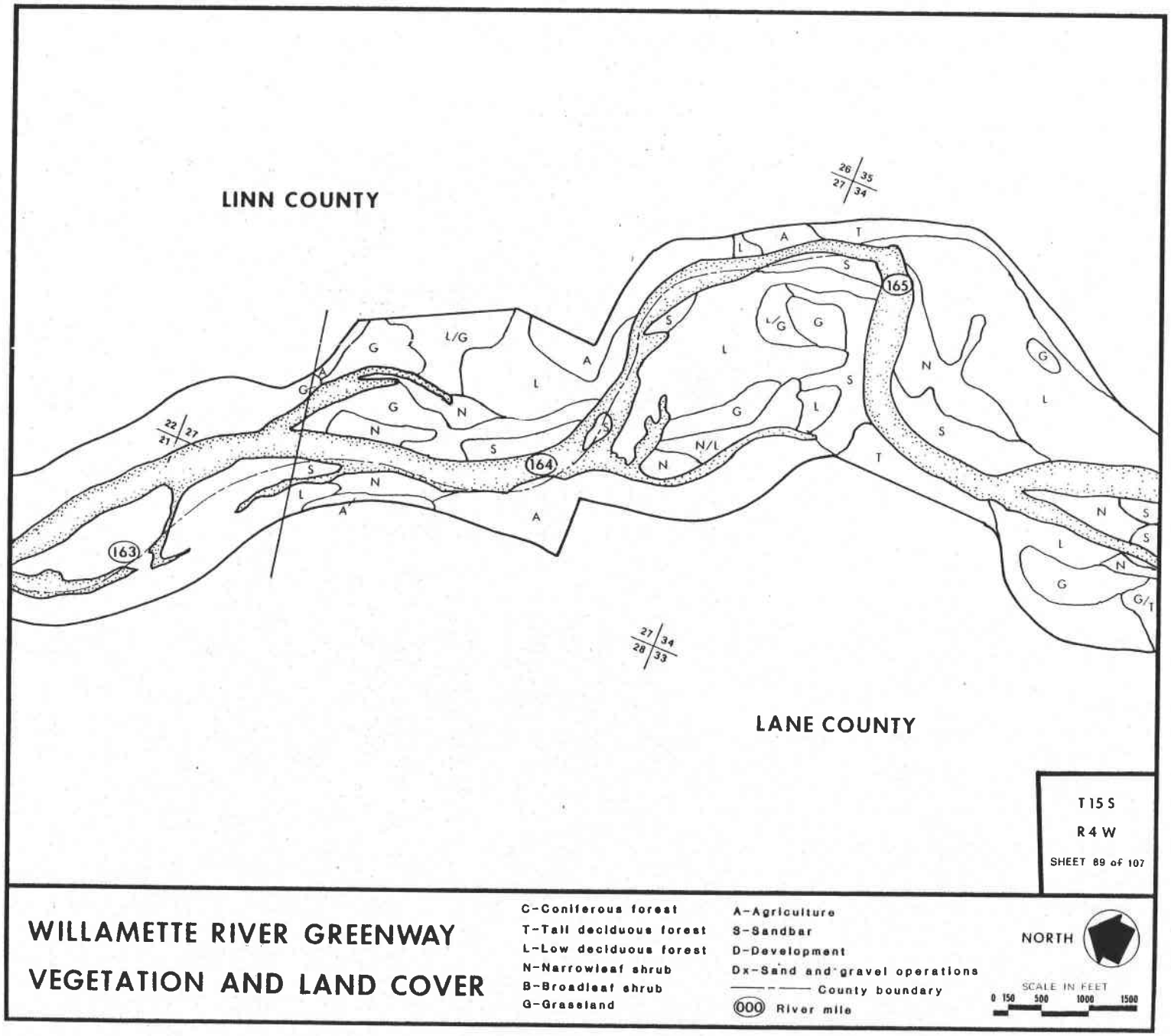
County boundary
(000) River mile


LINN COUNTY
LANE COUNTY
161
162
10 15
9 16
15 22
16 21
22 27
21
16 21
17 20
21 28
20 29
T 15 S
R 4 W
SHEET 88 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

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D-Development
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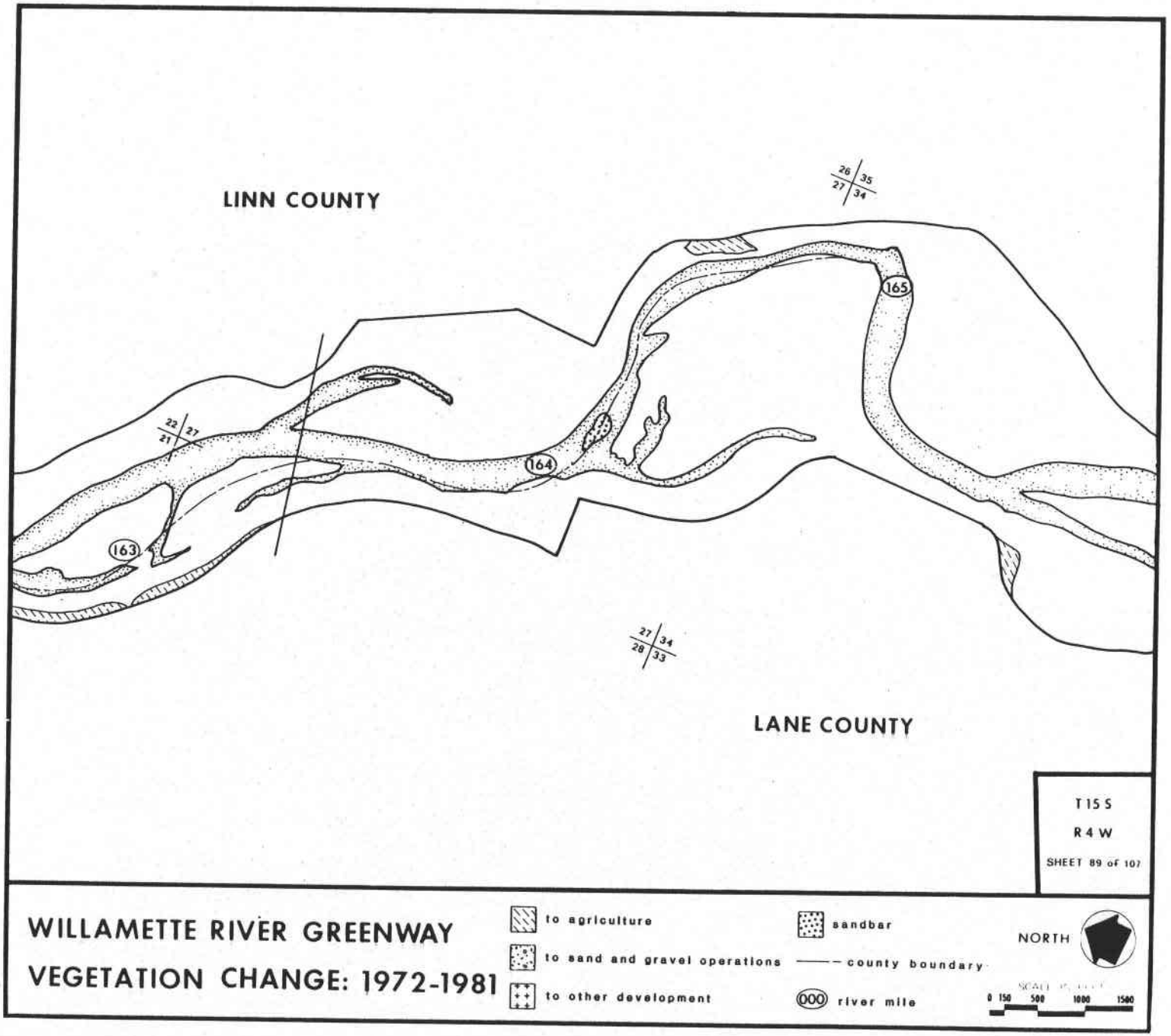
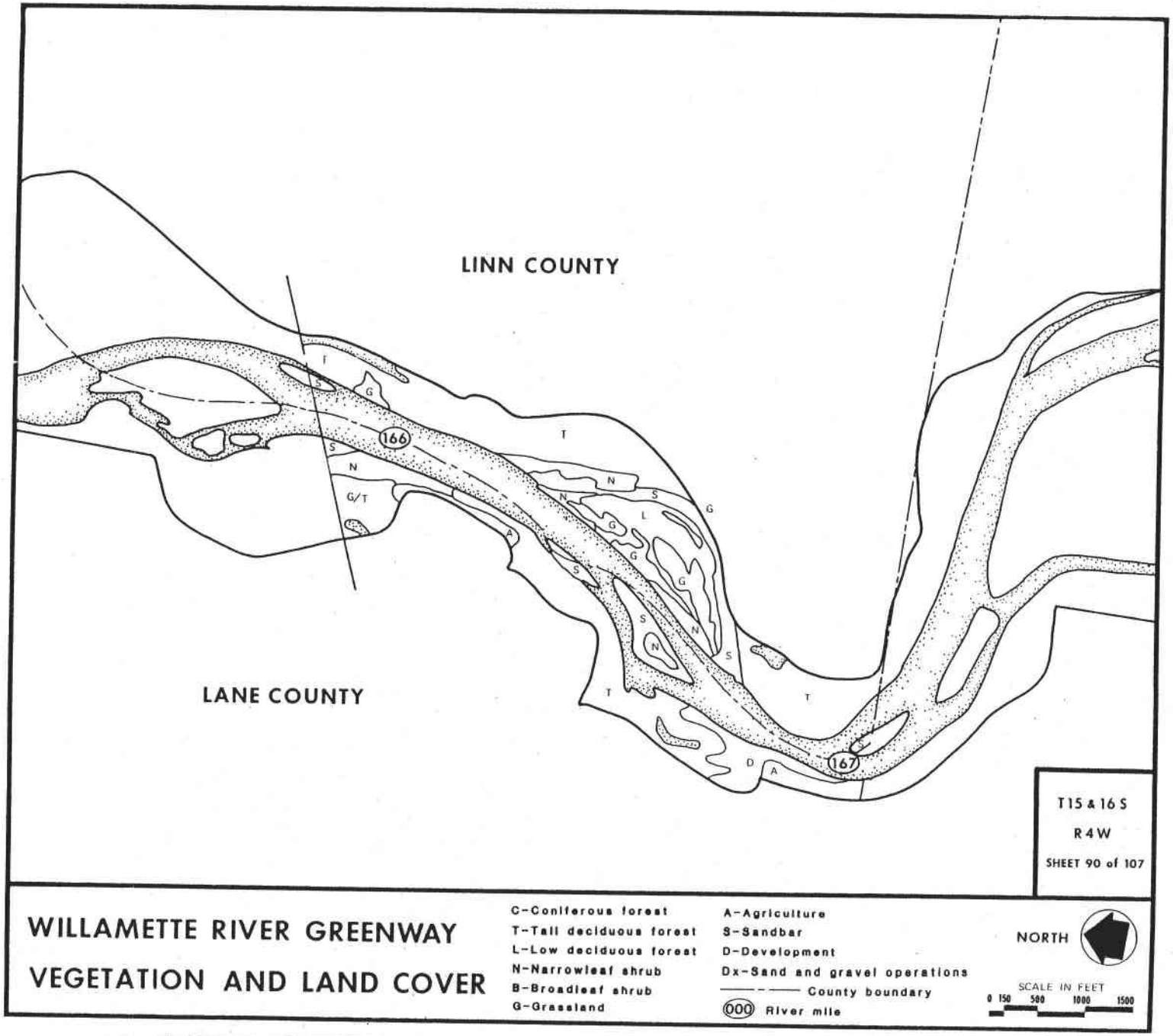
County boundary
(000) River mile


LINN COUNTY
LANE COUNTY
163
164
165
22 27
21
26 35
27 34
27 34
28 33
T15S
R4W
SHEET 89 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
0 150 500 1000 1500

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D-Development
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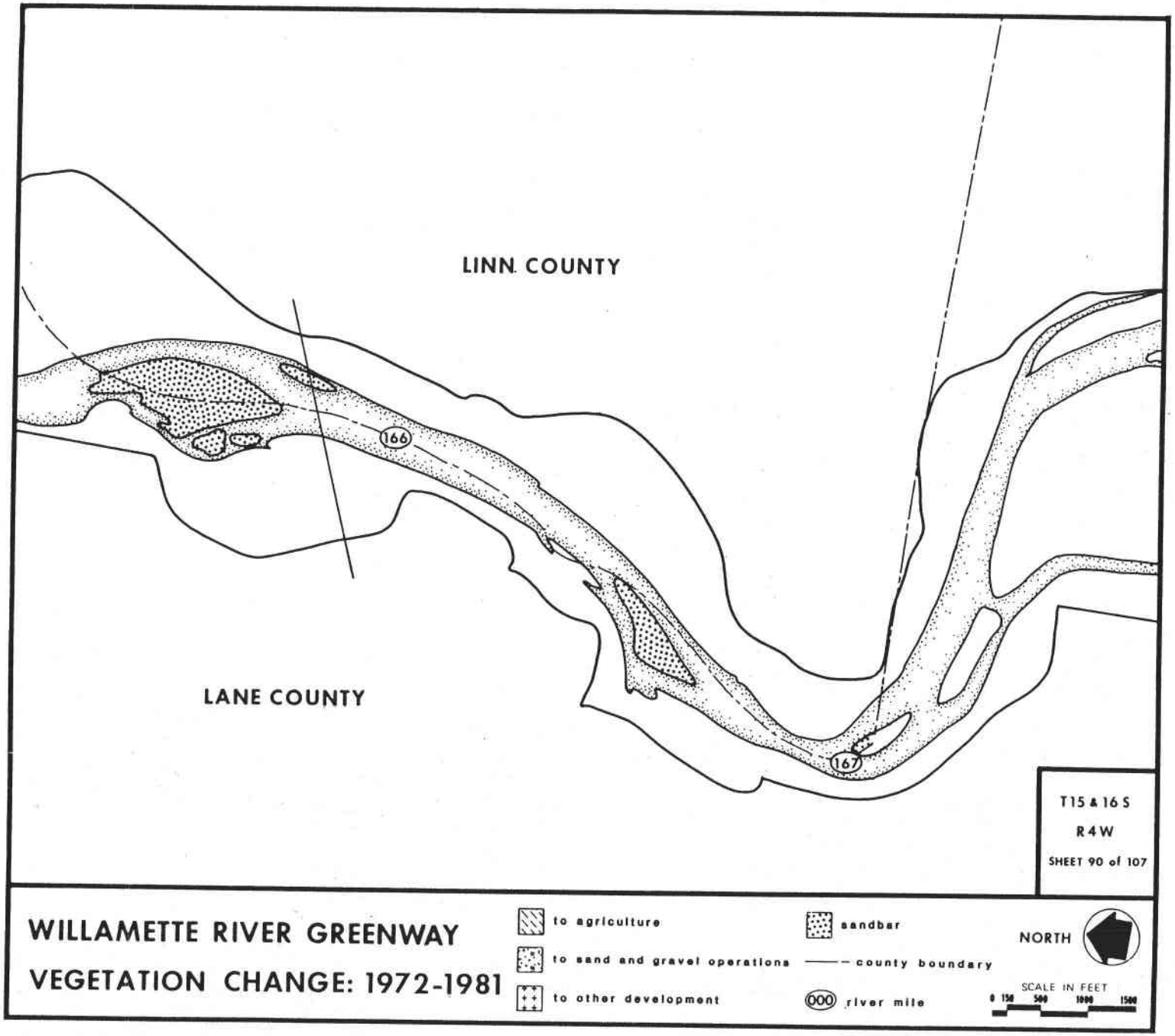
County boundary
(000) River mile


LINN COUNTY
LANE COUNTY
166
167
T15 & 16 S
R4W
SHEET 90 of 107
WILLAMETTE RIVER GREENWAY
VEGETATION CHANGE: 1972-1981
to agriculture
to sand and gravel operations
to other development
sandbar
county boundary
river mile
NORTH
SCALE IN FEET
0 150 500 1000 1500

APPENDIX 2

List of Common Vascular Plants by Occurrence in Cover Type in the Willamette River Greenway, Benton and Linn Counties

| Scientific Name[a] | Common Name | Cover Type[b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| TREES: | | | | | | | | |
| Abies grandis | grand fir | 0 | | 0 | | | | |
| Acer macrophyllum | bigleaf maple | 0 | 0 | A | | | | |
| Alnus rhombifolia | white alder | | 0 | | 0 | | | |
| Alnus rubra | red alder | | 0 | 0 | 0 | | | |
| Cornus nuttallii | Pacific dogwood | | | 0 | | | | |
| Cornus stolonifera | red-osier dogwood | | 0 | 0 | 0 | | | |
| Crataegus douglasii | black hawthorn | | A | 0 | 0 | | | |
| Crataegus monogyna | hawthorn | | | 0 | | 0 | | |
| Fraxinus latifolia | Oregon ash | 0 | A | A | 0 | | | |
| Pinus ponderosa | ponderosa pine | 0 | 0 | | | | | |
| Populus trichocarpa | black cottonwood | | A | 0 | 0 | | | 0 |
| Prunus avium | sweet cherry | | | 0 | | | | |
| Prunus emarginata | wild cherry | 0 | | 0 | | | | |
| Pseudotsuga menziesii | Douglas-fir | A | | 0 | | | | |
| Rhamnus purshiana | cascara | 0 | 0 | 0 | 0 | | | |
| Quercus garryana | Oregon white oak | 0 | | 0 | | | | |
| Salix lasiandra | Pacific willow | | 0 | | A | | | |
| SHRUBS AND SUBSHRUBS: | | | | | | | | |
| Acer circinatum | vine maple | 0 | | 0 | | | | |
| Amelanchier alnifolia | serviceberry | | | 0 | | 0 | | |
| Berberis aquifolium | Oregon grape | 0 | | 0 | | 0 | | |
| Corylus cornuta var. californica | hazelnut | A | 0 | A | | | | |
| Cytisus scoparius | Scotch broom | | | | | 0 | 0 | |
| Gaultheria shallon | salal | 0 | | 0 | | | | |
| Holodiscus discolor | ocean spray | 0 | | 0 | | | | |

| Scientific Name[a] | Common Name | Cover Type[b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| Oemlaria cerasiformis | osoberry | 0 | | 0 | | 0 | | |
| Philadelphus lewisii | mockorange | | 0 | 0 | | | | |
| Physocarpus capitatus | ninebark | | 0 | 0 | 0 | | | |
| Rhus diversiloba | poison oak | 0 | | 0 | | 0 | 0 | |
| Rosa eglanteria | sweetbrier | | | | | 0 | 0 | |
| Rosa gymnocarpa | wood rose | 0 | | 0 | | | | |
| Rosa nutkana | Nootka rose | | 0 | 0 | | 0 | | |
| Rubus discolor | Himalayan blackberry | | 0 | A | 0 | A | 0 | |
| Rubus laciniatus | evergreen blackberry | | 0 | 0 | 0 | A | 0 | |
| Rubus parviflorus | thimbleberry | | 0 | 0 | 0 | 0 | | |
| Rubus spectabilis | salmonberry | | 0 | 0 | 0 | 0 | | |
| Rubus ursinus | trailing blackberry | 0 | 0 | 0 | | | | |
| Salix fluviatilis | river willow | | | | A | | | 0 |
| Salix rigida | rigid willow | | | | A | | | 0 |
| Salix scouleriana | Scouler's willow | | | | A | | | 0 |
| Salix sessilifolia | soft-leaved willow | | | | A | | | 0 |
| Salix sitchensis | Sitka willow | | | | A | | | 0 |
| Sambucus racemosa | elderberry | | 0 | 0 | 0 | 0 | | |
| Spiraea douglasii | Douglas' spiraea | | 0 | 0 | | 0 | | |
| Symphoricarpos albus | snowberry | 0 | 0 | A | 0 | 0 | | |
| Vaccinium parvifolium | red huckleberry | 0 | | | | | | |
| HERBS AND VINES: | | | | | | | | |
| Achillea millefolium | yarrow | | | | | | 0 | |
| Agropyron repens | quackgrass | | | | 0 | | 0 | 0 |
| Agrostis alba | redtop | | | | 0 | | 0 | 0 |
| Agrostis tenuis | colonial bentgrass | | | | 0 | | 0 | 0 |
| Aira caryophyllea | silver hairgrass | | | | | | 0 | 0 |
| Amaranthus powellii | Powell's pigweed | | | | | | 0 | A |
| Anaphalis margaritacea | pearly everlasting | | | | | 0 | 0 | 0 |
| Anthemis cotula | dog-fennel | | | | | | 0 | A |
| Arctium minus | burdock | | | 0 | 0 | 0 | | 0 |

| Scientific Name[a] | Common Name | Cover Type[b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| Artemisia douglasiana | Douglas' wormwood | | | 0 | 0 | | 0 | 0 |
| Athyrium filix-femina | lady fern | 0 | | 0 | | | | |
| Barbarea orthoceras | American wintercress | | | | | | | 0 |
| Brassica campestris | field mustard | | | | | | 0 | 0 |
| Brassica nigra | black mustard | | | | | | 0 | 0 |
| Brodiaea pulchella | brodiaea | | | | | | 0 | |
| Bromus mollis | soft brome | | | | | | 0 | |
| Bromus pacificus | Pacific brome | | 0 | 0 | 0 | 0 | 0 | |
| Bromus rigidus | ripgut brome | | | | | | 0 | |
| Camassia quamash | camas | | 0 | 0 | | | | |
| Capsella bursa-pastoris | shepherd's-purse | | | | | 0 | 0 | A |
| Cardamine angulata | angled bittercress | 0 | 0 | 0 | | 0 | | |
| Cardamine oligosperma | little west. bittercress | 0 | 0 | 0 | 0 | 0 | 0 | |
| Cardamine penduliflora | Will. Valley bittercress | | | 0 | | | | |
| Carex spp. | sedge species | 0 | 0 | A | 0 | 0 | 0 | 0 |
| Chenopodium album | white goosefoot | | | | | | | 0 |
| Chenopodium ambrosioides | Mexican tea wormseed | | | | | | | A |
| Chenopodium botrys | Jerusalem oak | | | | | | | 0 |
| Chrysanthemum leucanthemum | oxeye-daisy | | | | | 0 | 0 | |
| Cichorium intybus | chicory | | | | | | 0 | 0 |
| Cirsium arvense | Canada thistle | | | | | | 0 | |
| Clematis ligusticifolia | wild clematis | | 0 | A | | 0 | | |
| Convolvulus arvensis | morning glory | | | | | 0 | 0 | 0 |
| Conyza canadensis | horseweed | | | | | 0 | 0 | A |
| Cynoglossum grande | Pacific hounds-tongue | 0 | 0 | 0 | | | | |
| Cynosurus echinatus | dogtail-grass | | | | | | A | |
| Cyperus acuminatus | short-pointed flatsedge | | | | | | | 0 |
| Dactylis glomerata | orchard-grass | | | | | | A | |
| Datura stramonium | jimson-weed | | | | | | | 0 |
| Daucus carota | Queen Anne's lace | | | | | | A | 0 |

| Scientific Name[a] | Common Name | Cover Type[b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| Daucus pusillus | American carrot | | | | | | 0 | 0 |
| Delphinium trolliifolium | Columbia larkspur | | 0 | 0 | | | | |
| Deschampsia elongata | slender hairgrass | | | 0 | | | | |
| Digitaria sanguinalis | hairy crabgrass | | | | | | | 0 |
| Disporum smithii | fairy lanterns | 0 | | 0 | | | | |
| Echinochloa crusgallii | barnyard grass | | | | | | | 0 |
| Elymus glaucus | western rye-grass | | | | | 0 | 0 | |
| Epilobium angustifolium | fireweed | | | | | 0 | 0 | |
| Epilobium paniculatum | tall willow herb | | | | | | | 0 |
| Equisetum spp. | horsetail rush | | 0 | 0 | 0 | 0 | | |
| Erodium cicutarium | filaree | | | | | | A | 0 |
| Euphorbia peplus | pretty spurge | | | | | | | 0 |
| Festuca arundinacea | reed fescue | | | | 0 | | 0 | |
| Festuca bromoides | six-week's fescue | | | | 0 | | A | |
| Galium aparine | cleavers | 0 | 0 | 0 | 0 | 0 | | |
| Galium triflorum | sweetscented bedstraw | 0 | 0 | 0 | | | | |
| Geranium molle | dovefoot geranium | | | | | | 0 | |
| Geum macrophyllum | largeleaf avens | 0 | | 0 | | | | |
| Hedera helix | ivy | 0 | | 0 | | | | |
| Heracleum lanatum | cow-parsnip | | | 0 | | 0 | 0 | |
| Holcus lanatus | velvet grass | | | | 0 | 0 | A | 0 |
| Hordeum brachyantherum | meadow barley | | | | 0 | | 0 | 0 |
| Hydrophyllum tenuipes | Pacific waterleaf | 0 | | 0 | | | | |
| Hypericum perfoliatum | common St. Johnswort | | | | | 0 | 0 | 0 |
| Hypochaeris radicata | cats-ear | | | | | | 0 | 0 |
| Juncus spp. | rush | | | 0 | | | 0 | |
| Kickxia elatine | cancerwort | | | | | | | 0 |
| Lactuca serriola | prickly lettuce | | | | | | 0 | 0 |
| Lamium purpureum | red dead-nettle | | | | | 0 | 0 | |
| Lathyrus spp. | peavine species | | | | 0 | 0 | | 0 |
| Leontodon nudicaulis | hairy hawkbit | | | | | | 0 | 0 |
| Lolium multiflorum | Italian ryegrass | | | | | | 0 | 0 |

| Scientific Name [a] | Common Name | Cover Type [b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| Lolium perenne | perennial ryegrass | | | | | | 0 | 0 |
| Lomatium utriculatum | spring-gold | | | | | | 0 | |
| Lotus spp. | lotus species | | | | | | 0 | 0 |
| Lupinus micranthus | field lupine | | | | | | 0 | |
| Luzula campestris | field woodrush | 0 | | 0 | | | 0 | |
| Lysichitum americanum | western skunkcabbage | | 0 | 0 | 0 | | | |
| Madia madioides | Chilean tarweed | | | | | | 0 | |
| Marah oregana | manroot | 0 | 0 | 0 | 0 | 0 | | |
| Melilotus alba | white sweet-clover | | | | 0 | | | 0 |
| Mentha arvensis | field mint | | | | | | | 0 |
| Mertensia platyphylla | western bluebells | | | 0 | | | | |
| Montia perfoliata | miner's lettuce | | | 0 | | | | |
| Montia sibirica | western springbeauty | 0 | 0 | 0 | | | | |
| Mollugo verticillata | carpetweed | | | | | | | 0 |
| Navarretia squarrosa | skunkweed | | | | | | 0 | 0 |
| Oxalis suksdorfii | western yellow wood-sorrel | 0 | | 0 | | | | |
| Panicum capillare | common witchgrass | | | | | | | 0 |
| Phalaris arundinacea | reed canarygrass | | A | 0 | A | A | A | 0 |
| Phleum pratense | timothy | | | | | | 0 | |
| Phytolacca americana | pokeberry | | | | | | | 0 |
| Plantago lanceolata | ribwort plantain | | | | | | 0 | 0 |
| Plantago major | broadleaf plantain | | | | | | | 0 |
| Poa annua | annual bluegrass | | | | | 0 | 0 | |
| Poa pratensis | perennial bluegrass | | | | | | 0 | |
| Polygonum aviculare | doorweed | | | | | | 0 | A |
| Polygonum persicaria | heartweed | | 0 | | 0 | | | A |
| Polygonum sachalinense | giant knotweed | | | | 0 | | | |
| Polypodium vulgare | licorice fern | 0 | 0 | 0 | | | | |
| Polystichum munitum | sword fern | 0 | | 0 | | | | |

| Scientific Name [a] | Common Name | Cover Type[b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| Potentilla anserina | common silverweed | | | | | | | 0 |
| Prunella vulgaris | heal-all | | | | 0 | | 0 | 0 |
| Psilocarphus tenellus | slender wooly-heads | | | | | | 0 | 0 |
| Pteridium aquilinum | bracken-fern | | 0 | 0 | 0 | 0 | 0 | |
| Ranunculus uncinatus | little buttercup | 0 | 0 | 0 | | | | |
| Rorripa curvisiliqua | western yellowcress | | | | | | | 0 |
| Rumex acetosella | sheep sorrel | | | | | | 0 | 0 |
| Rumex conglomeratus | clustered dock | | | 0 | 0 | | | 0 |
| Rumex crispus | curly dock | | | 0 | 0 | | | 0 |
| Saponaria officinalis | soapweed | | | | 0 | | | 0 |
| Senecio jacobea | tansy ragwort | | | | 0 | 0 | 0 | 0 |
| Senecio vulgaris | common groundsel | | | | | | 0 | 0 |
| Smilacina stellata | starry false Solomon's seal | 0 | | 0 | | | | |
| Solanum dulcamara | bittersweet | | 0 | A | 0 | | | |
| Solanum nigrum | black nightshade | | | 0 | 0 | 0 | | 0 |
| Stachys cooleyae | Cooley's hedge-nettle | 0 | 0 | 0 | | | | |
| Stachys rigida | rigid hedge-nettle | | 0 | 0 | | | | |
| Stellaria media | chickweed | | 0 | 0 | 0 | 0 | A | 0 |
| Tanacetum vulgare | common tansy | | 0 | | 0 | | 0 | A |
| Taraxacum officinale | dandelion | | | | | | 0 | 0 |
| Tellima grandiflora | fringecup | 0 | 0 | A | 0 | | | |
| Thalictrum occidentale | western meadowrue | 0 | 0 | 0 | 0 | | | |
| Tolmiea menziesii | youth-on-age | 0 | 0 | 0 | | | | |
| Trifolium spp. | clover species | | | | 0 | | 0 | 0 |
| Urtica dioica | stinging nettle | | A | A | 0 | 0 | | |
| Verbascum blattaria | moth mullein | | | | | | 0 | 0 |
| Verbascum thapsus | common mullein | | | | | | 0 | 0 |
| Veronica americana | American brooklime | | | | | | 0 | 0 |
| Vicia spp. | vetch species | | | | | 0 | A | |

| Scientific Name [a] | Common Name | Cover Type[b] | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CF | TDF | LDF | NS | BS | G | S |
| Viola adunca | early blue violet | | | | | | 0 | |
| Viola glabella | yellow violet | 0 | 0 | 0 | | | | |
| Xanthium strumarium | cocklebur | | | | | | | 0 |

[a] Nomenclature follows Hitchcock and Cronquist (1973) and binomial authors have not been included. Listed taxa have been observed in the Willamette River Greenway. Abundances and distributions are approximate. No detailed floristic plots have been taken. The best floristic description is in Hall (1976).

[b] Cover types follow description in the text: CF - Coniferous Forest; TDF - Tall Deciduous Forest; LDF - Low Deciduous Forest; NS - Narrowleaf Shrub; BS - Broadleaf Shrub; G - Grassland; S - Sandbar. Abundances are indicated by: A - abundant or dominant in cover type; O - occasional in cover type.

It should be noted that the Narrowleaf Shrub (NS) cover type represents higher stabilized bars and that the Sand Bar (S) cover type represents newly formed unstable cobble, gravel and sand bars.