



FERNHILL WETLANDS
CONCEPT MASTER PLAN

June 1992

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A special thanks to Michael Wilhelm
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INTRODUCTION



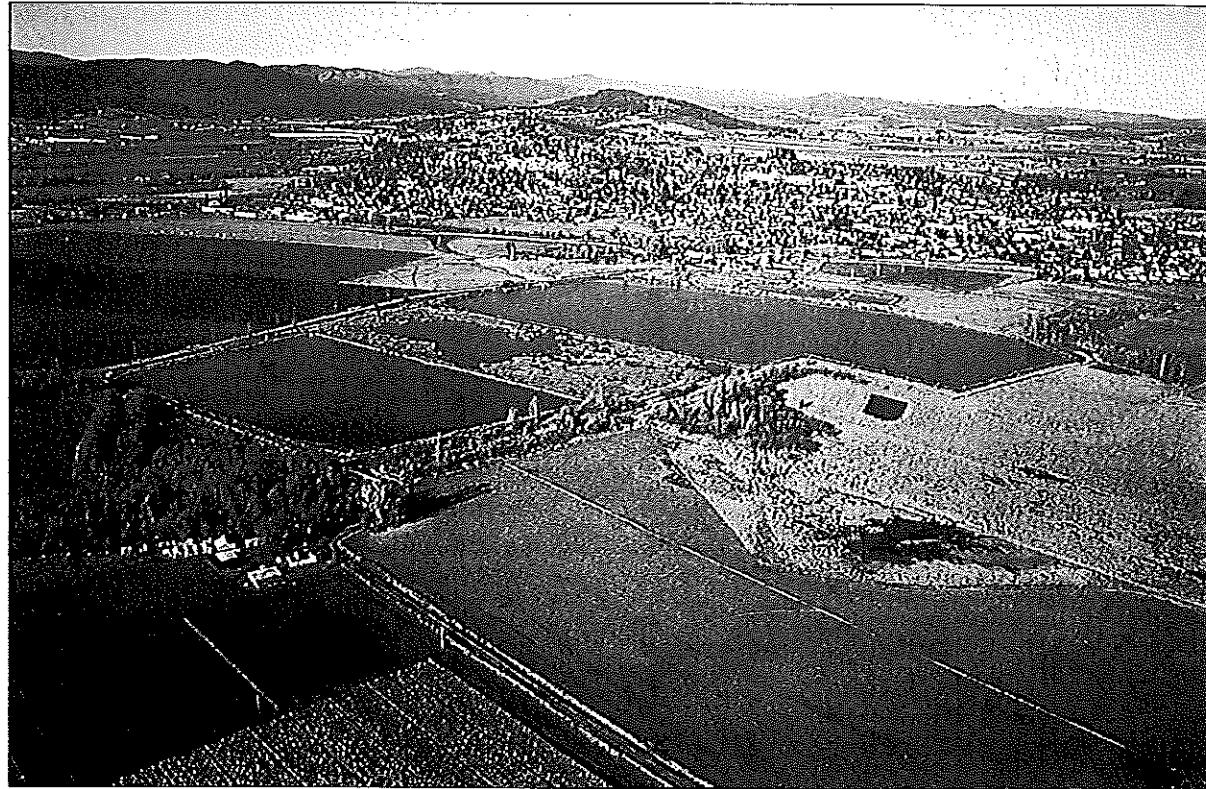
INTRODUCTION

As a result of past land use practices and developmental pressures, wetlands throughout the country have been disappearing at an alarming rate. However, increased understanding has developed in recent years of the important natural resource and humanistic values provided by wetland systems. The benefits generated from preservation and enhancement of wetlands can be enormous; including improved water quality, provision of critical habitat for a variety of plants and animals, provision of recreational and educational opportunities, and the protection of valuable open spaces throughout the urban area.

The Fernhill Wetland is located on the southerly edge of the city of Forest Grove and offers a unique opportunity for wetland and wildlife enhancement that will bring pride to the community and become a model for use in other areas. The wetland in this area consists of approximately 100 acres, 20 acres of which is presently managed by the Unified Sewerage Agency for water quality and wildlife enhancement. Fernhill's location at the apex be-

tween the Willamette and Yamhill flyways provides critical habitat to a great diversity of migratory birds and water fowl. The close proximity to urban areas also provides an excellent opportunity to educate the public about the role of wetlands in our environment and offers a premier site for viewing wetland dependant wildlife, while also providing a means for improving water quality for water entering the Tualatin River.

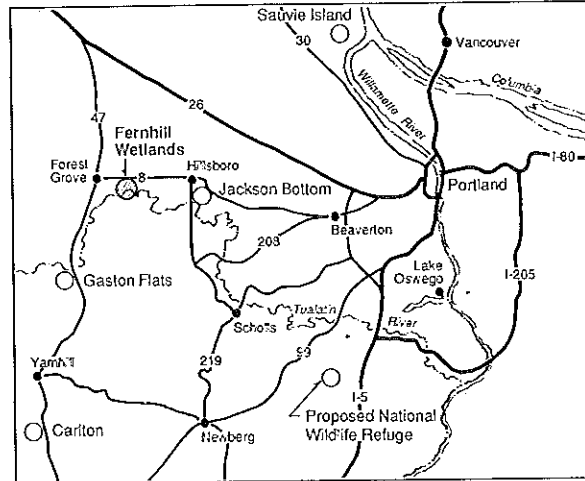
The Fernhill Wetland is a critical link in the chain of regional wetlands that provide habitat and forage for a host of migratory and wintering waterfowl as well as a variety of resident fish and wildlife. From late fall to early spring, thousands of geese, swans, ducks and other waterfowl flock to the area, providing the region with one of its finest and most well renowned bird viewing sites. The Metropolitan Service District recognized the unique value of this area in 1991 through a federal grant for wetland enhancement. Fernhill was one of 14 project areas to have been selected for the METRO Greenspaces Program.



Aerial View of Fernhill Wetlands



View of Fern Hill Across the Wetland



Location Map

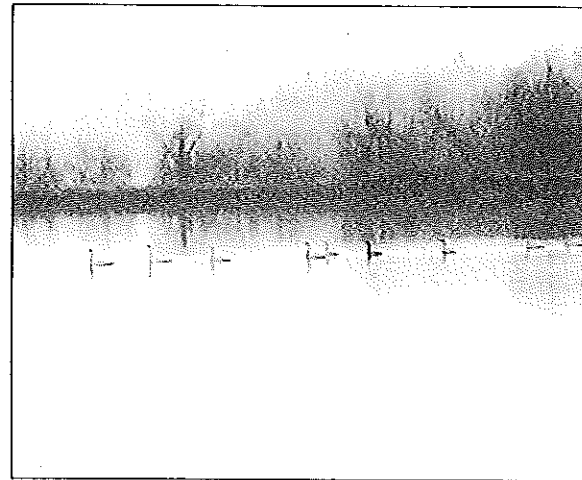
PLANNING BACKGROUND

For a number of years, local waterfowlers have expressed concerns about the developmental encroachment of city, industry, and urban housing which threatens the traditional wetland and waterfowl areas adjacent to the Unified Sewerage Agency property south of Forest Grove. This site was identified early in 1990 by representatives of Oregon Waterfowl and Wetlands Association and the Wetlands Conservancy, who initiated an effort to create a 'Jackson Bottom' like project on the property. Early planning efforts received enthusiastic support from the Unified Sewerage Agency, and during the winter of 1990, a Memorandum of Intent was prepared and agreed upon by the three organizations, officially launching the Fernhill Wetlands project. A copy of the Memorandum of Intent is included in Appendix A. The base of participation was then expanded to incorporate expertise from numerous public and private organizations, including the City of Forest Grove, the Forest Grove Chamber of Commerce, Portland Audubon Society, Ducks Unlimited, Oregon Department of Fish and Wildlife, and the Oregon Hunters Association. Representatives from each organization first met on January 30, 1991 to form

the Fernhill Wetlands Management Council. The group then began to cooperatively develop the initial concept for the Wetlands into a phaseable master plan. The Council clearly recognizes the important environmental asset Fernhill offers and is committed to managing, protecting, and enhancing this unique wetland and riparian area with the best interest of local and regional communities in mind.



Local Residents Admiring Passing Ducks



Swans on the Large Pond

COMMUNITY INVOLVEMENT

Citizen involvement in local issues is essential in developing a strong sense of pride in the community and creating a vision for the future. As the City of Forest Grove has grown over the past few years, residents have clearly begun to recognize the significant treasure that Fernhill Wetlands can provide to the community.

Numerous community groups have already taken an interest in becoming involved in the project, and the Fernhill Wetland Council is committed to increasing public exposure to the area. Community efforts currently underway include the following:

- The Council is in the process of preparing a signage program and informational brochures for dissemination to schools and local organizations.
- Efforts have been initiated to promote a "Friends of Fernhill Wetlands" organization that might aid in securing independent funding sources and volunteer laborers.
- The retired community has expressed interest in volunteering for planting and maintenance efforts.

- Pacific University in Forest Grove has expressed interest in using the wetlands as an outdoor laboratory for student research projects.
- The recent application nominating Forest Grove for an All-American City Award listed the Fernhill Wetlands as one of the city's major assets for building community pride and participation.

As the project is developed, many additional opportunities for community involvement and civic education will arise. The biological diversity of the site makes it ideally suited for use as an outdoor classroom for primary and secondary schools. Planting, trail construction and maintenance can be undertaken by citizen groups. As these community efforts work hand-in-hand with overall planning efforts, a comprehensive project can be created in which all participants receive a strong sense of pride and commitment.

EXECUTIVE SUMMARY



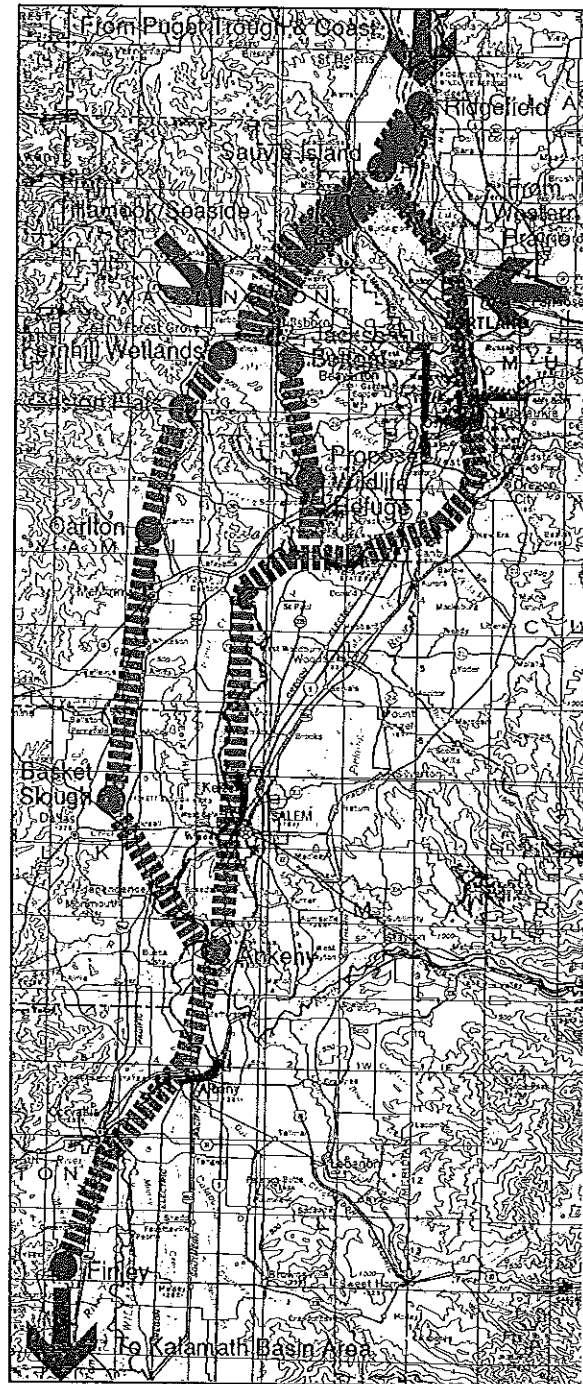
EXECUTIVE SUMMARY

VALUE OF THE MASTER PLAN

The Fernhill Wetlands Master Plan provides an exciting vision of the future which brings together diverse interest groups in a single effort to enhance the environment of the region. The master plan also provides a set of goals, objectives, and priorities for the community, offering direction to local citizens and service groups who wish to get involved. As the plan is developed and integrated into land use plans in the area, the benefits to wildlife and the community will multiply in a very positive manner.

It is well recognized that wetlands are among the most productive natural ecosystems in the world. Protection and enhancement of these sensitive areas provides numerous benefits including: food and habitat for fish and wildlife, water quality improvement, flood protection, erosion control, opportunities for recreation and education, and aesthetic appreciation. In addition to providing all the aforementioned benefits, the Fernhill site also functions as an integral part of a complex system of wetlands that provide forage and resting sites for a diversity of migratory waterfowl passing through the region annually. As Fernhill is developed, it will become a pearl in the "Necklace" of regional wetlands and wildlife refuges that circle the Portland metropolitan area. They include the proposed Ridgefield National Wildlife Refuge, Sauvie Island, Fernhill, Jackson Bottom, Gaston Flats, Carlton, the proposed national wildlife refuge near Sherwood, Basket Slough, Ankeny and Finley. This regional significance provides not only benefits to the wildlife, but will also attract tourists and wildlife enthusiasts.

The preservation of these important open spaces also offers tremendous potential for enhancing the quality of life for future generations. As pressure on remaining tracts of undeveloped land increases, it becomes even more critical to protect the traditional rural and agricultural characteristics of this



Major Flyways Through the Region



Agricultural Character of the Area



Resident Waterfowl Enjoying the View of Mt. Hood

region. By utilizing the vast flood plains of the region as a framework for an open space system, rural quality can be preserved, agricultural productivity of the area can be maintained, and urban areas can be provided with an outlet for recreation and aesthetic enjoyment.

A final benefit of the Master Plan is the potential of Fernhill to become a regional model for the agricultural use of wastewater. The area will be used to "showcase" numerous methods of crop production through extensive use of irrigation of treated wastewater.

THE MASTER PLAN

The concept master plan is described in detail in Chapter V. Key components of the plan include the following:

- Wetlands will be constructed using treated wastewater to polish the water before it enters the Tualatin River.
- Existing natural wetlands will be enhanced and expanded to attract wildlife.
- The use of treated water for irrigation will be expanded creating a showcase of various methods for combining agricultural production and water quality enhancement.
- Wetlands will be constructed to capture and filter stormwater runoff before it makes its way to the Tualatin River.
- Wildlife habitat will be enhanced and expanded through the development of a complex system of wetlands, open areas and forest, to encourage a greater diversity of wildlife.
- A trail system will be developed allowing pedestrian access to selected portions of the site.
- Interpretive signage will be provided to inform visitors of the unique features of the area.
- Parking and viewing areas will be provided allowing greater public access to the site.
- On-site research will be encouraged, contributing information to the base of knowledge regarding use of treated wastewater for wildlife enhancement and food production.

AREA HISTORY



AREA HISTORY

The present geological condition of the Tualatin River Valley stretch back to the end of the last ice age, nearly 11,000 years ago. At that time, a mammoth ice dam across western Montana collapsed under the incredible force of the melting glaciers. When the dam burst, thousands of square miles of water raged down the Columbia River system, inundating lowlands to the 500 foot elevation, including the Willamette and Tualatin Valleys. Vast amounts of sediment remained when the waters finally receded 4,200 years ago, creating a flat valley floor with deep, rich, soil.

THE LAND

The central portion of the Tualatin Valley is nearly level and covered with deep sedimentary deposits, which reach a thickness of over 1,300 feet near the city of Hillsboro. The middle and lower stretches of the Tualatin River, now a sluggish waterway, cross this level plain. Due to its flat gradient and minimal current, the river's course, and hence the surrounding area, has changed very slowly over the centuries. Except for the undercutting of river banks and the ever-shifting oxbows resulting from occasional major floods, the valley has not been subjected to much downward erosion over the past 2,300 to 3,000 years.

This lack of downward erosion can be directly attributed to basalt formations which are located near the surface of the valley in several locations. The high erosional resistance of basalt means that the downward cutting power of the river has been effectively reduced. A basalt formation southeast of Fernhill Wetlands, between Laurel Ridge and Bull Mountain, has acted as a check-dam, slowing the rate of erosion and keeping the river gradient nearly flat along most of its length. The erosion that does occur is primarily due to the river meandering back and forth across the basalt base.

Because so little sediment has been carried out of the valley by the river system, it can be assumed

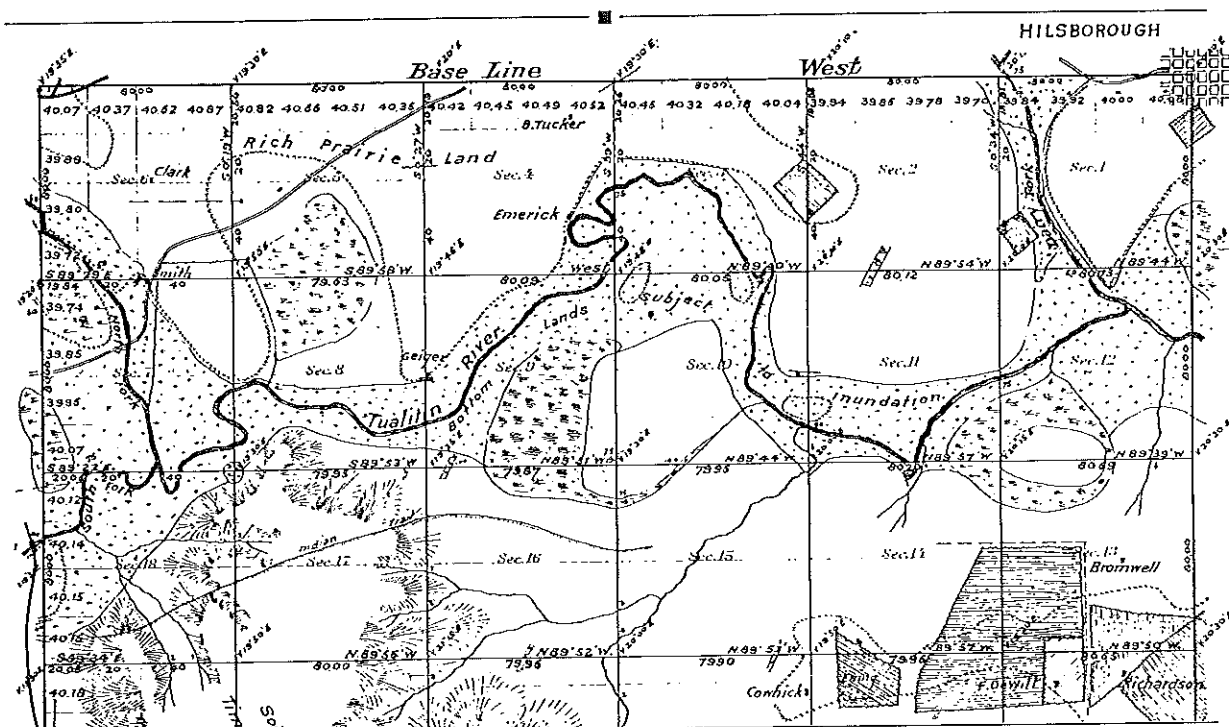
that present topographic conditions have existed at least since the end of the last ice age. Indeed, the upper portions of the Tualatin Valley have actually gained in sediment. Younger alluvium soils have been carried down from the coast range, gradually building up the river bottoms. These soils, high in both organic materials and clays, are, in a sense, just passing through, carried as they are by successive winter floods. The consolidation of rich, slow draining soil, and constant replenishment, creates an ideal wetland environment throughout the central valley, including Fernhill Wetlands.

EARLY INHABITANTS

Members of the Atfalati tribe of the Kalapuya linguistic group, are known early users of the land surrounding the Tualatin River. Evidence suggests that an earlier group of big game hunters roamed the region but were willing to cede it to the northward migrating Kalapuyas. With the falls at Oregon City blocking any large-scale salmon runs on the Willamette or its tributaries, perhaps the earlier inhabitants considered the region to have little value.

Yet, the Atfalati made good use of what was available, hunting small game and collecting plants such as camas, wapato, wild onion, seeds, and nuts. Additionally, they ranged widely across the region, travelling as far as Tillamook Bay and the Columbia River for salmon, though they remained centered at Wapato Lake just southwest of the Fernhill area.

The mainstays of the Atfalati diet were waterfowl, bulbs of the flower called camas, and tubers of an arrow-leaved water plant called wapato. Conjecture also holds that the Atfalati ate insects, i.e., grasshoppers, caterpillars, and yellow jacket larvae, although this assumption is based on the knowledge that other Kalapuya tribes did so. Nonetheless, the marsh would have been a prime habitat for such creatures.



DLC Map

Without a dependable and plentiful food source, such as the fall salmon runs, the Atfalati initiated the practice of burning the plains, clearing the dense wooded vegetation in favor of the broad grasslands. On these plains above the river, the tribe collected seasonal plant foods across what had become an excellent habitat for deer and elk.

Begun in pre-historic times, field burning continued until the arrival of white settlers in the 1830's. By this time, much of the valley floor had been transformed into a grass covered plain. Areas within the flood plain remained more or less in their natural wooded state, although in particularly dry seasons, sections of lowland were known to burn. Nevertheless, compared with the almost total destruction of the forested plains, the marsh remained basically unchanged in character.

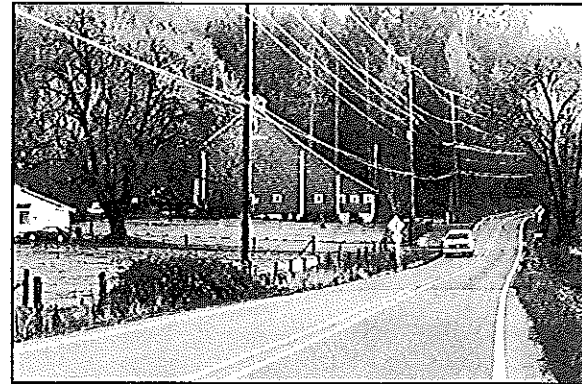
When the Atfalati used the bottom land, it was primarily for hunting small game and waterfowl, and for root gathering. It is recorded that fishing

was fairly poor, though some freshwater fish and lamprey eel were caught. Additionally, the river was regarded more as an obstacle than as a transportation route by the tribe.

Seasonal use of the site is known, but no significant village finds have been identified. Archaeologists have found simple utensils such as bowls, mortars, pestles, and mauls in the general vicinity. Additional scattered arrowheads and other items have also been found by landowners. The tribe's main winter camp was at Wapato Lake, however, an outlying camp is known to have occurred in the Forest Grove area. This site would have been composed of semi-subterranean houses dug in shallow, circular pits, and covered with earth. All of these sites have been found above the 160 foot contour (the marsh lies below the 140 foot contour). Only temporary summer shelters of brush would have been located within the marsh.



Historic Fernhill Farmhouse Bordering Site



Historic Barn

SETTLEMENT ERA

By the 1830's, a majority of the Atfalatis were dead, killed off by the same diseases which had swept the continent with the arrival of the Europeans; smallpox and malaria brought by the fur trappers took the largest toll. Virtually decimated, (and gone completely by 1838), the Atfalati left an agricultural treasure as their legacy: the broad fertile plains of the Tualatin Valley.

The first use of the Tualatin Valley by Caucasians was as summer pasture for the cattle of Fort Vancouver, presaging the agricultural value future settlers would place on the area. Soon after, retired trappers began to settle the valley and establish the makings of a permanent settlement. The first American settlers arrived in the 1840's.

The Eastern Tualatin Valley was one of the first areas settled in the Oregon territory after the Hudson Bay Company's Fort Vancouver. Under the system of Donation Land Claims (DLC's), a majority of the high quality agricultural lands were claimed by 1852. Split by the claims of three men, the Fernhill Wetlands area was considered of only minor usefulness. Most of these DLC's remained on the northern side of the valley. The Tualatin River floodplain, including Fernhill, hindered access to the south for several decades.

Among the early land claims in the Fernhill area were the homesteads of Alvin T. Smith, William Yates, Solomon Emerick, and William Geiger. The Smith DLC bordered the marsh on the west, while the Yates, Emerick and Geiger claims split the bulk of the marsh proper, according to the 1852 Donation Land Claim survey map.

RECENT TIMES

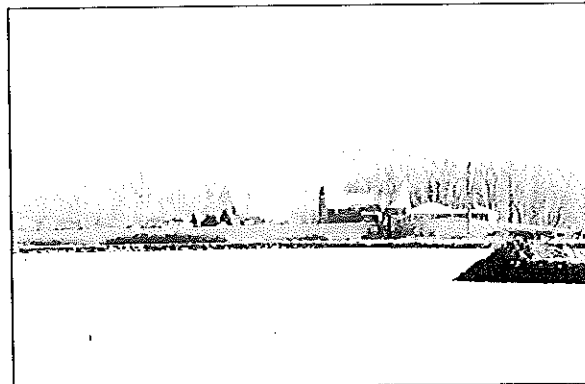
For the better part of this century, the site has predominately been used for agricultural purposes. On-site irrigation began in 1938 through the City of Forest Grove Sewage Treatment Plant. Between the period of 1954-1963, irrigation was expanded to encompass the land currently owned by the City of Forest Grove. Squash, cucumbers, and barley were grown in the area of the existing storage ponds and some sheep grazing was allowed. The area of the southern-most storage pond was part of a hop farm owned by the historic Fernhill Farm just south of the river. The old stream pattern cut diagonally through the north pond and flowed into a swampy area, where the natural wetland presently exists, before emptying into the Tualatin River.



USA Storage Ponds

The storage ponds were constructed in 1964 and wheat crops were planted between 1964-1969. Sheep grazing continued until 1969 and was replaced by cattle grazing from 1970 to 1989.

The Unified Sewerage Agency took over operation of the sewage treatment plant in 1971 and expanded irrigation throughout their property to the west. Current management plans call for the Forest Grove plant to be used for winter-time liquid operations only. Pumping will occur between the Rock Creek and Forest Grove plants. During the summer, all wastewater will be sent to the Rock Creek plant for treatment. A more purified class 4 water will be pumped back to Forest Grove for irrigation purposes.



Upper Storage Pond



Middle Pond



Lower Pond

EXISTING CONDITIONS



EXISTING CONDITIONS

LOCATION

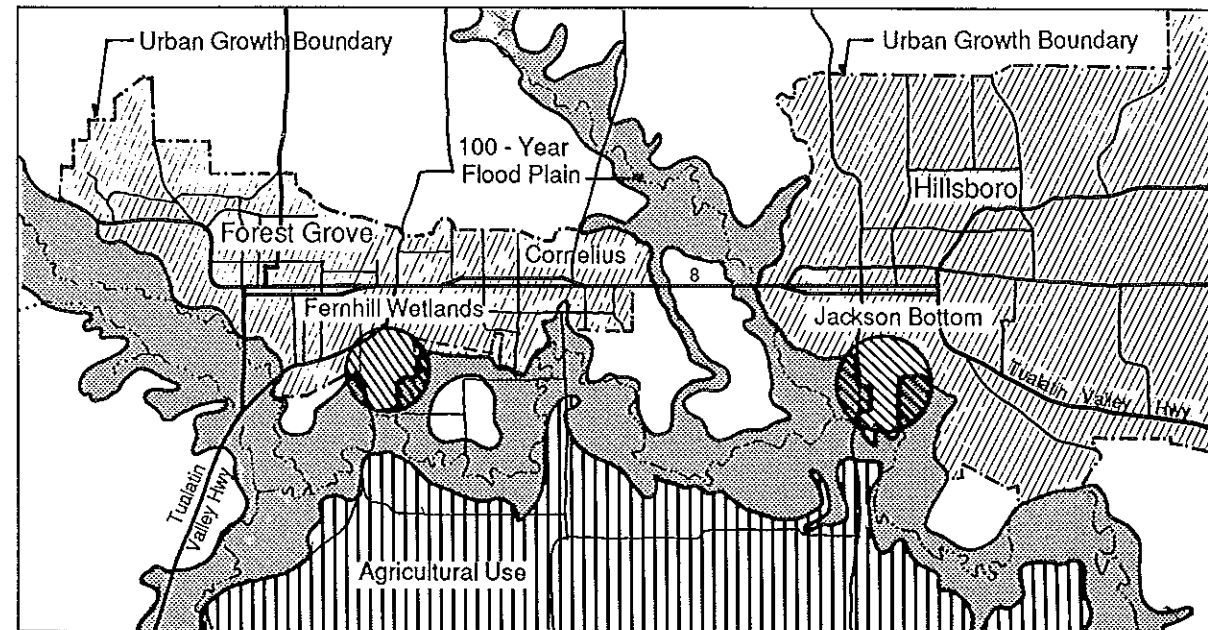
The Fernhill study area consists of 160 acres situated to the south of Highway 47 and to the southeast of the Forest Grove central business district. The site extends over one half mile west of Fernhill Road, eastward toward Lafollette Road and south to the Tualatin River. The northern boundary is formed by the Southern Pacific Railroad and the Tektronix campus.

CLIMATE

This area experiences a mild marine climate due to prevailing winds from the Pacific Ocean, which greatly moderate the colder temperatures of winter and heat of summer. Rainfall is most pronounced during the winter with an annual precipitation of 40 inches. Plentiful moisture and moderate temperatures contribute to a long and fruitful growing season of 220 days.

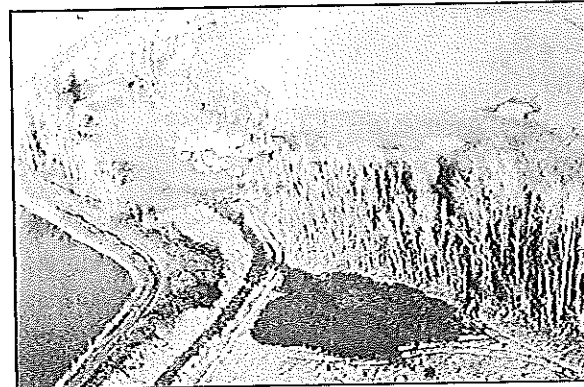
SITE CHARACTER AND VEGETATION

The Fernhill Wetland area is typical of the low-lying flatlands of the upper Tualatin River basin and is not unlike the vegetation communities found at Jackson Bottom a few miles to the east. The entire area, prior to the construction of the Forest Grove Wastewater Treatment plant in 1953, was given over to various sorts of agricultural uses including dairy farm pasture, truck gardening, grains, nuts and small fruits. Areas of excessive moisture were either drained or left unattended and subsequently were invaded by reed canary grass choking out less robust native sedges, rushes and other emergent wetland species. The wastewater ponds provide large open water habitat for resident and migratory waterfowl and shore birds. The Unified Sewerage Agency is, however, permitting the control pond (middle pond) to revert back to an emergent wetland situation with its entire community of emergent vegetation. A complete inventory of this area has not yet been done but will be completed during the 1992 spring growing season.



Context Map

The farmland area to the north-east of the wastewater lagoons is crossed by a stream with well established ash and cottonwood riparian growth. This portion of the site, like a large area to the south, has been invaded by reed canary grass. However, a recent METRO Greenspaces grant funded the excavation in this area to provide open, braided stream channels which will be planted with shrub-scrub vegetation to complement the existing and undamaged ash gallery. This forested area contains many large dead trees that provide excellent perching sites for heron and raptors.



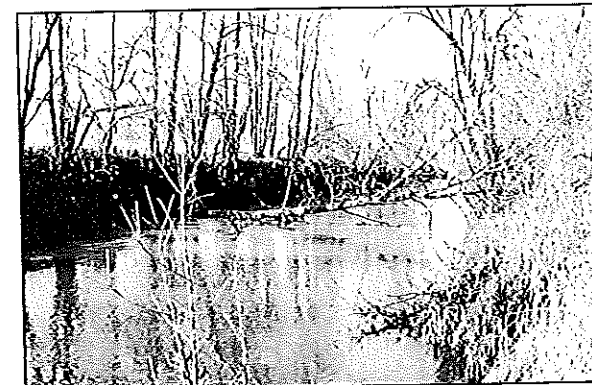
Aerial View of New Freshwater Wetland

To the south of this forested wetland, and east of the three storage ponds, the stream has been straightened and channelized. The low area east of the stream is very wet and is largely overgrown with reed canary grass. There are thriving remnants of forested wetlands scattered through this area which probably, at one time, defined the natural stream meanders. There are also areas of scrub-shrub wetland on this part of the site, the largest of which is on the western portions of the neighboring properties to the southeast. An ash-cottonwood riparian strip borders the channelized stream all the way to its juncture with the Tualatin River just south of the Geiger Road bridge.



Existing Natural Wetland East of the Storage Ponds

The river takes a large northward meander through the southern part of the Fernhill Wetland territory and is bounded on both sides by typical riparian trees and understory. This vegetation mix is mostly ash with a few douglas fir and areas of predominately Oregon oak. Some of the ash and oak are of large size, up to 30" diameter. Dead trees are well dispersed along the banks, and beaver have recently cut down several ash along the river. The understory contains Oregon grape, snowberry, nootka rose, elderberry, wild current, salmonberry, red osier dogwood, trailing and Himalayan blackberry, bracken, reed canary grass and many unidentified herbaceous species. This habitat is very diverse with an abundance of native fruiting species attractive to wildlife.



Tualatin River

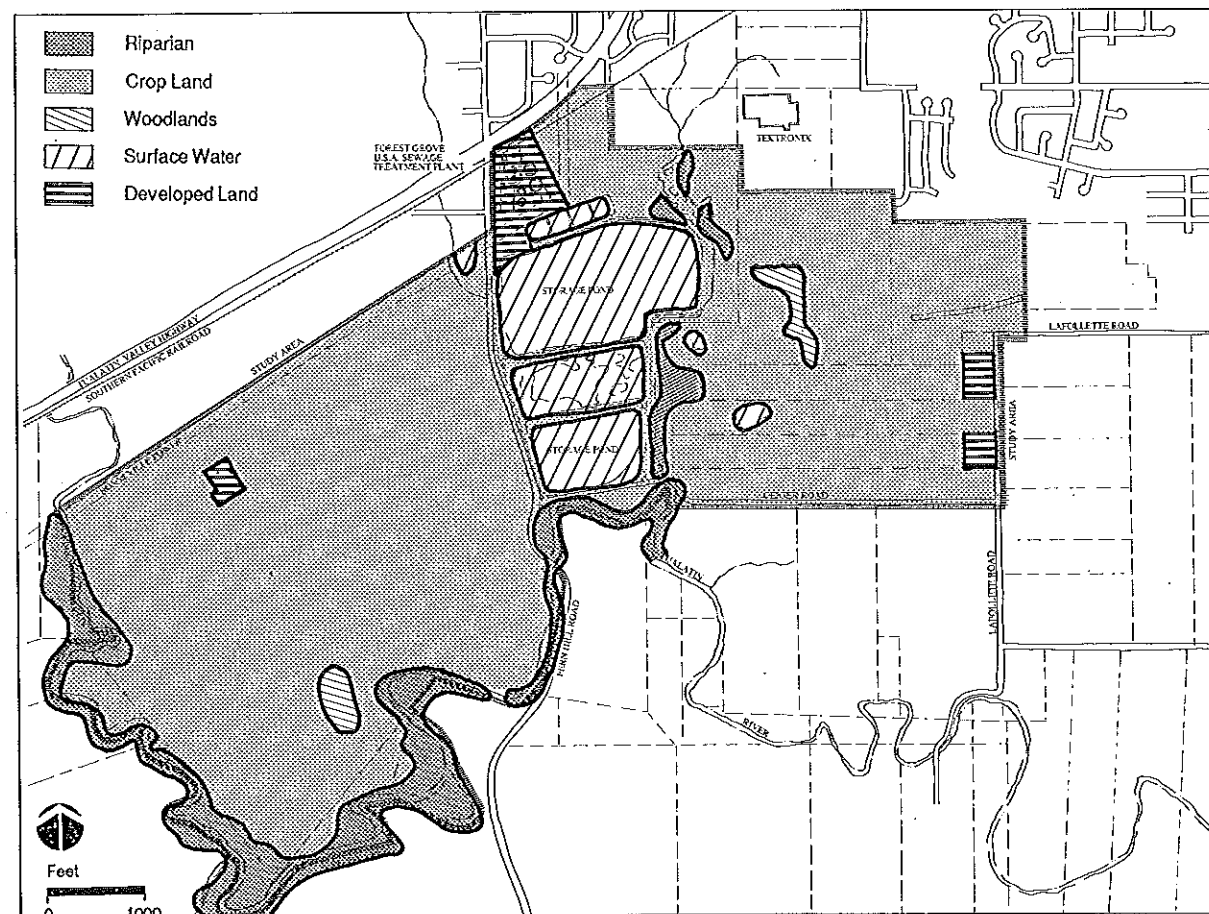
The triangular fill area between Geiger Road and the river south of the treatment ponds has been filled in years past and now contains teasel, Canadian thistle and other plants typical to disturbed sites. This triangular area is proposed for eventual public parking, river access and treatment pond observation blinds. A buffer strip of native vegetation will be planted between Geiger road and the parking area.



Site for Proposed Parking

West of Fernhill Road the land is regularly used for agriculture except for an emergent wetland area in the northeast corner. This wetland was recently employed as a mitigation site for some wetland fill involved with the new Taylor Industrial Park. This mitigation work is small and in-

involved the excavation of shallow ponds to provide more year-round open water habitat for resident waterfowl and wading birds.



Site Vegetation

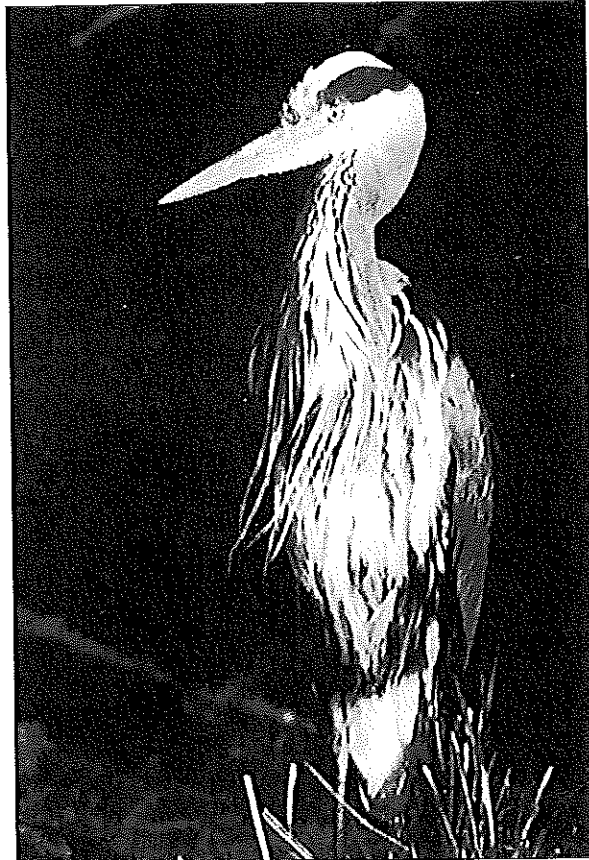
WILDLIFE

The Fernhill Wetlands Study area has a diversity of wildlife habitat types that provide a unique resource for the county. These habitat areas include the effluent storage ponds, the Tualatin River, small woodlots, mowed, irrigated fields, and reed canary grass wetlands. The greatest wildlife use occurs in the winter because of migrating waterfowl, but there is also significant use in the spring and summer by a variety of birds, mammals, reptiles, and amphibians.

Presently, the effluent lagoons attract several thousand ducks, geese, swans, and miscellaneous shorebirds during the winter. The unusual variety of diving ducks that use the lagoons make the area especially valuable to bird watchers. These birds include: canvasback, scaups, ring-necks, buffleheads, hooded mergansers, american mergansers, ruddy ducks, and several species of grebes. Shorebirds including sandpipers, yellowlegs, dowitchers, snipe, and killdeer use the mudflats created when the lagoons are drained. Great blue herons are very common users of the lagoons because of the excellent food supply provided by carp and other small fish. Common egrets are also seen in the winter and early spring.

The slow moving Tualatin River provides a variety of habitat for fur bearers such as beaver, nutria, and mink. (In addition to a variety of reptiles, amphibians, and waterfowl.) The adjacent riparian forest provides cover and nesting habitat for herons, wood ducks, mergansers, woodpeckers, red-tailed hawks, owls, and a variety of songbirds including sparrows, finches, and warblers.

Several small woodlots are present on the study area. They are unique because they have a lot of old dead snags. These provide valuable habitat for cavity nesting birds such as swallows, wrens, chickadees, flickers, kestrels, woodpeckers, wood ducks, and hooded mergansers. There are also



Great Blue Heron

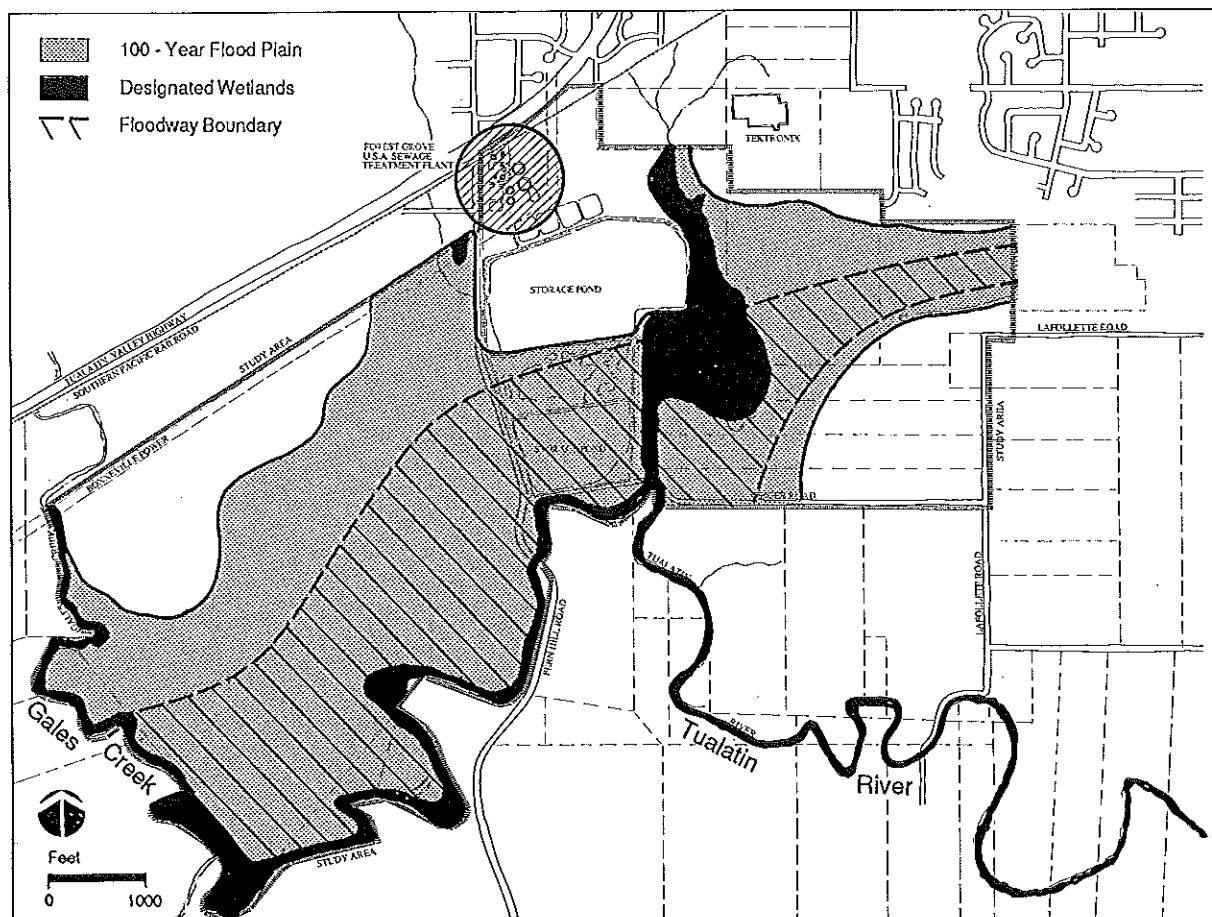
HYDROLOGY

Lying almost completely within the 100 year flood plain, the entire Fernhill Wetland study area is subject to winter-time flooding which regularly blocks traffic on Fernhill and Geiger Roads. This annual flooding adds to the wetland characteristic of the central portion of the site where water often stands well into the spring. High water commonly reaches to the 176 foot elevation and is sometimes much higher.

The Forest Grove Wastewater Treatment Plant, operated by the Unified Sewerage Agency, is located on the northern corner of the site just south

of Highway 47. The land managed by USA includes three effluent storage ponds covering 80 acres and irrigatable agricultural fields covering 70 acres.

The effluent storage ponds are situated on the flood plain adjoining the Tualatin River. The southern end of the southernmost pond is located about 100 feet from a meander bend of the Tualatin River at about river mile 55. The WWTP lies in a topographically higher position to the north of the ponds on a terrace above the flood plain. The area was protected from flood waters resulting from historic floods of 1933 and 1964 in which the area, including the ponds, was under water.



Hydrology Map



On-Site Tributary Stream



Newly Constructed Emergent Marsh

Wetlands and Streams. The study area is bounded by Gales Creek to the west and the Tualatin River to the south. A network of surface drainage ditches, subsurface drains, and creeks also flow through the site and ultimately discharge into the Tualatin River.

A natural tributary stream which carries much of the stormwater runoff from eastern Forest Grove enters the site from the north, just west of the Textronix campus, and flows along the east of the USA treatment ponds. As the stream nears the Tualatin River it broadens to form an emergent wetland. Additional natural wetlands lie to the east of the stream.

With the aid of a federal grant from the Metro Greenspaces Program, the Fernhill Wetlands Council is currently in the process of developing a 7 acre emergent marsh fed from the aforementioned tributary stream. The marsh edges are tapered at a 20:1 slope to create water levels from 3 inches to 3 feet. This allows for the establishment of a diversity of new aquatic plant such as cattails, bulrush and sedges.

Groundwater. The principal aquifers used in the region occur in the valley fill deposit and Columbia River Basalt. The highest ground water yields required for some municipal, irrigation or indus-

trial wells are from aquifers in the Columbia River basalts. Wells completed in this formation are typically in areas where the thickness of overlying valley fill is 1,000 feet or less. Oregon Water Resources Department well logs show that the highest yields from wells completed in the valley fill in the Forest Grove-Hillsboro area come from sand beds and occasional gravel deposits that typically occur at depths of about 40, 100, 200 and 300 feet below the ground surface.

Groundwater in the valley fill deposits is predominantly unconfined. The water table fluctuates with the annual rainfall cycle. Fluctuations of 15 to 20 feet in the water level in wells are common. Principal recharge to the ground water in the basin is believed to be from infiltration of rainfall. Ground water is also recharged from treated wastewater land application, flood waters, and lateral inflow of water from adjoining uplands. Principal ground water discharge in the basin is in the form of springs or seeps and discharge to the Tualatin River and tributaries. Base flow in the Tualatin River is maintained even in drought years by a combination of ground water discharges and stored water releases from Scoggins Reservoir in the upper Tualatin River Basin.

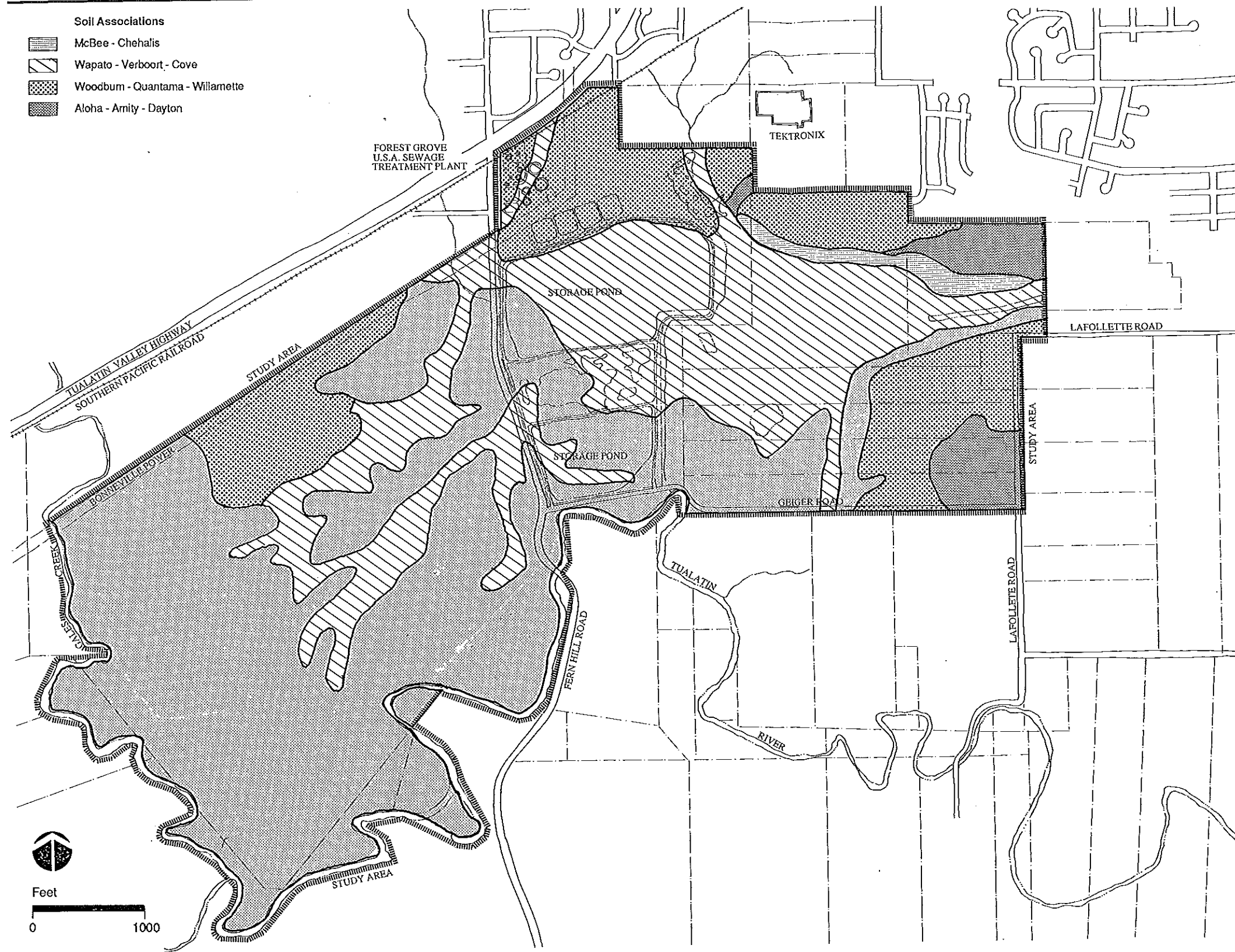
SOILS

The primary associations on the site are the McBee-Chehalis and the Wapato-Verboort-Cove Associations. These silty clay loams are poorly drained and are located within the 100-year flood plain. The Wapato-Verboort-Cove Association possesses particular limitations due to excessive wetness and is often designated a jurisdictional wetland. Surface ponding is also common with the McBee-Chehalis Association during the rainy season. Both associations are adequate for farming, however, their slow draining characteristics make them ideally suited to the creation of ponds and wetlands.

Upland soils consist of the Woodburn-Quantama-Willamette and the Aloha-Amity-Dayton Associations. These silty loams have good native productivity and are adequately drained, making them excellent agricultural soils.

Depth to bedrock in the Forest Grove area is about 300 feet. Maximum depth to bedrock in the Tualatin basin reaches down to 1,500 feet. The underlying basalt is covered by valley fill deposits consisting primarily of recent alluvium deposits along the flood plains, and Willamette silt deposits along the entire valley floor below an elevation of 250 feet.

- Soil Associations
- McBee - Chehalis
 - Wapato - Verboort - Cove
 - Woodburn - Quantama - Willamette
 - Aloha - Amity - Dayton



OWNERSHIP

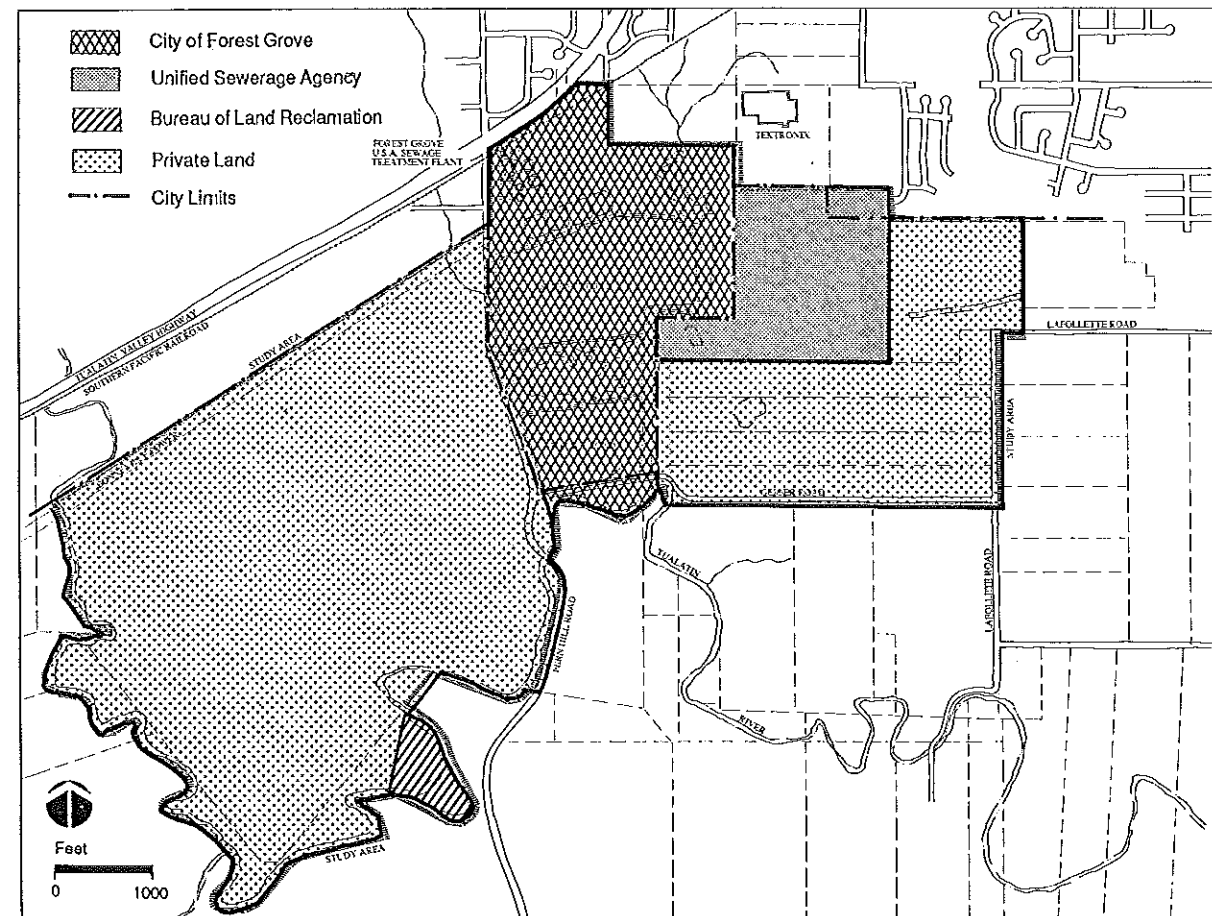
The core of the Fernhill Wetlands Study area includes an 190 acre tract of land jointly owned by the City of Forest Grove and the Unified Sewerage Agency. USA manages this parcel for wastewater treatment. Directly east and south of the USA property, is privately owned agricultural land, which contains both upland and wetland areas. The Fernhill Council would eventually like to acquire all, or a portion of, this property as part of their wetland enhancement and effluent treatment program.

To the west of Fernhill Road lies a 406 acre tract of privately owned land utilized primarily for ag-

ricultural purposes. This parcel also contains some lowland acres that could be enhanced for wildlife attraction. USA is currently reviewing this property for purchase and use in its recycled wastewater program.

The study area is bordered by the City of Forest Grove and the Tektronix campus to the north and residential areas to the northeast. Agricultural lands surround the rest of the site.

The core of the study area falls within the jurisdiction of the City of Forest Grove and is zoned under the general industrial designation. The southern-



Ownership Map



Tektronix Campus Across the Large Storage Pond

most and eastern-most sections of this area are subject to environmental review by the City. The remainder of the study area lies within the 100 year flood plain and is designated as open space by Washington County.

The City of Forest Grove and the Fernhill Wetlands Council envision that USA will continue management of the current property, with the City and Council acting in an advisory capacity. As resources develop and funds for acquisition became available, additional land will be purchased either via the City of Forest Grove or USA.

CURRENT USE

The Unified Sewerage Agency currently intensely manages the site for the irrigation and storage of effluent. The management area contains 80 acres of storage ponds, 70 acres of irrigated fields, and 20 acres of natural wetlands. In the past, Fernhill has been characterized as a waste water disposal ground. However, decreased water quality of the Tualatin River has led to tighter regulations on the disposal of treated wastewater. By July 1, 1993, USA must be in conformance with new regulations from DEQ which set the limit of permissible irrigation of treated wastewater.



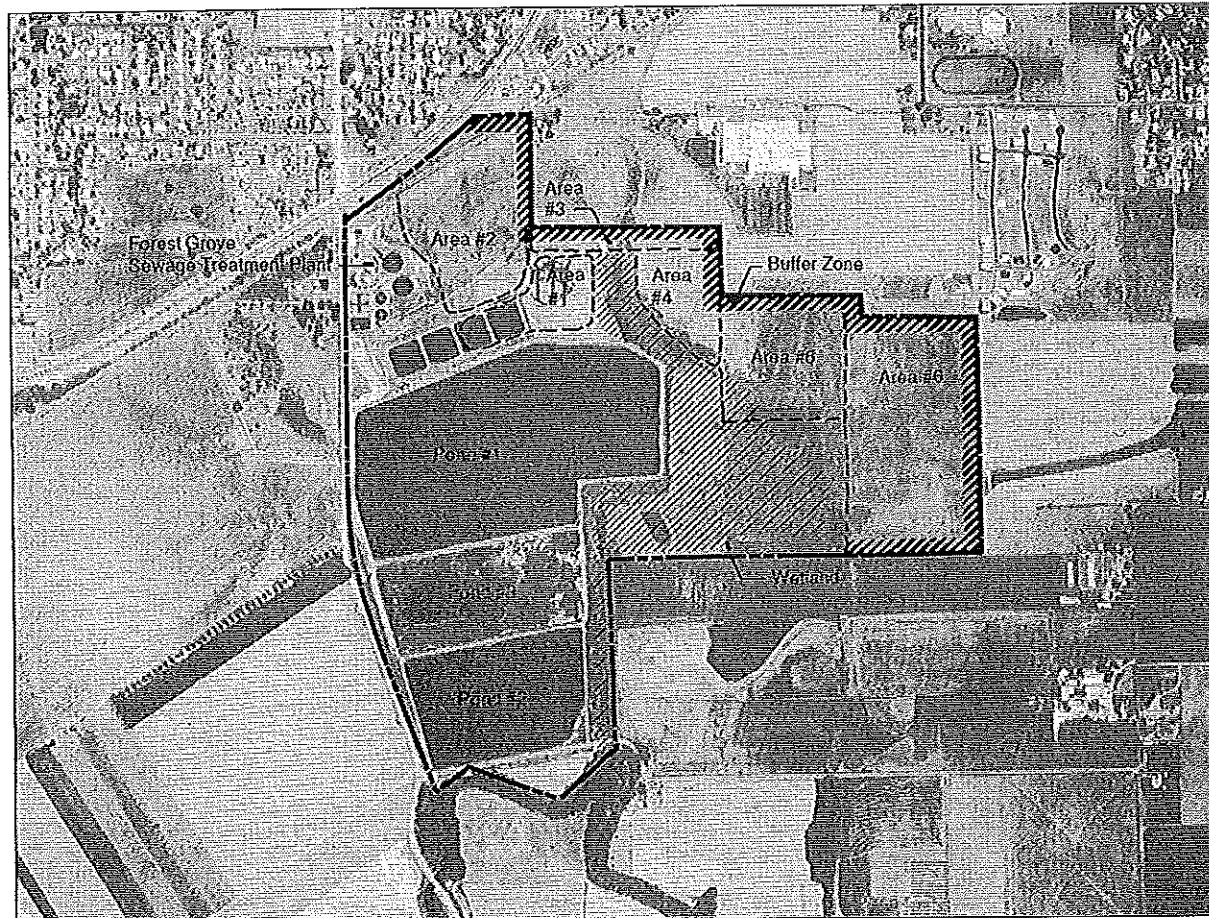
Agricultural Property to the West

Site and Regulatory Constraints. Certain site restrictions apply to the use of irrigation of recycled wastewater. Natural wetland areas must be protected from irrigation runoff, and buffer zones must be employed to protect neighboring residences. If spray irrigation is employed, a 70 foot buffer must be in place. However, the use of drip irrigation will decrease the buffer zone to 10 feet.

USA's current management philosophy aims toward turning site constraints into opportunities to create a showcase for the agricultural use of effluent. The goal is to utilize the site as efficiently as possible while working cooperatively with wildlife enthusiasts and wetland advocates.

A key to meeting the new restrictions and efficiently utilizing the site will involve a comparative examination of the agronomic loading rate of various crop species. For example, grass will absorb irrigated water at the rate of 13" per year compared to an agronomic rate of 26" per year for corn and 28-30" for poplars. USA is currently experimenting with various crops and irrigation techniques and plans to continue the use of demonstration crops as part of the master plan.

The use of alternative crops, such as corn and poplars, has proven to offer several benefits. Corn has the advantage of absorbing twice as much water as grass, thus less land is required, and



Current USA Use Map

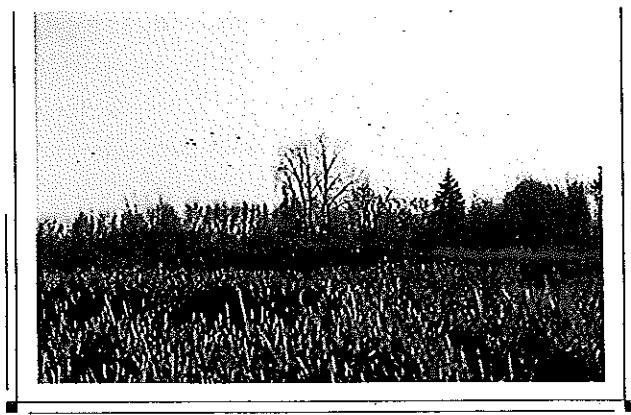
wildlife is provided with a forage crop. Poplars also absorb twice as much water as grasses and can be irrigated with drip irrigation, thus limiting buffer constraints to 10 feet. The trees can also be harvested after 2-5 years to provide sawdust or wood chips, which are a key component of sludge treatment. The planting of poplars in perimeter buffer zones has already begun, and USA is working with consultants to determine other suitable locations throughout the property.

Existing Effluent Treatment Areas. The land currently managed by USA is illustrated above. By the summer of 1993, USA plans on utilizing all irrigatable property as efficiently as possible. Presently, moving rollers are used to irrigate areas 4, 5 and 6, except for the 70' buffer along property

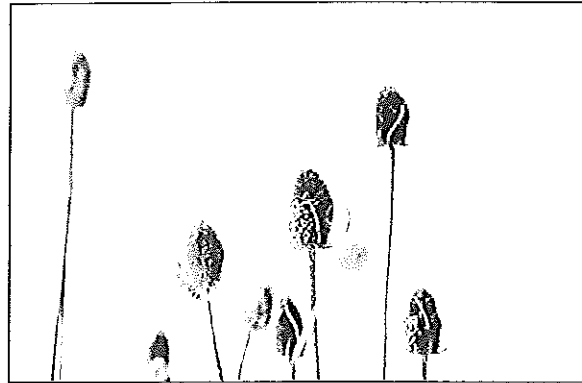
lines. Only half of area 2 is currently irrigated. However, USA plans to expand irrigation to take in the rest of area 2 as well as areas 1 and 3. Drip irrigation is being experimented with in the buffer zones. Area 1 will be leveled out and then irrigated with big gun sprinkler heads. The southern portion of area 6 has been plowed and disked, and will be planted in corn.

Three storage ponds exist on site. Ponds # 1 and 2 are scheduled to continue in present use as storage of treated wastewater, however, they will be dredged within two years, and the existing dikes will be raised by approximately 5 feet. Pond # 3 began silting in during the late 1970's and is now reverting back to a natural appearing wetland. This pond will remain undisturbed.

MASTER PLAN



MASTER PLAN



Teasels Commonly Found on Site



Cattle Grazing on Irrigated Fields

INTENT

The intent of the concept master plan is to create a multi-purpose wetland system which serves to improve water quality for the Tualatin River while offering combined benefits of wildlife enhancement, recreational enjoyment, educational interpretation and improved quality of life for the present and future generations. The master plan also provides a framework for guiding and implementing future improvements and encouraging local support.

Due to similar site features and programmatic concerns, the master plan for Fernhill Wetlands is based on the model established for Jackson Bottom. However, individual components have been customized to address the unique features and location of the site.

GOALS

Improve Water Quality. The proposed plan for water quality management will assist the Unified Sewerage Agency's Recycled Wastewater Plan by providing opportunities to use highly treated wastewater within the wetlands management area. The treated wastewater will be used for non-discharge constructed wetlands (providing additional wildlife habitat), restoration of agricultural wetlands, and irrigation of farm fields for commercial agriculture and wildlife feed. The areas for these uses include land immediately east and west of the existing wastewater treatment plant storage ponds. These types of uses will allow treated wastewater to receive additional filtration and purification through natural systems prior to release in the Tualatin River.

Urban surface water runoff quality improvements will also occur on the fringe of the Fernhill Wetlands. Development of storm water runoff treatment wetlands, north and west of the newly constructed wetlands will provide treatment of urban surface water runoff for a portion of southeast Forest Grove by filtering pollutants through grassy swales and ponds before the runoff enters the Tualatin River.

Enhance Wildlife Habitat. The proposed plan seeks to maximize wildlife habitat and diversity, while providing adequate provision for public use and enjoyment of these resources. Habitat is enhanced through the preservation of existing wetlands and riparian areas, the development of additional wetlands, and the planting of trees, shrubs, and other vegetation to provide cover, forage, and nesting sites.

Enhancement of the wildlife habitat is expected to lead to increased year-round use of the site by a greater diversity of species including:

- Increased usage of the area by water fowl and upland birds.
- Attraction of shore birds, especially during periods when water storage levels are lowered exposing mud flats.
- Attraction of more wading birds, including great blue and green heron, and cattle or snowy egret.
- Attraction of nesting raptors, including great blue heron and possibly migrant osprey and bald eagles.
- Increase in warm water fish populations.
- Increase in mammalian populations, including beaver, weasel, raccoon, fox, coyote, skunk, rabbit, vole, moles, mice, shrew, and occasionally deer.
- Increase in amphibians and reptile populations, including frogs, toads, newts, salamanders, garter snakes and the possible re-establishment of historical turtle populations.



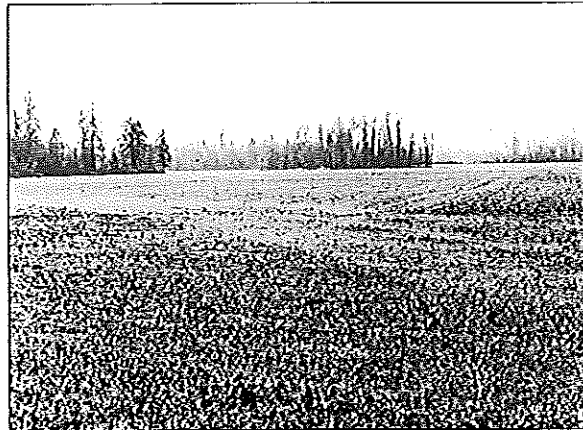
Juvenile Spotted Sand Piper Preparing for Flight



Wildlife Pond and Surrounding Habitat



On-Site Trails



Existing Agricultural Open Space

Provide Recreational and Educational Opportunities. As wildlife diversity increases and a more complex wetland system is created, greater numbers of people will also be attracted to the Fernhill Wetlands. Use of the site for educational and recreational purposes will be encouraged through:

- Development of a system of looped trails and view points which allow exposure to wildlife yet minimize disturbance in critical wildlife areas.
- Development of a perimeter trail along the Tualatin River and Gales Creek as part of a regional greenway trail system.
- Development of information kiosks and interpretive signage along the trails calling attention to specific features of the site such as wildlife in the area, the water treatment process, and the role of hunters in supporting habitat.
- Construction of a permanent shelter/classroom facility for the convenience of participants in field trips.
- Encouragement of on-site research for students and researchers.
- Production of a brochure for distribution in schools, describing the site and its purposes.
- Creation of a slide show for schools and service clubs.
- Distribution of quarterly newsletter about activities and developments at the site.

Preserve Rural and Agricultural Open Space. The Tualatin Valley is characterized by broad flood plains and rich agricultural lands. The master plan proposes that the agricultural character of the site be maintained offering benefits of continued productivity, scenic value, wildlife enhancement, and the perpetual preservation of rural open space within close proximity to urban populations.

COMPONENTS OF THE MASTER PLAN

The concept master plan for Fernhill Wetlands is illustrated on page 33. Key elements of the plan are described below.

Irrigation With Recycled Wastewater. Because the Forest Grove Wastewater Treatment Plant is proposed to be a 'liquids only' treatment facility, utilizing highly treated class 4 wastewater, the use of recycled wastewater for irrigation will be a key component of the master plan. The utilization of recycled wastewater for irrigation offers two advantages: it consumes treated wastewater laden with nutrient, thereby reducing nutrient loading of the Tualatin River, and it conserves fresh water supplies which would otherwise be diverted from the river to irrigate the fields. It is proposed that existing agricultural lands east and west of the storage ponds be acquired by the Unified Sewer-

age Agency for its recycled wastewater program. The lands not designated for wetlands construction will continue to be farmed and will be irrigated with recycled wastewater. Crops to be grown will be for commercial agriculture and wildlife feed.

Effluent Storage Wetlands. It is proposed that non-discharging wetlands be constructed in suitable areas outside existing wetland areas to receive highly treated wastewater runoff from irrigated fields. They will not have a surface discharge to the Tualatin River or its tributaries so as to protect the nutrient water quality of the Tualatin River. These ponds will be constructed to produce minimal leakage to groundwater. These wetlands are proposed to be located on the large tract of land to the west of Fernhill Road and will be constructed as part of Phase II, after the privately owned parcel is acquired.



Agricultural Fields for Irrigation

Restored Agricultural Wetlands. It is proposed to either enhance existing wetland areas, or restore historic wetlands on hydric soils through the use of flow control structures and by allowing irrigated recycled wastewater to flow into the low lying areas. The recycled wastewater will be polished by overland flow through grass and field crops irrigated near the wetlands. The flow control structure will be designed to maintain stable water levels in the wetlands. The depth of water will be according to the desired vegetation, wildlife use of the wetland, and amount of land desired to be inundated.

Stormwater Treatment Ponds. It is proposed that a pond or wetland be built to capture surface water runoff for treatment before the water reaches existing wetland areas. The pond will be located at the north border of the Fernhill Wetlands management area near Tektronix. The existing perennial "drainage ditch" should be redesigned to incorporate stormwater quality and quantity detention times necessary to polish the water. The pond should be shaped and vegetation planted to blend the pond into the surrounding landscape.

Wildlife Habitat Enhancement. The development of a complex wetland system containing deep open water, shallow ponds and emergent vegetation will enhance existing wildlife habitat and attract a greater diversity of fish and wildlife. These wetlands may contain treated wastewater, surface water, or shallow groundwater.

Ponds and wetlands will be constructed with variable edge and bottom configurations to increase shoreline conditions and water depths will increase habitat diversity and create "niches" that will be occupied in time by a wide range of plants and animals. In addition, small islands will be placed in many of the ponds to provide safe nesting and resting areas for waterfowl.

Areas between ponds will be planted in a variety of patterns to provide food and shelter for wildlife and encourage a more diverse wildlife population. Trees will be planted in some areas to produce a thick forest cover. In other areas, only a few trees will be planted for nesting areas and perches. Shrubs will be planted in selected areas to restore existing or create new "fence row" habitat for upland birds and wildlife and to provide a buffer between areas.

Perimeter buffer zones will be planted with poplars and edged with shrub species to provide a variety of niches for wildlife. Although the poplar groves will be irrigated, the planting can take on an informal configuration along the edges.

Additional wildlife enhancement measures proposed include the installation of nest boxes and structures around the effluent pond perimeter, and the periodic moving of irrigated areas to provide forage for selected areas.

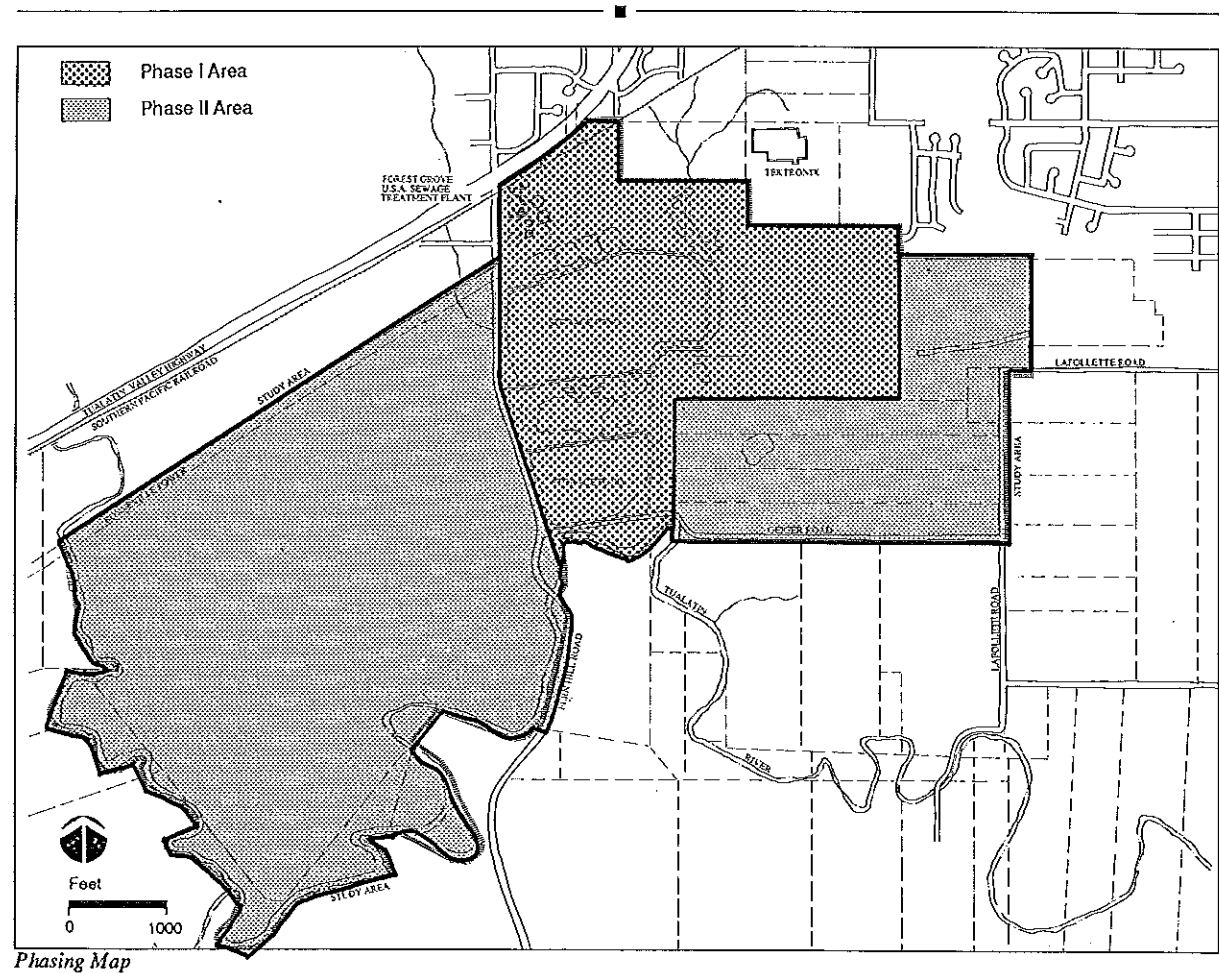
Trail System. In order to minimize disturbance to wildlife and to USA treatment operations, public access will be limited to selected portions of the site. During the first phase of improvements, access will be controlled through scheduled tours guided by leaders knowledgeable of the unique features of the site.

After impacts of increased public use have been monitored, the trail system will be refined and opened up to the public. This is planned to occur during Phase II. If private holdings are acquired to the west, the trail system will be expanded to include a perimeter bicycle and pedestrian path along the Tualatin River, Gales Creek and the Bonneville Power Easement. This will provide connection to a broader network of regional parks and open spaces.

The overall trail system will lead to a series of viewing areas overlooking key areas of the site. Trails and viewing areas will be designed for pedestrian access only and will be buffered with vegetation to minimize disruption to wildlife. Interpretive signage will guide visitors and inform them of unique aspects of the site.

An off-street parking area and an observation post is proposed for the City owned triangular shaped parcel of land adjacent to the Tualatin River. The observation post will be handicap accessible and a pedestrian trail will connect this portion of the site with a second viewing area to the north, overlooking the historic natural wetlands. Canoe access to the Tualatin River will also be provided from this parcel of land. An additional Phase II parking area is proposed on the west side of Fernhill Road if land acquisition negotiations are successful.

Research. Research will be encouraged that increases the base of knowledge regarding use of treated wastewater to benefit wildlife and food production. Sites will be made available to interested scientists dealing in applied research. Portions of the site will also be made available to the regional schools for use as outdoor classrooms.



Phasing Map

PLAN PHASING

Overall development of the Fernhill Wetlands will be accomplished through a phased program based on the provision of funding for land acquisition and infrastructure improvements. The phasing schemes described below provide a suggested outline to guide improvements.

Phase I

The first phase of improvements focuses on enhancement of the property currently owned and/or managed by the City of Forest Grove and the Unified Sewerage Agency. Improvements include:

- Development of a 20-40 acre emergent marsh. A portion of this wetland is currently being constructed. Seven acres of ponds have been completed and revegetation of the marsh edges will occur during the winter of 1991 and spring of 1992. Expansion will occur when additional funding is raised.
- Development of stormwater treatment ponds north of the new emergent marsh.
- Development of an off-street parking area on the land owned by the City of Forest Grove by the Tualatin River.
- Development of a handicap accessible viewing platform near the parking area which overlooks the USA wetlands.
- Development of a trail system to selected portions of the site and incorporation of interpretive signage and viewing areas.
- Regrading and reconfiguration of the existing drainage ditch to create a more natural appearing stream and enhance the adjacent riparian zone.
- Construction of a flow control structure, allowing for the enhancement of the natural wetlands.
- Expansion of effluent irrigation on the appropriate parcels of property and continued experimentation with demonstration crops.

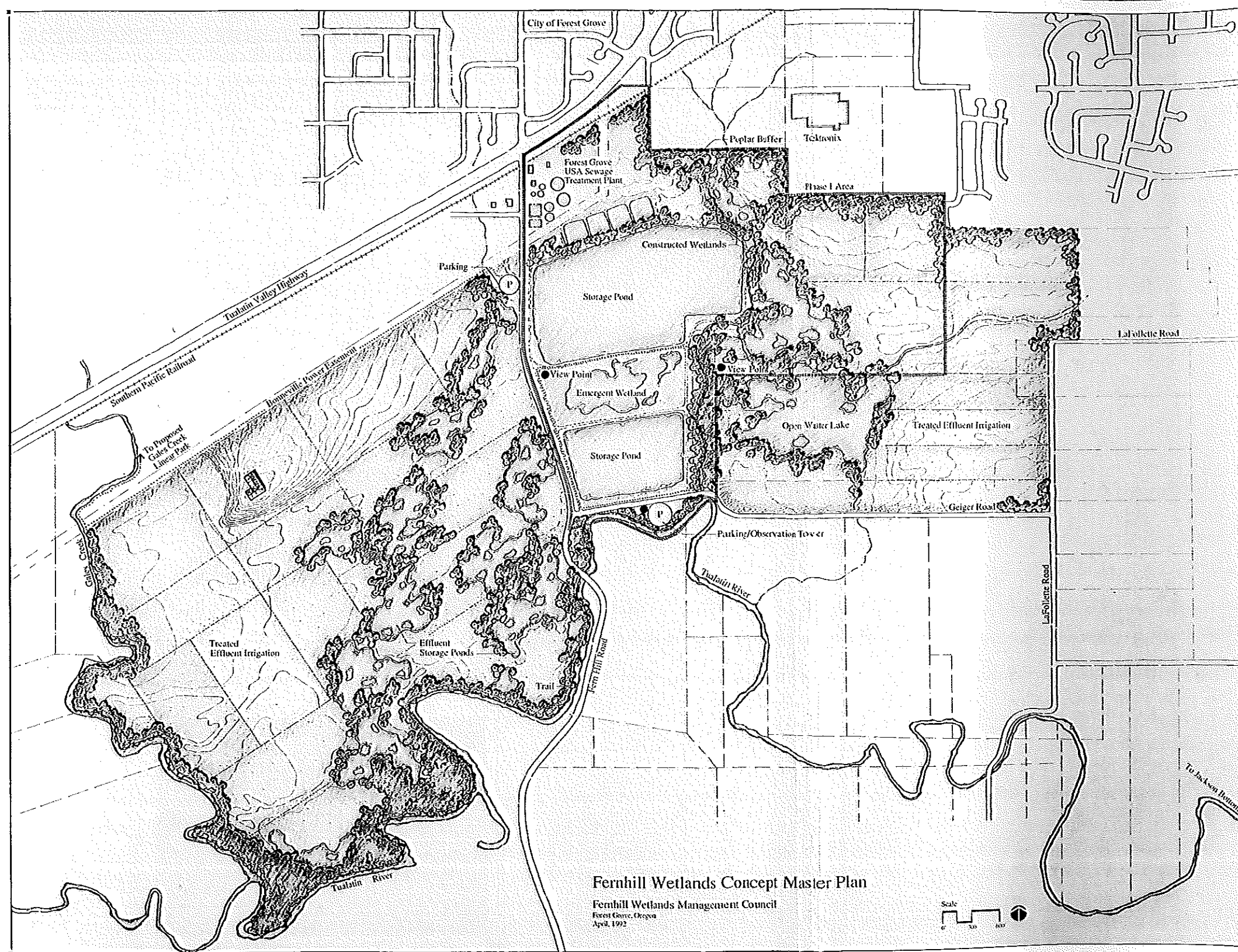


Potential Phase II Property

Phase II

Phase II improvements hinge primarily on the acquisition of additional property to the east and west as it becomes available from consenting land owners. Suggested improvements include:

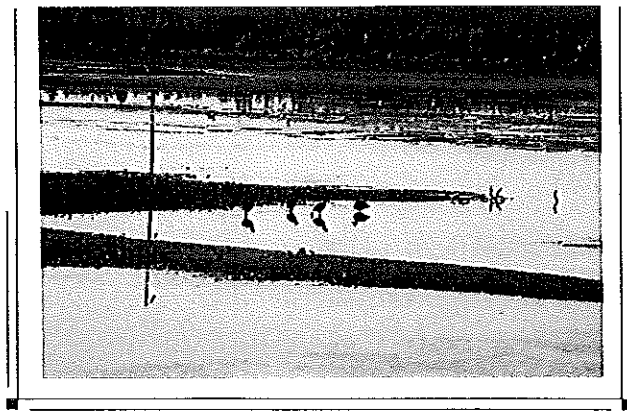
- Expansion of the trail system to provide for a series of loops.
- Provision of a perimeter trail along the Tualatin River, Gales Creek and Bonneville Power Easement.
- Expansion of irrigation to the west of Fern Hill Road as private property becomes available.
- Development of effluent storage ponds to catch irrigation runoff on the western property.
- Provision of an additional parking area on the northeast corner of the property west of Fern Hill Road.
- Expansion of irrigation fields to the east as private property becomes available.
- Develop a permanent, deeper open water lake/wetland on the acquired property to the east.
- Provision of on-site research opportunities.



Fernhill Wetlands Concept Master Plan
Fernhill Wetlands Management Council
Forest Grove, Oregon
April, 1992



APPENDICES



MEMORANDUM OF INTENT
FERN HILL WETLANDS PROJECT

A. PARTIES

The parties to this Agreement are the Oregon Waterfowl and Wetlands Association, an Oregon nonprofit corporation, (OWWA); The Wetlands Conservancy, Inc., an Oregon nonprofit corporation, (TWC); and Unified Sewerage Agency, an Oregon county service district and municipal corporation (USA).

B. STATEMENT OF PURPOSE

The parties desire to develop a project to be known as the Fern Hill Wetlands Project in or near Forest Grove, Oregon. The project shall consist of the establishment of multiple purpose wetlands and related facilities similar to the Jackson Bottom wetlands in and near Hillsboro. It appears to be feasible to the parties to develop available, suitable property in the vicinity of USA's Forest Grove treatment plant site for these wetlands. Exhibit "A" identifies the property initially identified by the parties as suitable.

The parties intend this document to be a statement of present intention and a commitment to cooperation in pursuit of common objectives. This agreement does not commit any party to take specific action or expend any funds except in accordance with applicable laws and its authority, budget, policy, and procedures.

C. BENEFITS OF THE PROJECT

Such development is expected to provide multiple benefits to the parties and the public, including enhanced wildlife habitat, water quality enhancement, water quantity management, public recreation and education. The project may also include waterfowl hunting by handicapped persons on a permit basis, and a structure adapted for such hunting and available to the public as a viewing area except during the waterfowl hunting season.

D. THE PROJECT

The parties agree to do the following:

1. to seek funds to prepare a master concept plan for the project;
2. to participate in development of the plan, through provision of available information; participation of officers, employees, or members in technical or advisory bodies; contribution of available funds; and other activities

determined by the parties to be necessary for project purposes;

3. to investigate the availability and suitability of additional public and private lands which could be acquired or managed cooperatively for project purposes;

OWWA and TWC will endeavor to acquire additional property from willing owners through donation, conservation easement, or purchase. Such property will be included within the project boundaries.

USA agrees to manage the land within the Forest Grove Treatment Plant site deemed suitable and available by USA, according to the objectives of the Fern Hill wetlands master plan; provided that the USA Board has adopted such plan, funds are available, and such management does not conflict with any terms of USA NPDES permits or applicable laws or rules;

E. FERN HILL WETLANDS MANAGEMENT COUNCIL; ADVISORY BOARD

The parties shall invite the following organizations to provide one member to the Fern Hill Wetlands Management Council: OWWA, TWC, USA, City of Forest Grove, Forest Grove Chamber of Commerce, Oregon Department of Fish and Wildlife, Portland Audobon Society, and Ducks Unlimited.

Other organizations and persons may be invited to serve on the Fern Hill Wetlands Advisory Board and make recommendations to the Management Council. The Management Council shall provide general direction for the Project. The Advisory Board shall make recommendations to the Management Council regarding technical issues in the operation of the wetlands. Each organization participating in the Management Council or Advisory Board shall be responsible for the negligent or wrongful acts of its own employees, officers and agents.

F. TERM; TERMINATION; LIABILITY

This agreement shall continue for a term of twenty years, provided that any party may withdraw its participation upon providing 90 days' written notice to the other parties. This agreement may be extended or renewed upon further written agreement of the parties. Each party shall bear its own expenses incurred pursuant to this agreement. As between the parties to this agreement, each party is responsible for any claims arising from the actions of its officers, employees, and members, arising from this agreement.

The parties have authorized to enter into this agreement pursuant to actions of their respective governing bodies.

DATED this 27th day of March, 1998.

OREGON WATERFOWL & WETLANDS ASSOCIATION

BY Garry W. Blankenship TITLE President

THE WETLANDS CONSERVANCY INC.

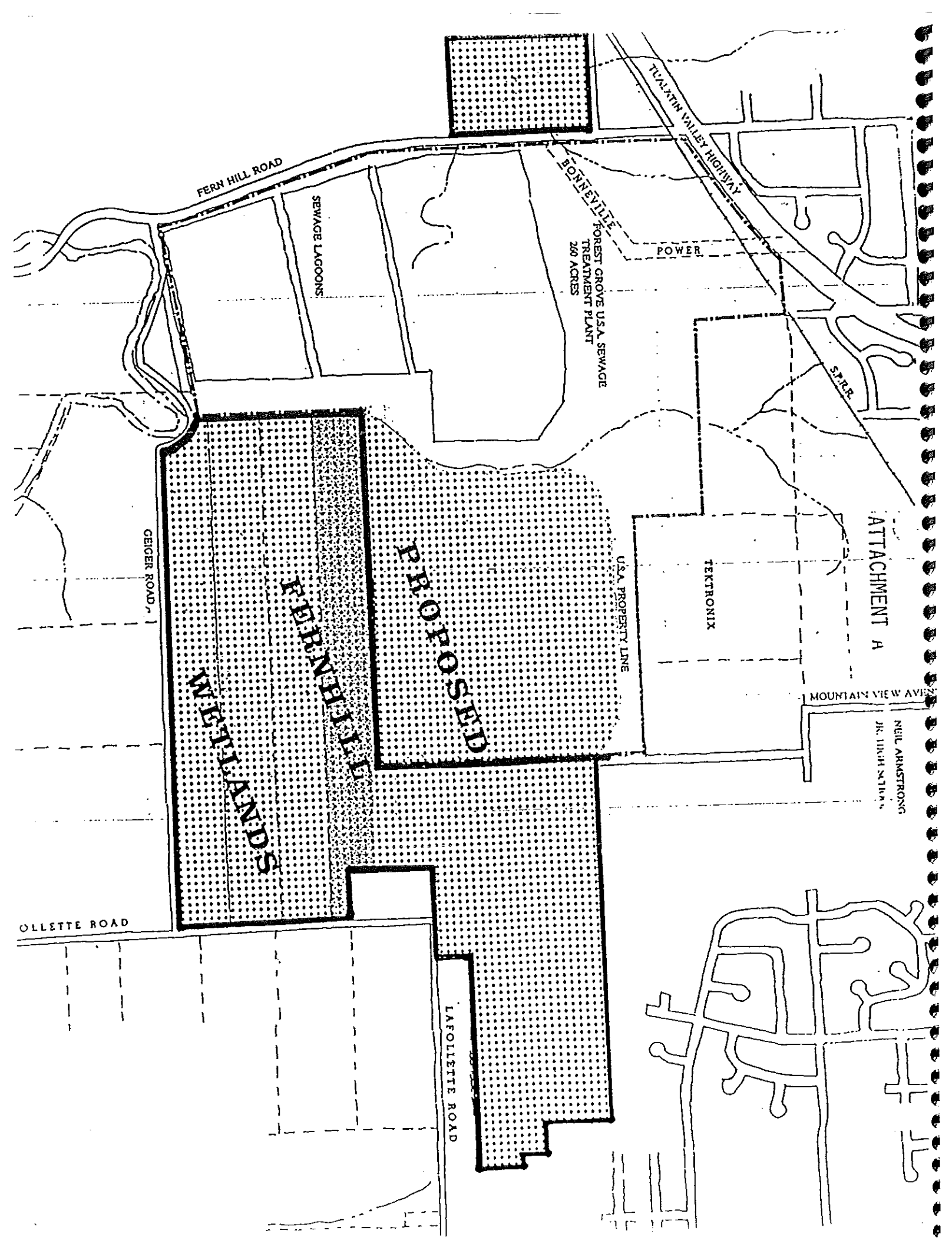
BY John W. Browne TITLE President

UNIFIED SEWERAGE AGENCY OF WASHINGTON COUNTY, OREGON

BY Gary F. Kraemer TITLE GENERAL MANAGER
GARY F. KRAEMER

APPROVED AS TO FORM:

BY Deetta Rindahl TITLE Agency Counsel



APPENDIX B

Sources of Information

Cascade Earth Sciences, Ltd. Unified Sewerage Agency Forest Grove
Waste Water Treatment Plant Potential Grounds Water and Surface
Water Impacts from Effluent Reuse Practices.
February 4, 1991

Scientific Resources Inc. Wetland Inventory Within the Forest
Grove Urban Growth Planning Area.
August 1, 1991

United States Department of Agriculture Soil Conservation Service.
Soil Survey of Washington County, Oregon
July, 1982