PUD No 1 of Clallam County

In Association with Clallam County

Sewer Feasibility Study for Carlsborg UGA

July 2007

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PUD No 1 of Clallam County

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July 2007

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A Report of Examination for Existing Clallam PUD Well
B Public Involvement Program

Companion Document –
'Carlsborg Treated Wastewater Disposal and Reuse Options'
Technical Memorandum, Aspect Consulting, April 6, 2007

Executive Summary

Two basic problems exist within Carlsborg:

- Onsite septic systems do not provide adequate treatment, and nitrate levels in the ground water are increasing with some samples exceeding drinking water standards of 10 mg/L.
- Carlsborg has been designated as an urban growth area (UGA), which means urban services including sewers must be provided. However, the cost of sewers is a concern.

Key issues identified to date include: future land use, population, and employment; estimated project costs and funding; reuse of reclaimed water, affect on Dungeness River, and water rights; plus inter-agency relations with Clallam County, the PUD, City of Sequim, and the tribes.

The Carlsborg UGA includes about 560 acres with 828 residents in April 2006 and an annual growth rate of 0.5 percent. These are mostly retired, senior citizens living on limited incomes. Home occupancy is about 1.85 people per dwelling. Winter water use averages about 125 gallons per day (GPD) per home. These demographics should continue, but change is possible.

A revised comprehensive plan will define land use densities compatible with sewers. Population growth was projected at 2.15 percent, which would be 2,140 people in 2050. Average day wastewater flow then is estimated to be 226,000 (GPD). The treatment plant capacity in 2050 would be designed for 398,000 GPD. A 12-inch interceptor would carry the 978,000 GPD peak flow. However, economics and demographics may change, which could require a 15-inch pipe.

The public involvement program demonstrated that not all property owners want to participate in a sewer system at this time. Agency funding limitations also indicate that implementation of a sewer system should occur in phases. The most logical initial sewer system would be built in Carlsborg Road from the PUD Operations Center south to the old Costco site across US 101 and would serve the parcels adjacent to the pipe, focusing on new developments.

The treatment process is envisioned as a membrane bioreactor (MBR) because the resulting discharge can be reused for irrigation, which would conserve the existing limited water rights for potable purposes. Excess reclaimed water would be percolated through soil into Matriotti Creek to augment the stream habitat and the local aquifer. Solids would be thickened and hauled to another agency for disposal. The MBR process is modular, and the treatment facility can be readily expanded as Carlsborg grows and the sewer collection system is extended.

Project costs for the initial system are estimated to total about $ 13,000,000. The actual amount will depend on how many parcels are included initially, so the total could be more, or a bit less. Connecting Carlsborg to the Sequim sewer system would not decrease the estimated project costs, and returning reuse water to Carlsborg from Sequim would increase costs. Some grant funding will be essential from federal, state, and local agencies to make the cost affordable to the property owners. The availability of such funding has not been determined, but may be higher with reuse. A variety of assessment methods can be used to distribute the remaining costs to property parcels according to be relative benefit provided by sewer service to different land uses.

Besides the new comprehensive plan, several steps remain to be done before sewers can be built.

1 Introduction

1.1 Background

Problems addressed by this Sewer Feasibility Study are basically two:

1. Carlsborg has been designated as an urban growth area, which means urban service must be provided, and that includes sewers.
2. Onsite septic systems are not adequately treating sewage, which is passing through the granular soils into the aquifer and nitrate concentrations in the groundwater, forming the potable water supply, are rising enough to approach or even exceed the maximum contaminant level (MCL) for drinking water.

Partnering to resolve these problems has been discussed between the Public Utility District No. 1 of Clallam County (PUD) and Clallam County. To date, the PUD and Clallam County have jointly agreed to fund preparation of this Sewer Feasibility Study for the Carlsborg UGA. If the two agencies decide to implement a sewer system for Carlsborg, Clallam County may grant to the PUD the authority to build and operate sanitary sewer facilities.

Authorization for the Feasibility Study is described by the Professional Services Agreement and work was directed to begin by the PUD in a letter dated September 12, 2006 to BHC Consultants LLC. BHC Consultants was assisted by Triangle Associates Inc for public involvement; and by Aspect Consulting for hydrogelogic consultation.

1.2 Key Issues

The Initial Meeting with staff representatives from Clallam County and the PUD reviewed the key factors influencing the need for the Feasibility Study. Some of the key factors addressed through studying the feasibility of a sewer system for the Carlsborg community were identified as follows:

- Existing septic systems are not providing effective sewage treatment, resulting in nitrates entering the groundwater aquifer.
- A variety of relationships are possible between Clallam County, the PUD, Tribes, and City of Sequim.
- The maximum population and the equivalent residential units (ERU) anticipated to be served by sewers needs to be projected to define the capacity required in the sewer facilities.
- Alternative collection, treatment, conveyance, and disposal options should be identified. The Feasibility Study will not fully evaluate these options, but only select a likely feasible ‘baseline sewer concept’ as a benchmark for further evaluation through a facilities plan should a baseline sewer concept be deemed feasible.
- The recommendations of the Carlsborg Community Advisory Council need to be considered in evaluating the feasibility of a community sewer system.
- Use of reclaimed water for community and environmental benefit is highly desirable due to apparent declines in the aquifer water level and the limitations of the Dungeness River and Matriotti Creek stream flows.

- Water rights may be the limiting factor in developing the Carlsborg community to the land use densities that can support a sewer system, and the possibilities for obtaining additional water rights through transfer or credit for use of reclaimed water need to be explored.
- Financing options including assessments, rates, and possible agency contributions needed to be described, with particular emphasis on the prospects for grant funding.
- Project should be completed during the first part of 2007 under a schedule of phases with appropriate milestone dates.
- A sewer system for the Carlsborg UGA is assumed to develop in phases, which is a concept compatible with modular expansion of the treatment facility using membrane bioreactor (MBR) technology.
- Regulatory requirements associated with reclamation, reuse, and disposal of water obtained through the wastewater treatment process need to be addressed, and compared with the ability of on-site septic systems to meet these regulations.
- Public involvement program consisting of three public meetings is needed to inform the community and property owners about the project, the relationship to past sewer studies for Carlsborg, and prospects for implementation including estimated conceptual costs.
- Feasible polices for developing an equitable assessment method will be explored, together with other financing options.
- Possible efficiencies and cost savings with treatment being provided by the City of Sequim needed to be considered.

1.3 Report Outline

In addition to the Introduction, the work was organized into eight chapters for preparation of this document. With subordinate sections listed in the Table of Contents, the title for each chapter is intended to describe the essential content of each chapter as noted below:

Chapter 1 Introduction
Chapter 2 Goals and Objectives
Chapter 3 Background Information
Chapter 4 Projected Population and Flows
Chapter 5 Baseline Wastewater System
Chapter 6 Reclaimed Water Reuse
Chapter 7 Financial Considerations
Chapter 8 Implementation
Chapter 9 Feasibility Conclusions

2 Goals and Objectives

2.1 Growth Management

This general vicinity of Clallam County surrounding the Carlsborg community is shown on Figure 1.

The Carlsborg Urban Growth Area (UGA) was defined by Clallam County Code 31.03.350 in accordance with the Growth Management Act (GMA) adopted by the State of Washington as shown on Figure 2 as designated in 2000. Clallam County desires to encourage residential and commercial development within Carlsborg in accordance with the GMA. A key requirement of any UGA is the provision of 'urban services' and sewers are often the most challenging to provide initially because of the high initial cost.

Existing on-site sewage disposal within the Carlsborg UGA has been guided by County Policy No. 13 from Clallam County Code 31.03.350, which has three basic components:

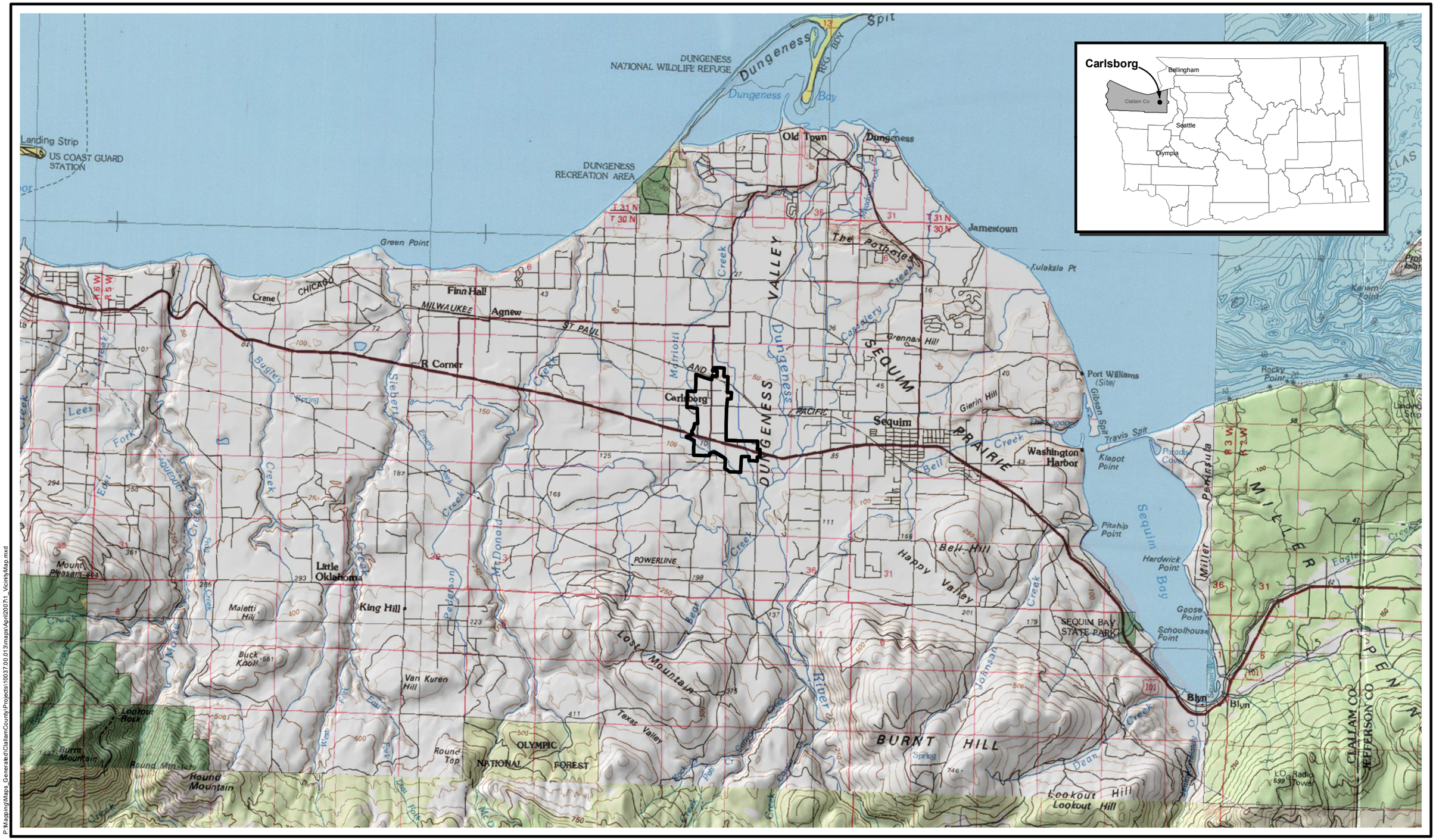
- An on-site sewage system operations and maintenance program developed through the Carlsborg Capital Facilities Plan is intended to be implemented, which is to include periodic monitoring and inspection of the on-site systems.
- All new on-site sewage systems and all system repairs shall use enhanced treatment to achieve a minimum reduction in nitrate discharge of at least 50 percent.
- Other existing on-site sewage systems will be encouraged to upgrade to enhanced treatment.

Over the longer term Clallam County recognizes that land use development at urban densities, which is usually considered to be at least 4 residential units per acre, cannot be achieved with on-site sewage systems. A public sewer system will be required. The sewer system should be implemented in phases, to collect all sewage within the UGA eventually, provide treatment, and dispose of the effluent in an environmentally accepted manner.

The Sewer Feasibility Study is intended to establish the planning and cost basis for the PUD, Clallam County, and the Carlsborg community to decide whether developing a sewer system to serve the Carlsborg UGA is appropriate. This work builds on previous efforts including the 1994 Study, the 1998 Capital Facilities Plan, the recommendations of the Carlsborg Advisory Council, the 2004 Greater Dungeness Regional Wastewater System Plan, and subsequent documents.

2.2 Integrated Water Resources Management

Installation of sewers for Carlsborg offers an opportunity to integrate the management of all water resources in the vicinity. These water resources include potable, irrigation, storm, and ground waters, as well as in-stream flows. Several obstacles need to be overcome to do so; however the environmental, economic, and social benefits are substantial.



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Graphic Source:
National Geographic/USGS 2001

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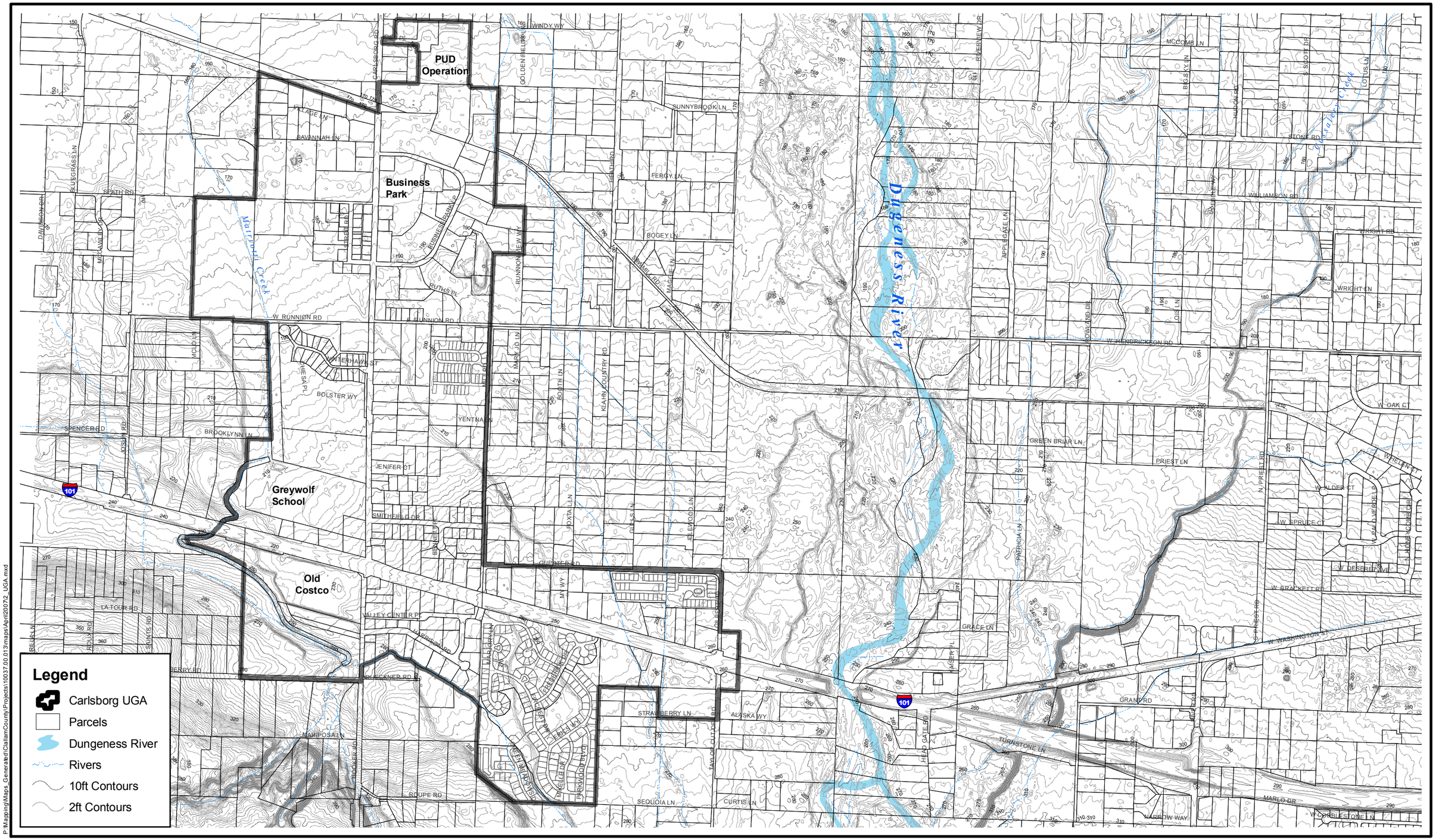
PUD #1 of Clallam County

Vicinity Map

Sewer Feasibility Study
April 2007

Figure
1



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Carlsborg Urban Growth Area

Sewer Feasibility Study
April 2007

Figure

2

The Dungeness River Executive Committee Working Group has been meeting regularly to assist the Department of Ecology in developing effective an in-stream flow rule for the Dungeness River, which will affect water availability for future population growth in the Carlsborg UGA.

The Dungeness Aquifer Recharge (AR) Feasibility Study is now in process with an expected completion during 2008. The main objective of the AR study is to evaluate the feasibility of using artificial recharge to augment the Dungeness River's and tributaries' base flows during low flow times, minimize ground water declines, mitigate for future water rights, then recover and use stored ground water. The reuse water from the Carlsborg sewer system may be a potential source of recharge water for the AR project.

2.3 Groundwater Contamination

Nitrate concentrations in the groundwater are an ongoing concern within Carlsborg and vicinity. Federal drinking water standards require potable water to have less than 10 mg/L of nitrates. Most wells within the Carlsborg vicinity currently test below the federal standard. However, nitrate levels in the shallow aquifer have been rising, in some cases above the 10 mg/L standard for drinking water, and may continue to rise further in future years.

Clallam County and the PUD want to decrease the risk of nitrate contamination. Implementing a sewer system for the densest area of development in the Carlsborg area will promote that objective.

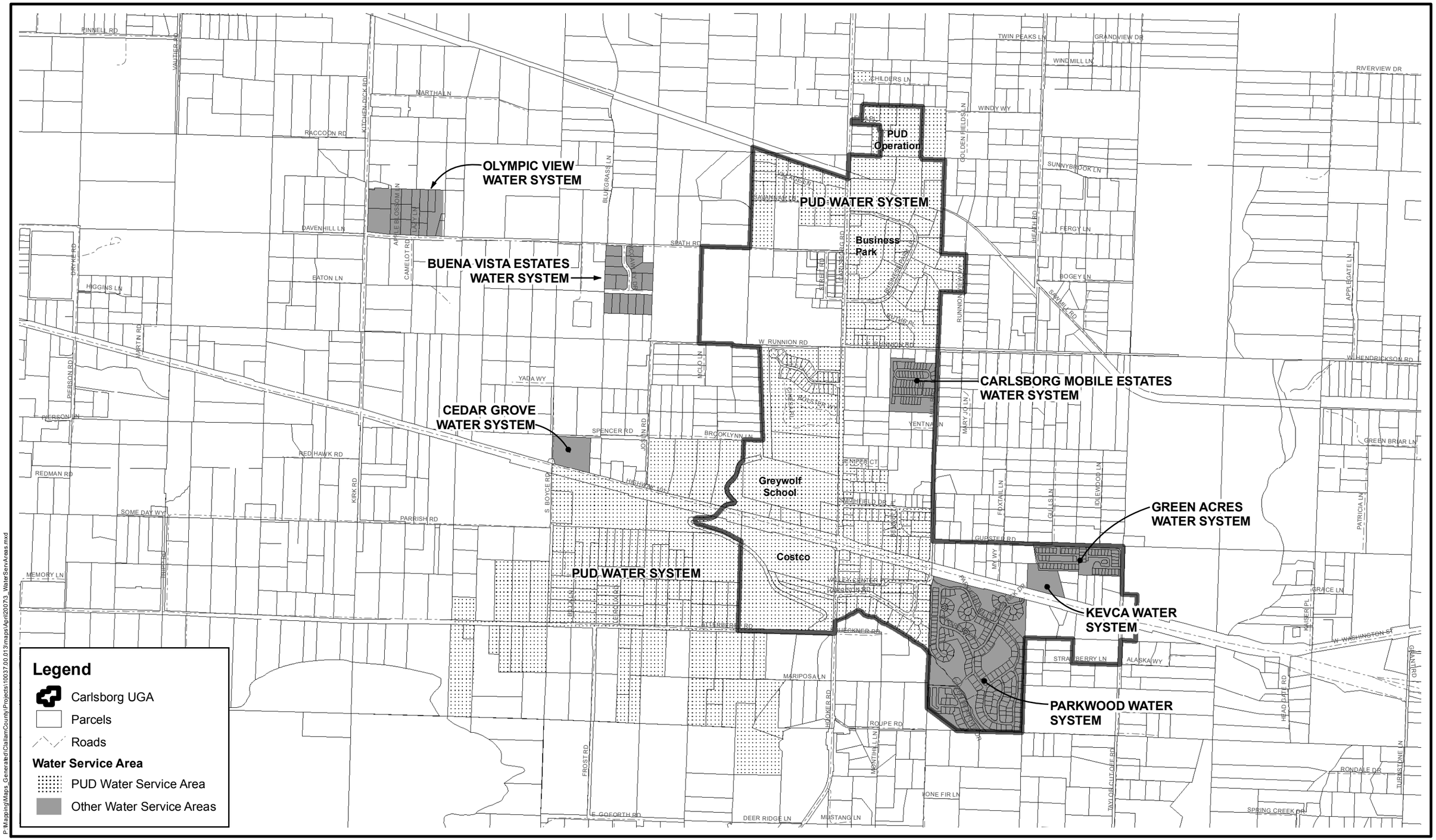
2.4 Carlsborg Water Supply

The PUD provides water service to about half of the Carlsborg UGA plus some properties outside of the UGA. The remainder of the UGA is served by private wells and several smaller private purveyors as shown on Figure 3, including the following:

- Parkwood Mobile Home Community
- Green Acres Mobile Home Park
- Carlsborg Mobile Estates
- Rainbows End RV Park

About 111 individual lots within the Carlsborg UGA are served by private wells. Some of these parcels are residential, and others are commercial properties.

Clallam County would like the PUD to expand its water service area to include the entire UGA, and the PUD is interested in doing so. However, the existing water rights for the PUD are inadequate for such expansion. Additional water rights are needed for the UGA to become developed at urban densities. Obtaining additional water rights may be facilitated by the proposed sewer system which would collect wastewater and reuse the reclaimed water for stream augmentation, aquifer recharge, and replacement of some potable water uses such as crop or landscape irrigation (residential and/or commercial).



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Water Service Areas

Sewer Feasibility Study
April 2007

Figure

3

2.5 Reclaimed Water Reuse and Environmental and Efficiency Benefits

Wastewater generated within the Carlsborg UGA is recognized by the PUD and Clallam County as a resource with economic and environmental value. It may be practical for wastewater reclaimed through a community sewer system to be treated to 'Class A' standards and reused for an environmental benefit. Eventually the reused water possibly could be converted into additional potable water rights. This possibility is explored through this Feasibility Study, though a number of regulatory hurdles make this long-term goal uncertain.

A more immediate use for reclaimed water could be irrigation within the UGA. Lawn and garden irrigation and other outdoor uses with 'Class A' water would reduce summer time demand for potable water, thus making more potable water available for domestic use. This reuse of reclaimed water during the peak water use season would increase the efficiency of the water supply system. It would also reduce the demand for irrigation water from the local irrigation companies, and result in less withdrawal from the Dungeness River and more flow left in the stream. Irrigation would continue to provide some recharge to the upper aquifer.

Outside of the irrigation season during the winter, the 'Class A' water could augment flows in the Dungeness River or Matriotti Creek. Both of these streams provide fish habitat for salmon listed under the Endangered Species Act. Augmentation of Dungeness River flows during winter or other high flow periods could mitigate any impacts of withdrawals for storage purposes. Accordingly, a net environmental benefit appears to result from providing sewers in the Carlsborg UGA with reuse of the reclaimed wastewater. However, 'stream augmentation' is not direct discharge in that the reclaimed water can enter the stream by percolation through the soil but not by a point discharge as with a pipe.

2.6 Inter-Agency Cooperation

A Memorandum of Agreement dated 12 September, 2006, between Clallam County and the PUD defined the responsibilities for implementing this Sewer Feasibility Study. The PUD is the lead agency and has agreed to operate the sewer system for Carlsborg, should one be built.

Clallam County will support the development of a sewer system financially, and through their land use planning and general government powers. Clallam County also operates several small sewer systems in other parts of the County and some joint management approaches may be appropriate.

The Lower Elwha Klallam Tribe and the Jamestown S'Klallam Tribe have both been invited to participate in whatever form of joint sewer system development and operation is deemed appropriate to their respective nations. Each is considering or developing a sewer system to serve their respective communities. However, each will be a small system with limited customers and resources. Some joint approaches may be found beneficial to all, such as the following:

- Sludge and biosolids management, processing, and disposal
- Staff training and relief coverage for sickness and vacations
- Utility billing and records

- Common equipment standards for maintenance and repair
- Emergency assistance

Details of future cooperation remain to be refined, should a sewer system for Carlsborg be found feasible and actually implemented.

2.7 Public Involvement

Public support is essential for implementation of a sewer system within Carlsborg. Accordingly, the Feasibility Study has been developed with an on-going public involvement program. The public involvement program helps the community and property owners gain an understanding of the sewer planning and implementation process. It also provides the public with opportunities to ask questions and to participate in determining the outcome. Two public meeting were held as the draft Sewer Feasibility Study was developed, and a third will be held after the draft Study is completed:

Initial Public Meeting was held on 26 October, 2006, at the Greywolf School in Carlsborg. About 70 interested people attended. The scope of the Feasibility Study was presented, together with the relationship of this Study to previous studies of the Carlsborg situation.

Intermediate Public Meeting was held on 22 February, 2007, to review the estimated project costs for an initial service area and how these might be applied to typical properties within the UGA. About 40 people attended. Some comments were submitted expressing interest in sewer service for several properties, while several had comments opposed to installing sewers.

A conceptual Initial Sewer Service Area was shown to the public at the Intermediate Public Meeting, together with a conceptual estimate of what the initial sewer system might cost participating property owners. The owners of several parcels inside of that Initial Area expressed interest in being included, as well as some owners outside that area, and some property owners within the Initial Area stated objections to being served as summarized below:

- One property owner of several parcels did not want to participate
- Three owners would like sewers, but believe the costs are too high
- Three owners of a number of commercial and residential parcels want to participate

In addition, several people commented that they were not ready to offer an opinion regarding sewer service, or had concerns but were outside the UGA and can not participate.

Concluding Public Meeting will be conducted after the final Feasibility Study is released. It will provide a forum for the public to make their opinion of sewer system feasibility known to the PUD and to Clallam County.

No decision has been made as to whether a sewer system should be started or not. The Initial Sewer Service Area shown at the Second Public Meeting was only a concept. The Initial Sewer Service Area was revised in response to comments received. The actual service area for any initial sewer system that is implemented has yet to be defined and will likely be different than the

system shown in this Study, depending on further property owner comments and the funding that can be secured.

2.8 Financial Feasibility

Several financial goals were envisioned for the Feasibility Study to improve on previous studies:

- Determine if a lower cost system than was developed previously can be found.
- Explore whether a phased approach and modular construction can reduce initial costs.
- Include other project cost elements that may have been omitted from previous studies.
- Update construction and project cost to current conditions as a result of inflation.

In the long term, a sewer system for Carlsborg must be self-supporting if it is to be deemed feasible. However, it is recognized by the PUD and by Clallam County that initial construction of a sewer system, and start-up operations, will require some level of financial assistance. Some of the funds advanced may eventually be recovered by the two agencies through fees for subsequent development of additional parcels and sewer connection charges.

Federal and state funding for part of the initial project costs is possible, though specific amounts remain undefined.

The basic funding mechanism to implement a sewer system for Carlsborg would be through formation of a local utility district (LUD) under the PUD funding umbrella in accordance with RCW 54.16. Benefiting property owners would be assessed an equitable share of the total project costs for the sewer system, not to exceed the ‘special benefit’ received by each property parcel by construction of the sewer system.

In addition to the challenges involved in funding the construction of the initial sewer system, challenges will arise in funding the initial operating costs as well. The initial sewer service area needs to include enough customers to make the system financially viable. However, the PUD recognizes that start-up operations may be slow. Several years may pass before enough operating revenue is generated to fund all operating costs.

3 Background Information

3.1 Community Description

The Carlsborg UGA as presently defined comprises about 560 acres, of which about 70 acres are currently public rights-of-way. Additional rights-of-way will be created if the UGA is developed to urban densities. Existing land uses are illustrated in Figure 4 and in the aerial photograph shown as Figure 5.

Carlsborg began in 1919 with the building of a saw mill and shingle mill by Mr. C. J. Erickson. A town with a general store, a post office, a dining hall, and related shops soon developed to accommodate the approximately 75 people working at the mills.

The mill closed in 1966 and the site has been converted to the Carlsborg Industrial Park. The older part of Carlsborg has been designated as a historic village. The Greywolf School has since been built, a number of commercial/industrial facilities have been developed, and several subdivisions and mobile home parks have been built.

The state Office of Financial Management report on small areas lists Carlsborg with a population of 828 people in 2005 and 2006 while living in 457 housing units.

3.2 Soils

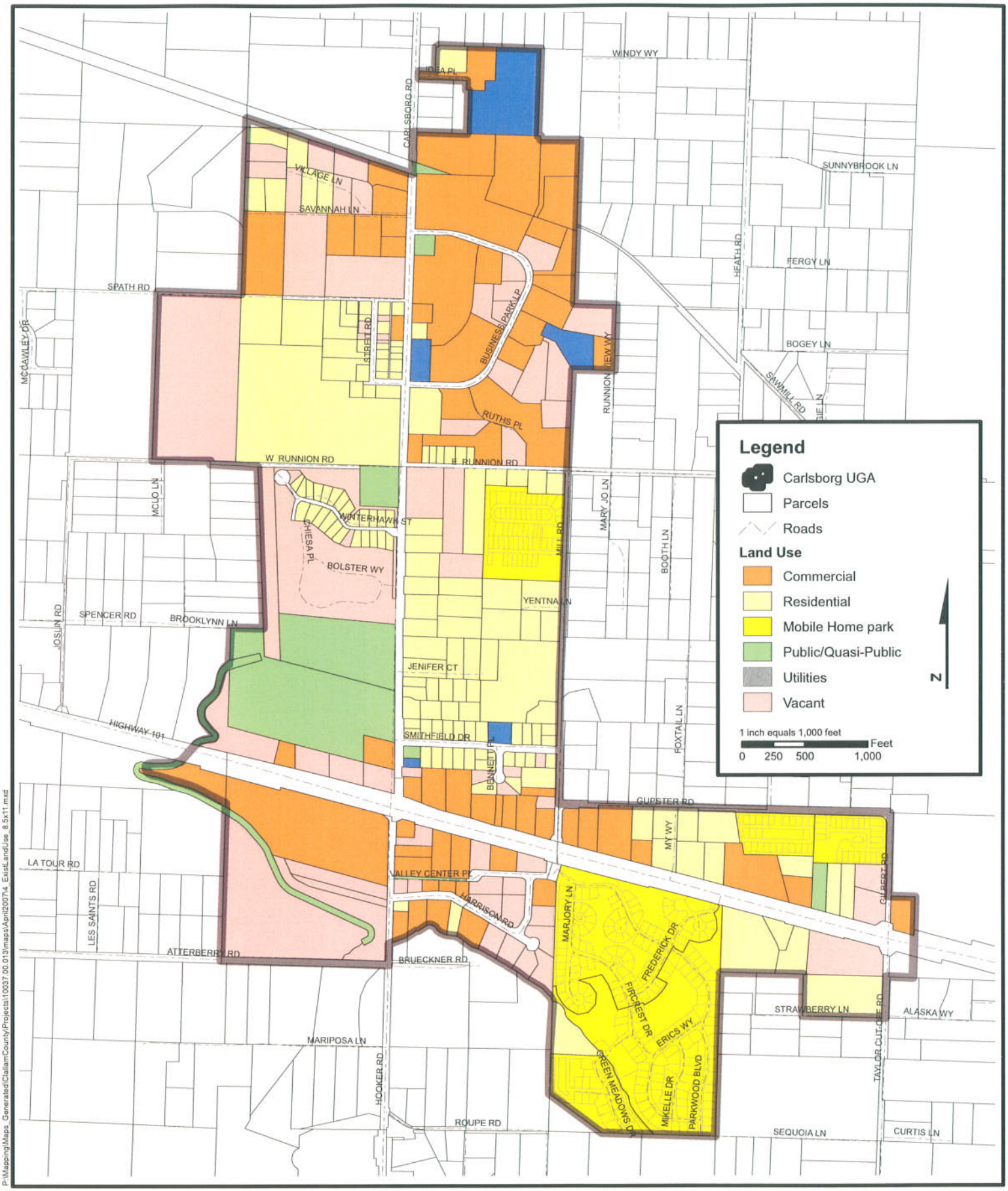
The soils typical throughout the UGA are a particular concern for on-site sewage treatment. Such systems depend on the drainfield soils providing much of the treatment by retarding sewage effluent flow through a surficial aerobic layer.

Unfortunately, soils beneath Carlsborg are usually Type 1; which are very coarse grained, drain rapidly, and do not retard the drainfield effluent flow long enough for effective treatment to occur. As a result, the septic effluent tends to travel vertically through the soil column into the aquifers, which results in elevated nitrate levels reaching the groundwater.

3.3 Previous Studies and Documentation

A list of previous studies and documents consulted during preparation of this Feasibility Study is provided in the Bibliography. Several of these past documents were found important in formulating a feasible approach for a sewer system in Carlsborg. However, the benchmark for comparison purposes is the ‘Carlsborg Comprehensive Sewer Study’, dated December 1994.

Some of the key findings from the 1994 effort are summarized in Table 1 based on the number of equivalent residential units (ERU) for initial operations and at build-out conditions using a sequencing batch reactor (SBR) as the treatment process.



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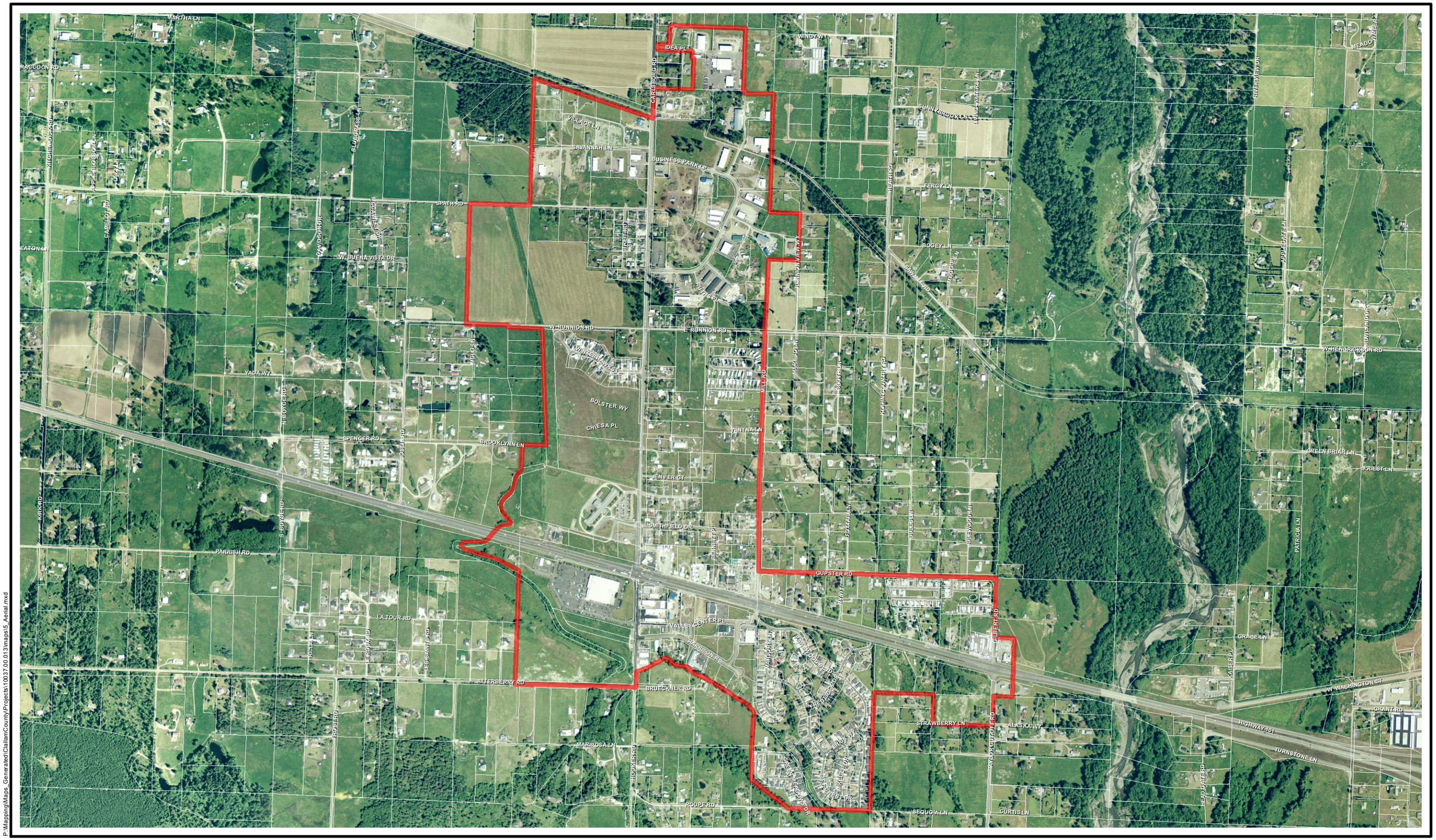
Existing Land Use

Sewer Feasibility Study
April 2007

Figure 4



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Aerial Photograph of Carlsborg Area

Sewer Feasibility Study
April 2007

Figure 5

Table 1
Summary of 1994 Study Data

Carlsborg Study Area

Area = 680 acres Initially 365 ERU in 1998 Build-out 705 ERU

Estimated Project Cost – in 1994 dollars

Sewer Collection System	$ 3,552,000
Sewage Treatment & Disposal System	$ 3,249,000
Estimated Total Cost (1994 dollars)	$ 6,801,000

Notes 1) SBR Treatment with effluent discharged to Clallam Irrigation Ditch
2) Projects costs elements only allowed at 21 % above construction
3) On-site sewer connection cost excluded, estimated at $ 1,810 each

Escalation to Present Costs – in 2006 dollars

Construction Cost Escalation 1994 to 2006 = 148 %
Escalated Total Project Cost in 2006 Dollars = $ 10,120,000
On-site sewer connection costs additional

Costs per Connection

Four Assessment Scenarios varied from $ 500 to $1,000 annually per ERU
Monthly O & M estimated from $ 35 to $ 87 per ERU

The 'urban growth management area' studied in 1994 was larger than the UGA subsequently adopted, as it included additional parcels east of Mill Road and north of Gupster Road. The current UGA is about 120 acres less. The 1994 plan also envisioned sewer service eventually encompassing all property between Brueckner Road north to the Old Olympic Highway, and east from Kitchen Dick Road to the Gilber Road-Grandview Drive alignment.

The 'project costs' estimated in 1994 and shown in Table 1 would have been sufficient to prepare the system design and oversee construction; however, the estimate omits costs for various permits, land acquisition, formation of a local improvement district, financing, and various related activities that would have been required even in 1994. More extensive requirements now exist due to additional regulation and changed conditions.

The 'Carlsborg Capital Facilities Plan', initially dated October 1998 and subsequently December 2000, was an update of the 1994 document with the service area revised to become the 'proposed urban growth area', which is the UGA subsequently adopted. Sewer service was considered in three scenarios. The 1998 document shows the estimated project cost for the Scenario 1 (essentially the commercial/industrial area along Carlsborg Road and US 101) sewerage collection system as $ 2,641,000. Treatment and disposal costs were additional and in the range of $ 6,708,000 to $ 6,916,000. The estimated total project cost for the Scenario 1 sewerage system was therefore in the range of $ 9,349,000 to $ 9,557,000. However, the estimate provided only 20 percent for project cost items, which is insufficient to fund the ancillary studies associated with initiating a new sewer system, nor were the costs of forming an LUD included.

The 'Engineering News Record' Construction Cost Index for Seattle in December 1998 was 6957.81. In November 2006, the Index was reported at 8655.83, which is an increase of 24.4 percent. The escalated project cost estimate for the 1998 Scenario 1 sewer system would therefore be $ 11,630,000 to $ 11,946,000 in 2006 dollars.

As noted, the very limited project cost elements included in the estimates for both documents significantly understates the actual costs required to implement the system described. For instances, the costs associated with abandoning the existing on-site sewage systems and installing side sewers was estimated at $1,810 per unit ($2,250 in 2006 dollars), but these costs are not included in the total project cost estimate.

Both previous Plans envisioned that the treated wastewater would be discharged to the Dungeness River or to an irrigation ditch under an NPDES permit; however no costs were included for acquisition of that permit. In any event, the regulatory climate has changed. It is unlikely that a new NPDES permit would be issued for a point discharge to surface waters in the Carlsborg vicinity for wastewater treated only to secondary standards, or maybe to any standard.

Possibilities for reclamation of wastewater and reuse were not considered or addressed.

Connection to the City of Sequim sewer system was considered in these previous studies. The resulting cost analyses for both the 1994 and 1998 Plans concluded that a local sewer system would be more cost-effective than sewer service by the City of Sequim. The alternative of connecting Carlsborg to Sequim was analyzed again during preparation of this Sewer Feasibility Study with similar conclusions.

3.4 Groundwater and Aquifer Concerns

The hydrologic conditions underlying Carlsborg and the Dungeness River valley can be described as summarized below with varying unit thicknesses, elevations, and permeabilities:

Unit 1 – permeable surface aquifer	about 50 feet thick
Unit 2 – aquitard of limited permeability	25 to 50 feet thick
Unit 3 – permeable intermediate aquifer	starts 0 to 25 feet above MSL
Unit 4 – aquitard of limited permeability	
Unit 5 – permeable lower aquifer	starts 50 to 100 feet below MSL
Unit 6 – undifferentiated material	
Unit 7 – bedrock	

Nitrate concentrations in the groundwater are an ongoing concern within Carlsborg and vicinity. Two significant public health concerns are associated with nitrates:

- Methemogoblinemia is a disorder which reduces the oxygen-carrying capacity of hemoglobin in the blood of infants less than six months of age – often known as 'blue baby syndrome', though the condition can affect anyone at any age.
- High incidences of stomach and esophageal cancer may be correlated with high levels of nitrates and nitrites, which may be a particular concern for elderly people.

Federal drinking water standards require potable water to have less than 10 mg/L of nitrates. However, the State of Washington anti-degradation policy prohibits any discharge to groundwater from significantly increasing pollutants linked to public health or environmental concerns.

Clallam County has been concerned about the nitrate levels in drinking water at Carlsborg for some time, as documented in two reports prepared for the County:

- 'Groundwater Quality in the Agnew and Carlsborg December 2000 – September 2002', April 2003, was prepared by the Department of Ecology and the US Geological Survey.
- 'Groundwater Monitoring for Nitrates in the Agnew-Carlsborg Area, July 2004, was prepared by Clallam County Environmental Health Services.

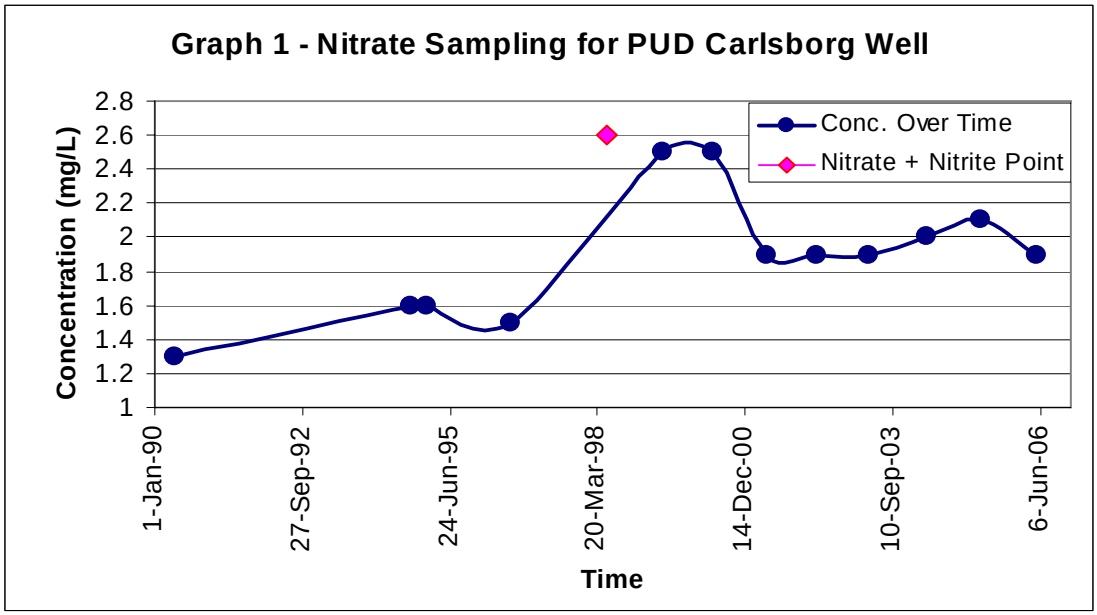
The July 2004 study documented tests results for samples from 125 wells. Most of these wells draw from Unit 1. At least three wells within Carlsborg or close by have tested nitrate levels exceeding 10 mg/L. The maximum concentration found was 18.9 mg/L.

Most public and private wells in the area have recorded nitrate levels that are significant, though low single digit and well below the 10 mg/L standard. This includes the PUD well from the Unit 3 aquifer at about 170 feet below ground surface. This well is into the middle aquifer, which is separated from the Unit 1 aquifer by the 25 to 50 foot thick aquitard of Unit 2. This sampling record is summarized in Table 2.

Table 2
Nitrate Sampling Results for PUD Carlsborg Well

Sample Date	Nitrate mg/L	
18 May 90	1.3	
28 Sep 94	1.6	
25 Jan 95	1.6	
7 Aug 96	1.5	
18 May 98	2.6	total nitrate/nitrite
7 Jun 99	2.5	
8 May 00	2.5	
9 May 01	1.9	
9 Apr 02	1.9	
3 Apr 03	1.9	
4 May 04	2.0	
3 May 05	2.1	
16 May 06	1.9	

The Table 2 records have shown an upward trend in nitrates levels over the years so that recent tests results are about a third higher than tests from 15 years ago, though lower than were recorded a few years ago. These sampling results are shown graphically in Graph 1.



Nitrates are a chemical compound without a DNA marker that allows the specific pollutant to be traced. Consequently it is not possible to establish with certainty how much of the increasing nitrate level is due to septic drainfield effluent; versus how much is from other human activities like lawns, pets, landscaping, or stormwater; and how much is from agricultural fertilizer, livestock wastes, wildlife, or other sources.

However, water quality in Hood Canal has been studied extensively by the Department of Ecology, University of Washington, and others. The Puget Sound Action Team and the Hood Canal Coordinating Council released the 'Preliminary Assessment and Corrective Action' (PACA) in May 2004 that focused on dissolved oxygen levels in Hood Canal. The PACA concluded that nitrogen played a key role in depleting Hood Canal oxygen, and that the largest source for nitrogen was the on-site sewage systems bordering Hood Canal. The PACA estimates human sewage contributes from 33 to 84 percent of the anthrogenic nitrogen entering Hood Canal.

The contribution of nitrogen from on-site septic systems to groundwater at Carlsborg may be of a similar magnitude (though no documentation of this has been developed). If so, a public sewer system for the UGA is the best method to reduce nitrate concentrations in the groundwater, which is the potable water source for most private wells in the area.

3.5 Existing On-Site Sewer Systems

All developments existing within Carlsborg are currently served by on-site sewage systems. New on-site sewage systems and all system repairs are required to use enhanced on-site treatment devices to achieve a minimum reduction in nitrate discharge of at least 50 percent in accordance with Clallam County Code 33.20.060. However, most existing on-site systems

continue to use older, less effective technology. Many of these older systems are believed to be under sized and do not conform to modern standards.

Even new on-site systems meeting Clallam County standards for Carlsborg remove only half of the nitrate load. The remainder still is discharged into the aquifer and form part of the drinking water for some residents. Yet these systems work only if properly operated and regularly maintained; otherwise the treatment goals will not be met.

In accordance with new on site septic requirements from Chapter 246-272A WAC, Clallam County has been developing a program to inventory, inspect and enforce on site septic systems for proper operation to protect public health and the environment. The County has an active On-Site Septic Program with an On-Site Septic Work Group meeting regularly to develop the requirements for a number of related programs, some of which are outlined below:

- Provide protection for sensitive areas
- Develop recommendation for on-site system inspections
- Identify all on-site systems within Clallam County

As documented in the report from the Carlsborg Community Advisory Council to the Clallam County Board of Commissioners, 17 June 2002, the community desires to extend the life of existing on-site sewerage systems for as long as possible. This position was extended the 'Recommendations of the Carlsborg Community Advisory Council' dated February 2003 with specific recommendations to improve the performance on on-site systems. Continued use of on-site sewage systems in endorsed in the 'Carlsborg Capital Facilities Plan', dated October 1998.

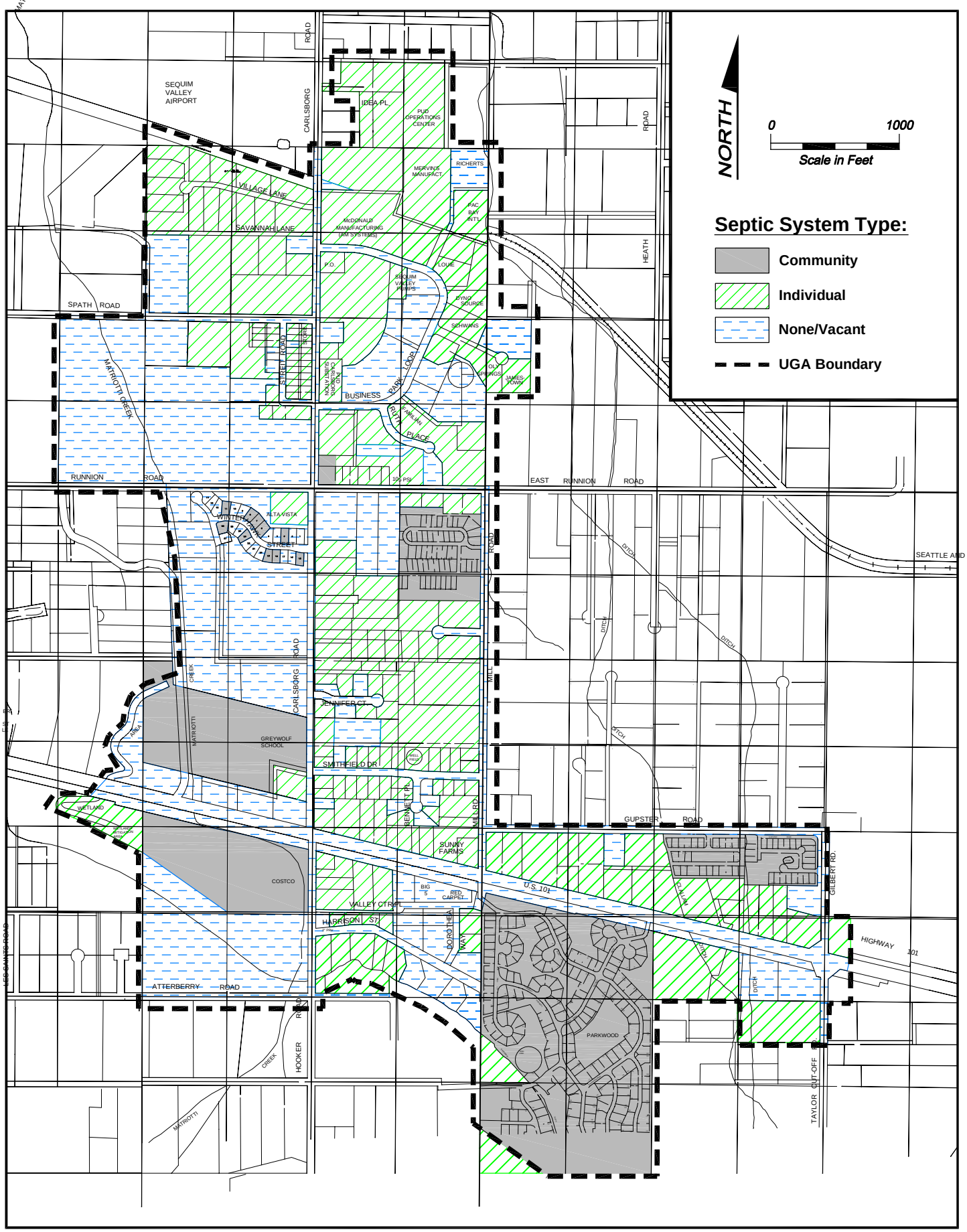
Several community on-site sewerage systems exist within Carlsborg that are operated by private entities. These existing systems are summarized in Table 3 and shown on Figure 6.

Table 3
Existing Community Sewerage Systems

Community	Existing Homes	On-Site Systems
Parkwood	187	33
Carlsborg Mobile Estates	51	1
Green Acres	49	1
Alta Vista	26	3

The Greywolf School has an on-site sewage system with three pods, each designed for 3,500 GPD and 10,500 gallons per day (GPD) in total. The existing commercial and industrial developments within Carlsborg have on-site sewage systems with design capacities ranging from 100 to 7,000 GPD.

A modern on-site sewage system able to reduce nitrates by at least 50 percent is reported to cost about $ 17,000 to $ 20,000 to construct for a typical single family home in the Carlsborg area during 2006, plus $ 3,000 to $ 5,000 additional in design and permit fees. The total cost is therefore about $ 20,000 to $ 25,000 per single family home.



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720 Third Avenue, Suite 1200
Seattle, Washington 98104-1820

CLALLAM COUNTY 1854

PUD #1 of Clallam County

Existing Community On-Site Sewage Systems

Sewer Feasibility Study
April 2007

Figu

6

Figure 7 shows a comparison between how a standard on-site septic system work in loamy soil (Type 1 or 2) in comparison with the gravely Type 1 soils in Carlsborg that do not allow effective treatment before the effluent reaches the aquifer. An on-site system meeting Clallam County standards is also shown.

3.6 Clallam PUD Water Supply Data

The Carlsborg Water System operated by the PUD has three wells. The principal well is located in the Carlsborg Industrial Park with a depth of 177 feet below the ground surface. It has a 10 hp motor and can pump 300 GPM.

The PUD also has two wells on Smithfield Drive in the Sequim Valley Tract, though neither is in current use. Well No. 1 is 163 feet deep with a capacity of 35 GPM and a water right for 16.8 acre-feet annually. Well No. 2 is 298 feet deep with a capacity of 75 GPM and a water right for 72 acre-feet annually.

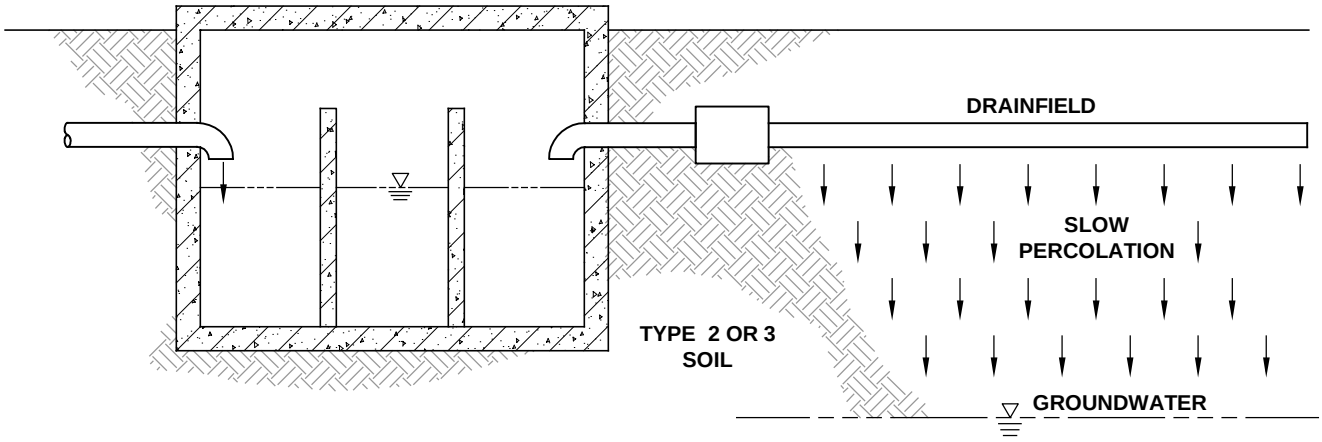
The statistics reported for water operations in recent years are shown in Table 4, with Table 4A showing the comparison between annual, summer, and winter water demands reflected in the water bills to residential and non-residential customers in relation to the total water produced from the principal PUD well. The difference between water produced from the well and water billed to customers is the measure of lost or unaccounted water from the system because of pipe leaks, flows from fire hydrants, and used for maintenance like pipe flushing.

Table 4A
Clallam PUD – Carlsborg Water System
Average Water in GPD

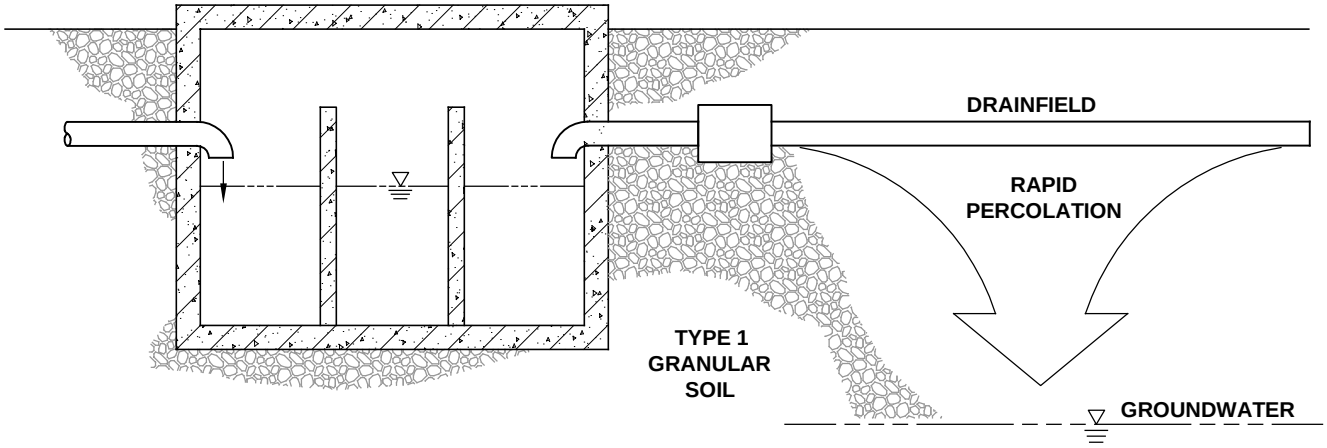
Month & Year	Residential	Non-Residential	Total Billed	Produced
2004 Annual Avg	24,045	36,340	60,385	66,265
Apr to Sep 04 avg	31,703	45,690	77,393	82,623
Oct to Mar 04 avg	16,345	26,938	43,283	49,816
2005 Annual Avg	23,146	38,259	61,405	69,744
Apr to Sep 05 avg	28,602	43,421	72,023	82,779
Oct to Mar 05 avg	17,659	33,069	50,728	56,638

Table 4B focuses on winter water use when little irrigation occurs and most water billed can be anticipated to become wastewater, except for some industrial use.

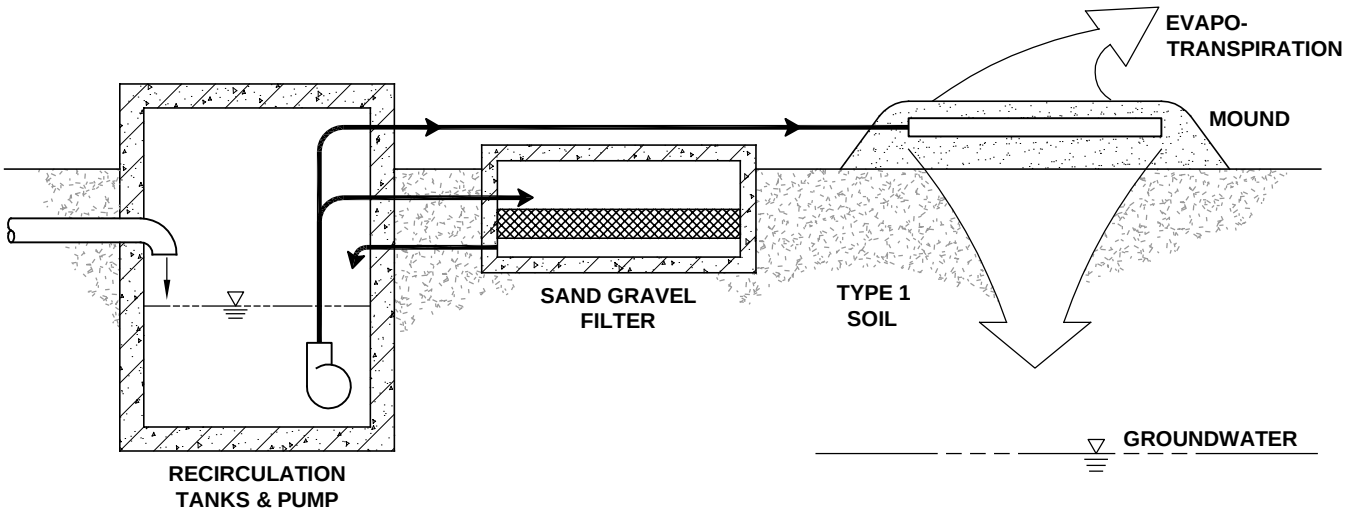
The comparison between water used during April through September with water used from October through March as shown in Table 4A indicates the potential potable water savings that might be achieved through reuse of reclaimed water for irrigation and other non-potable uses. Summer residential water use is 94 percent above winter use. Non-residential summer water use is 79 percent above winter use. Not all of this seasonal use can be saved through reuse of



NORMAL SEPTIC SYSTEM OPERATION



SEPTIC SYSTEM IN CARLSBORG - INADEQUATE TREATMENT



ON-SITE SEPTIC SYSTEM IN CARLSBORG TREATING NITRATES

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On-Site Sewage Systems Comparisons

Sewer Feasibility Study
April 2007

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reclaimed water, though the potential is clear – and it might even be possible for a reuse water system might even reduce the winter water use.

Table 4B
Clallam PUD – Carlsborg Water System
Winter Water Use per Customer in GPD

Month & Year	Residential	Non-Residential	Total Billed	Produced
January 2004	133.6	385.5	39,078	49,054
February 2004	117.3	485.3	45,927	44,479
March 2004	120.7	388.0	37,690	50,357
October 2004	119.5	476.0	45,172	52,770
November 2004	131.4	498.6	48,525	52,983
December 2004	118.3	456.6	43,729	48,837
Average	**123.5**	**449.8**	**GPD per customer**	
January 2005	131.4	463.1	46,457	49,030
February 2005	104.9	389.6	38,316	48,887
March 2005	121.2	441.2	48,831	52,891
October 2005	169.8	744.8	70,522	63,966
November 2005	116.5	564.8	51,602	60,812
December 2005	123.7	537.0	54,473	63,628
Average	**127.9**	**523.4**	**GPD per customer**	

The number of residential customers during 2004 varied from 127 to 138; and during 2005 from 135 to 142 customers. Non-residential customers varied from 57 to 62 during 2004; and from 62 to 65 during 2005. The average residential water bill was $ 35.56 for July 2005.

The residential water use as shown in Table 4B averaged about 124 gallons per day (GPD) per customer during the winter of 2004 and 128 GPD during the winter of 2005. The two-year winter average is about 125 GPD per residential customer. Commercial accounts averaged 450 GPD each during 2004 and 523 GPD each during 2005.

Several of the non-residential customers have significant water demands as shown in Table 5, though these water uses may not translate directly into wastewater flows.

Table 5
Major Non-Residential Water Customers in 2005
125 GPD per Residential Equivalent

Customer	Total Cubic Feet	Average GPD	Residential Equivalents
Olympic Springs	358,395	7,345	58.8
Greywolf School	217,846	4,464	35.7
Sequim Chevron	158,156	3,241	25.9

Customer	Total Cubic Feet	Average GPD	Residential Equivalents
Mark D Smith	79,178	1,623	13.0
Sunny Farm Store	64,649	1,325	10.6
Flippers Restaurant	60,994	1,250	10.0
PUD Operations Center	50,870	1,043	8.3
Ted McDonald	36,068	739	5.9

Much of the Olympic Springs water consumption goes into their bottled water product and would not enter a sewer system. Some of the Greywolf School water use may be irrigation.

The PUD water service area established by a local utility district (LUD) includes about half of the Carlsborg UGA, plus a significant area outside the UGA. The principal water source for the PUD is a well created through a water right application as documented in the 'Construction and Testing Report' date June 1990 by Northwestern Territories Inc. and the 'Report of Examination' by the Department of Ecology dated January 8, 1992. These documents comprise Appendix A. The water right appropriation was 393 acre-feet per year with a maximum withdrawal rate of 320 GPM. The Report of Examination directs the PUD to encourage property owners to use irrigation water rights where available for lawn watering and similar non-potable functions with the goal of minimizing further withdrawals from the aquifer and impacts to the Dungeness River.

The water right for the principal well represents an average use of 350,800 GPD throughout the year. Use during 2004 averaged 66,265 GPD and 69,744 GPD during 2005. Therefore, the 2005 use was about 20 percent of that water right. The three wells available to PUD in Carlsborg have a combined water right of about 481 acre-feet annually, for an average allowance of about 429,000 GPD. On that basis, the approximately 70,000 GPD produced during the year 2005 represents about 16.3 percent of the water rights available.

However the PUD believes the existing water right may be insufficient to support service to the entire UGA and adjacent LUDs into the future. Additional water rights are required, together with low impact development strategies, and are essential to support the UGA development to the land use density envisioned by Clallam County. This is a significant challenge because the Dungeness River and the related aquifer is currently being treated like a 'closed' system, meaning Ecology is not issuing additional water rights.

The PUD also has concerns regarding the ability of their Carlsborg water system to meet peak day demands. Some additional storage may be required to supply peak day demand, though water system efficiency improvements, such as reusing reclaimed water for outdoor and other non-potable purposes may result in a more manageable peak demand.

3.7 Additional Water Right

Generally speaking, only a few possibilities are available for the PUD to acquire additional water rights:

- Local irrigation districts and companies could sell some of their water rights to the PUD; however, these agencies do have obligations to provide water to their service areas. Transfer of a part of their water right may be difficult.

- Reuse of wastewater reclaimed for irrigation within the Carlsborg UGA may significantly lower the maximum potable water use during the summer.

- Acquisition of existing water rights by assumption of existing exempt wells, in general, means the PUD would gain only sufficient water to serve those existing users. Ecology has granted only about 400 GPD (out of a legal maximum of 5,000 GPD) when exempt wells have been consolidated into the PUD water right. This means that consolidating exempt well users into the PUD system provides little additional water for new customers.

- Improved efficiencies in existing water use may be possible. The PUD adopted an inverted block rate structure recently to encourage conservation. However, peak water use is currently about three times average use. This indicates that some further efficiency in water use may be achievable. If so, there may be opportunities to expand the water service area to some degree.

- Some private wells may exist within reasonable distances from Carlsborg that might be purchased, though none have been identified to date.

Wells withdrawing less than 5,000 GPD from the aquifer are exempt from the requirement to obtain a water permit; and may serve up to six private homes or the commercial equivalent. Some privately owned wells are larger and may serve developments with dozens of homes or the commercial equivalent, or be used for non-potable purposes such as irrigation. A number of such wells exist within the UGA, most into the Unit 1 or upper aquifer; and several reportedly have concerns with rising nitrate levels. Where property owners are interested, water service could be provided by the PUD and Ecology will credit the change as an addition to the PUD withdrawal right at about 400 GPD per home.

The severe limitations in acquiring existing water rights as indicated above shows the appeal of trading reclaimed water for added water rights. Conceptually, water could be withdrawn from a lower aquifer, such as Unit 3 or Unit 5, with only minor impact on the Unit 1 aquifer or the Dungeness River. After potable use, the sewage would be collected and treated to ‘Class A’ standards (which is generally of higher quality than Dungeness River water), and reused to augment flow in the Dungeness River or Matriotti Creek. The augmentation quantity would be several multiples of any affect the withdrawal would have on the surface waters. A net environmental benefit would result, such as an improved habitat to aid recovery of endangered species such as salmon. Also and in part, the improved quality of the returned reuse water for this approach would also mitigate any withdrawal quantity impact to the Dungeness River.

The PUD did apply in August 2006 for an additional 510 GPM in water rights to be drawn from the existing well. Applications are processed by the Department of Ecology in the order

received. Several dozen applications are pending ahead of the Clallam PUD. Four criteria are used by the Department in processing an application for a water right:

1. The water must be for beneficial use
2. Water must be available from the source identified
3. Existing water uses from that source must not be impaired by the new withdrawal
4. Proposed use must not be detrimental to the public interest.

The Department of Ecology has indicated that a number of complexities exist and must be resolved regarding any proposal by the PUD to withdraw water from Unit 3 for potable use, collect the resulting sewage, treat the wastewater to 'Class A' standards, and reuse the water to augment flow in the Dungeness River or another water body in the Carlsborg vicinity. Some of these issues are summarized below:

a. The Dungeness River is currently being treated like a 'closed' system, meaning no new or additional water rights are being issued in the basin.
b. Withdrawal from a deeper aquifer (Units 3 and 5) may affect a large area.
c. Several 'windows' are known to exist as connections between Units 1 and 3.
d. Some water must be reserved or 'banked' for future uses.

The 'Report of Examination' for the existing PUD well states that ' the upper confined aquifer is isolated from the water table aquifer' and 'no depletion of Matriotti Creek (one half mile away) or the Dungeness River (one mile away) will occur'.

This statement is supported by the 'Construction and Testing Report' which monitored three shallow wells in the vicinity during the test pumping and found none of the wells showed measurable drawdown. The Report also noted significant differences in water quality between the upper aquifer (Unit 1) and new well (Unit 3), which was a clear indication of separation between the two strata.

Furthermore, the Plan for WRIA 18 says that water withdrawals from Units 3 and 5 have less affect on the Dungeness River than similar withdrawals from Unit 1. However, the magnitude of this difference has yet to be established. If agreement can be reached on the extent of connectivity between the aquifer units, then a new water right may be possible at some future date for a reuse concept as envisioned by the PUD.

Transfer of irrigation water rights into potable uses is possible. However, irrigation companies have a service area and properties within that boundary are entitled to receive irrigation water. Changes in land use or crops for specific parcels within the service area may change the irrigation use for that parcel but do not necessarily mean irrigation water becomes available for transfer to potable use.

Transfer of an irrigation right encumbered to a specific parcel would be easier. The process requires defining the average consumptive use (ACQ) in the highest two of the past 5 years. Since different crops are planted in different years, this calculation is challenging for large areas, though it is manageable for small, discrete fields where records may be more available.

3.8 Environmental Concerns

Health concerns due to elevated nitrates in the ground water have been noted earlier. 'Groundwater Quality in the Agnew Carlsborg Area' by the Department of Ecology and the US Geological Survey, April 2003 reported on the quarterly monitoring of eight wells (Dec 00 through Sep 02) and found nitrogen concentrations ranging from <0.01 to 4.58 mg/L. Three of the wells showed statistically significant increased concentrations during this period, and one decreased. However, more recent tests, including the 2004 monitoring by Clallam County Environmental Health Services, seem to indicate further increases in nitrate levels. At least one well within the UGA recently tested above 10 mg/L in while samples for the same well from a few months earlier had recorded 7 mg/L and a year ago were about 3 mg/L.

Improved public health is a valid reason to grant an additional water right to the PUD for the Carlsborg system; but only to relieve the concerns for existing customers. Ecology stated in a meeting on January 24th 2007 that an additional water right cannot be issued on a public health basis simply to facilitate growth and development.

The 'Groundwater Quality' report also stated that precipitation in the Carlsborg area was believed to contribute an average aquifer recharge of about 3.5 inches annually, while irrigation provided an average of 4.5 inches. Installing irrigation piping in place of ditches appears to be reducing leakage from the irrigation ditches and the proliferation of exempt wells seems to be lowering the typical groundwater level.

Low summer dry weather flows in the Dungeness River are perhaps the principal environmental concern in the Carlsborg vicinity. Table 6 summarizes some of the data available.

Table 6
Dungeness River Flow in CFS

Parameter	2004	2005	2006
Daily Mean Maximum	3,020	2,210	2,490
Daily Mean Minimum	77.9	58.6	70.3
Annual Mean	351	268	415
Annual Median	272	169	253

Note: 1 cubic foot per second (CFS) is about 449 gallons per minute

Excessive low flows impact the aquatic habitat as well as the riparian habitat along the river banks. Low flows in the river result from several factors:

- Five irrigation agencies have water rights to withdraw up to 500 CFS (cubic feet per second) from the river for irrigation. Withdrawals in recent years have been significantly less than this water right allows as conservation measures have been implemented, but the quantity withdrawn is still significant.

- Some stretches of the river lose water into the soils comprising the river banks. This water loss does replenish the local aquifers, but the quantity removed from the river depletes the stream flow available for fish and riparian habitat.

- River channels have been altered by floods and levees. Now more flow is needed to fill the wider or deeper channel and side-channels to provide habitat for Chinook salmon spawning.

As noted above, existing irrigation ditches leak a significant quantity of the water passing through them. Most ditches are being upgraded by installing pipes to reduce the water loss. Water lost from irrigation ditches is not considered consumptive use, but is part of the return flow in that it enters the Unit 1 aquifer and is not considered 'degraded'.

The instream flow rule-making process is proceeding for WRIA 18. Ecology formed the Dungeness River Executive Committee which meets regularly to provide input for developing a water supply strategy including at least the following components:

- Growth occurring within WRIA 18 for residences, businesses, and institutions
- Community wants to retain an agricultural economic base
- River has water quality, quantity, and habitat concerns for endangered species
- Tribal rights must be included in any process
- Existing infrastructure imposes certain definable constraints

Not enough water exists for all desired uses, so conservation is essential.

3.9 Neighboring Sewerage Agencies

The Jamestown S'Klallam Tribe is proceeding towards construction of a sewerage system to serve the 7 Cedars Casino and allow further expansion of the economic potential at this resort. The Tribe owns about 700 acres in several parcels and eventually intends to construct additional community sewerage facilities to serve other planned developments.

Lower Elwha Klallam Tribe presently has most of its development using on-site sewage systems for parcels adjacent to the Elwha River. The two existing dams on this river are scheduled to be removed within a few years. When that occurs, the ground water for the presently developed area is expected to rise and cause most of the existing on-site system to fail. Accordingly, the Tribe is developing a community sewerage system to protect their public health, and the system may connect to the City of Port Angeles sewer system.

Sunland Sewer District served 950 residential lots. The sewer system originated during the 1970s with a sewage lagoon. The District currently operates a sequencing batch reactor wastewater treatment facility producing 'Class D' reclaimed water for summer flows averaging 90,000 GPD and winter flows averaging 120,000 GPD. The effluent is applied through spray irrigation to about 22 acres of adjacent pasture. However this application practice does not meet current Ecology standards. The District intends to upgrade their system to achieve 'Class A' water quality. Current sewer rates are $ 31 monthly.

City of Sequim operates a treatment facility producing 'Class A' reclaimed water with an annual average flow of about 500,000 GPD. The City population estimated at 5,030 in April 2006. The reclaimed water is currently used for recreational purposes in Carrie Blake Park and some landscape irrigation. The monthly sewer rate is about $ 37 for in-city customers, while outside customers pay an additional 50 percent surcharge.

City of Port Angeles has a population estimated at 18,970 in April 2006. The City operates a secondary wastewater treatment facility with effluent discharged in the Strait of Juan de Fuca. The City also operates a sludge processing facility.

4 Projected Population and Flows

4.1 Historic Population

The Washington State Office of Financial Management (OFM) records show the Carlsborg GMA with a population of 806 people from the 2000 Census and 602 people in 1990. There were 427 occupied homes in 2000, all but 49 being owner-occupied. The occupancy rate reported in the 2000 Census for owner-occupied dwellings was about 1.85 people per home. There were additional 34 housing units reported as vacant and 5 units for seasonal, recreational, or occasional use.

Employment within the UGA was reported to be about 240 people in the 2000 Census. The median household income was reported to be $ 28,103.

The 1990 and 2000 Census data, together with the OFM 'Small Area Estimate Programs', indicate the historic population for Carlsborg has grown about 2.0 percent annually. The April 2005 population estimate was 828 people for the Carlsborg UGA. The population gain of 2.3 percent over 5 years is an average increase of about 0.5 percent annually. However, the 2.0 percent gain since 1990 appears realistic for long-term planning, and does correlate with the City of Sequim experience.

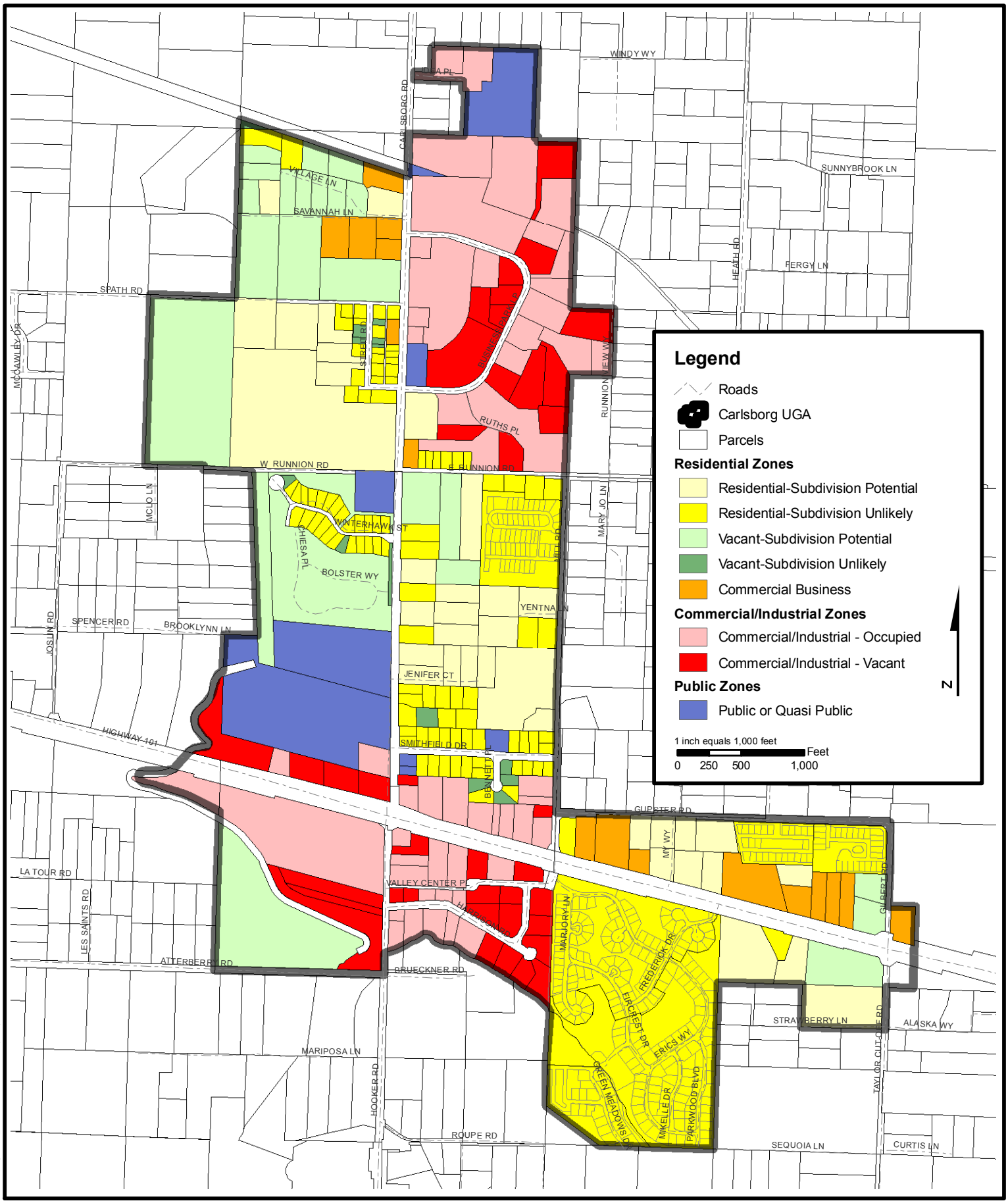
Port Angeles presently has about 28 percent of the Clallam County population, but is growing only about 0.5 percent annually since 2000. The City of Sequim had a population of 4,334 in 2000 and had reached an estimated 5,030 people by April 2006, which is an average annual gain was about 2.5 percent. General indications are that the future population increase within the County will generally be east of Port Angeles.

4.2 Land Use

Figure 4 shows the existing land use for Carlsborg as adopted by Clallam County. Generally, residential densities are limited to 2 housing units per acre, or about ½ acre per home. However, a number of homes have been developed on much smaller lots as allowed before the GMA was established. A few parcels are within areas that allow some higher densities. All existing developments use on-site sewage systems. State regulation for public health now require at least 12,500 square feet per lot for approval of any new on-site sewage system.

Figure 8 shows the future land use plan as envisioned by Clallam County in the 'Carlsborg UGA Buildout' revised April 2007. Clallam County is likely to consider increasing the allowable housing density to at least 4 units per acre, and maybe higher, should a sewer system be built for Carlsborg. However a specific land use plan for sewers within the UGA has not been prepared.

Four units per acre are often considered to be the minimum density needed to make construction of a sewer system economically feasible. Many communities with sewer systems planned for



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Proposed Future Land Use

Sewer Feasibility Study
April 2007

Figure 8

urban densities allow multifamily developments within at least part of the service area. Multifamily densities are usually at least 12 units per acre, and may allow up to 24 units per acre. It is anticipated that with a sewer system, some parcels along Carlsborg Road will eventually be developed at multifamily densities.

Non-residential land use densities are challenging to translate into projected wastewater flows. Such developments are usually described in terms of equivalent residential units (ERU). Parcels are evaluated by land use zoning to establish expected floor area ratios (FAR) of commercial structure to total parcel area to allow for parking, landscaping, surface water management, and sensitive area. Employment is estimated from the resulting floor area, and wastewater flow rates are estimated from the type land use. The results are usually summarized in ERU.

Clallam County has designated about a dozen zoning designations as applicable to various parcels within Carlsborg as shown on Figure 8. Clallam County has refrained from developing a land use plan based on sewer service for Carlsborg pending a decision on when such sewers would be built and how the system is funded, which could affect land use planning. Clallam County has stated that when sewers become available, the allowed residential densities will be at least 4 units per acre, and maybe more.

For sewerage planning purposes, the specific zoning for various parcels is not as significant as the development density that may eventually be allowed. Accordingly, the potential number of residential units at build-out was estimated, while recognizing that most parcels within the present UGA are constrained by the presence of existing structures or other limitations. An attempt to summarize these potential land uses is shown in Table 7.

Table 7
Land Use within Carlsborg
Build-out Potential in 2050

Land Use Classification	Acreage	ERU Density	Total Build-out ERU
Single Family Residential	162.9	3.5	570
Potential Multifamily Residential	48.0	12	576
Mobile Home Parks	78.0	4.7	367
Commercial	72.9	12	875
Industrial	87.1	8	697
Public	41.0	2	82
Total	489.9	---	3,560

Total acreage shown in Table 7 is only about 490 acres, while the UGA encompasses about 560 acres. The 70 acre difference is primarily public rights-of-way for streets. The build-out population capacity for the three residential classifications is about 2,640 people, assuming that single family occupancy remains about the current 1.9 people per home, and that multifamily occupancy averages about 1.5 people per unit. However, build-out densities rarely achieve more than about 80 percent of the allowed development, which would be about 2,110 people.

4.3 Projected Population

Clallam County projections show that Carlsborg will grow at about 2.15 percent to have about 1,267 people by the year 2025. However, utility capacity projections need to consider a longer timeframe, and a more severe worst case projection – not just what is actually expected.

It may be useful to establish context for that projection through reference to projected economic factors for the Puget Sound area in general as summarized in Table 8 for data in recent years and projected future years.

Table 8
Puget Sound Economic Outlook
Forecasted Percentage Change

Parameter	2005	2006	2007	2008
Employment	2.8	3.5	2.9	2.7
Personal Income	1.4	9.1	8.1	6.9
Retail Sales	7.0	7.1	6.5	6.1
Consumer Price Index	2.8	3.9	3.0	2.6
Housing Permits	9.9	2.5	0.5	2.7
Population	1.0	1.3	1.8	1.7

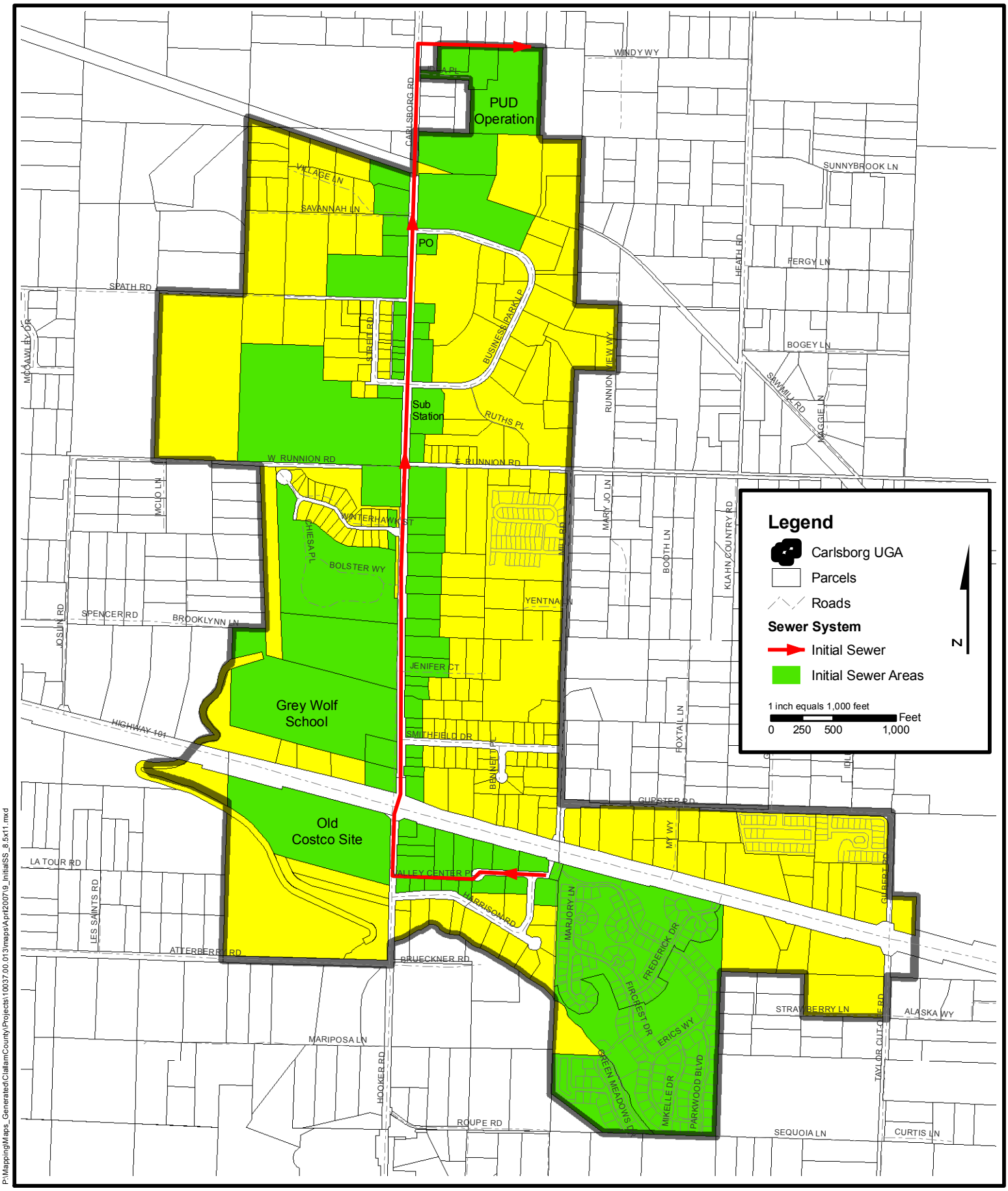
Source: The Puget Sound Economic Forecaster, December 2006

Projections shown in Table 8 may or may not prove accurate. In any event, the Puget Sound area of King, Pierce, Snohomish, and Kitsap counties had a population of about 3.5 million people in 2006. Clallam County population in 2006 was 67,800 people. Of course Clallam County is not directly part of the Puget Sound economy; however, events in the Puget Sound area do directly affect Clallam County.

Population within the Carlsborg UGA is projected for three levels of development to provide a time-line basis for estimating the sewerage facilities that may be needed:

1. Initial Sewer Service Area would conceptually extend from west from Parkwood to Carlsborg Road, thence north across US 101 down Carlsborg Road to the northern boundary of the UGA, then east to the PUD Operations Base as shown in Figure 9. This service area is similar to Scenario 1 as described in the 'Carlsborg Capital Facilities Plan', dated October 1998. Allowed densities are assumed to increase from the existing level, though not all parcels are expected to connect or be developed in the immediate future, which may extend through about the year 2020.

2. Initial Service Area at Build-Out assumes that development would approach the 4 units per acre density envisioned by Clallam County to be allowed for Carlsborg if sewers become available. This period may extend through about 2030, though the densities actually allowed by Clallam County may be increased before that date.



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Initial Sewer System

Sewer Feasibility Study
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Figure

9

3. UGA Build-Out Service Area would include the entire UGA as presently defined, though some changes in zoned land use are projected which would allow some parcels to be developed with at least 12 units per acre. This expansion from the Initial Service Area would likely occur through several sewer extensions over at least a decade to create approximately the sewer collection system shown in Figure 9. It is possible that the UGA may be expanded in future years; however the projections for this Study only consider the UGA as presently defined. Build-out densities may occur by about the year 2050.

OFM projections indicate that Clallam County will gain about 12,000 people by the year 2025. That is an annual rate of about 0.9 percent annually. However, Clallam County is planning for the high series forecast from OFM of about 20,000 people by that date. The GMA requires growth to be concentrated in UGA's, so the growth in Carlsborg should be higher than the Clallam County average. Accordingly, 2.15 percent annually was assumed for Carlsborg.

Table 9 summarizes projected population for Carlsborg and the sewer system for the above three development levels based on the growth rate derived above, and assumes that not all properties will be connected to the sewer even by 2050, or developed to the maximum residential densities shown in Table 7.

Table 9
Projected Population for the Carlsborg UGA

Population Element	2020	2030	2050
Carlsborg UGA	1,140	1,410	2,150
Sewer Service Area	400	1,000	2,150
Served by Sewers	380	800	2,000

Comparison of Table 9 with Table 7 shows that only about 80 percent of the projected capacity for the existing UGA will occur by 2050. In fact, the build-out ERU shown in Table 7 may or may not represent about the practical capacity for the Carlsborg UGA under presently envisioned zoning, since some properties in most communities are never developed to the allowed densities due to site constraints, owner preferences, and other factors.

Non-residential development within Carlsborg is not reflected in Table 9; yet will contribute a significant share of the wastewater flows to the sewer system. Non-residential water demand within the present PUD service area comprises two thirds to three fourths of the current total water demand. The residential share of water use may increase as the community grows, and as the PUD water service area expands. However, reuse of reclaimed water for irrigation and other non-potable purposes within the UGA may reduce future increases in residential water use, or even result in the use of less potable water.

Comment received at the Second Public Meeting in February 2007 indicated some property owners within the Initial Service Area described above want to participate while others do not at this time. Other property owners outside the Initial Service Area, though still within the UGA, want sewers. Some of the opinions may change over time, and other owners will voice their thoughts. The Initial Service Area as shown in Figure 9 was developed as a concept for this

Study. It was revised as the Study progressed based on comment from the Second Public Meeting, and will be reconsidered further should a facilities plan be developed. Many property owners expressed concerns about what sewers will cost them, and these concerns will affect how any initial sewer service area is defined.

The population projections shown in Table 9 are based on the continuation of current demographic tends for the Dungeness Valley. These demographics show the area is primarily a retirement community. Most homes are owner-occupied, and occupancies average less than 2 persons per home. Multifamily units are normally much smaller than single family homes (600 to 1,000 square feet) and occupancies are unlikely to average more than 1.5 persons except in unusual market or economic conditions. In the Dungeness Valley, these are likely to be retired senior citizens, often living alone. Present trends and evidence suggests that these demographics will not change in the foreseeable future.

However, higher occupancy rate are possible should economic conditions change. Developers do seem willing to build in Carlsborg even at two units per acre. The Dungeness Valley is widely perceived as one of the most appealing climates in the USA. It is not inconceivable that a major employer could choose to locate there and that would change the demographics. If so, the build-out population for the above land use could be as follows:

570 Single family	@ 2.3 persons/unit	=	1,311
576 Mulifamily	@ 2.0 person/unit	=	1,152
400 Mobile home	@ 2.0 persons/unit	=	800
Possible Build-out Population			3,263 people

The lower occupancy scenario is believed more likely during the foreseeable future; however some may believe that planning for a higher population is an appropriate investment.

4.4 Projected Wastewater Flows

Pipes installed for the Initial Service Area would be sized to convey the peak hour flow projected for the build-out development level of the entire UGA in about 2050. Sewer extensions from the initial system are expected from time to time until every parcel within the UGA has direct access to a sewer main. Wastewater flows are estimated from the following parameters:

Domestic Sewage is estimated at 125 GPD per single family residence or mobile home. This is the annual average day water demand derived from Table 2. Normally, sewage flow would be discounted to only 90 or even 80 percent of the water demand, but the water use in Carlsborg is unusually low by comparison with other Western Washington communities. Demographics from census records show many residents in Carlsborg to be elderly and retired living in small households. As new development occurs, the PUD water system expands, and sewers enter service; average water use may increase; although the typical residential profile seems unlikely to change markedly. Average household size is projected to remain below two occupants. Accordingly, engineering prudence indicates sewer capacity should be based on at least 125 GPD per residence.

Commercial and industrial sewage is estimated from projected employment at 25 GPD per employee. That average rate may be high for sewage from commercial/industrial facilities that are relatively 'dry' with little sewage generated other than employee restroom. However, some facilities will generate substantial sewage loads as indicated in Table 5 by the water demands for several businesses.

Infiltration and Inflow occurs even in new sewers, even in dry weather. Studies have shown most extraneous flow originates on private property in the laterals and side sewer. Sometimes this is due to faulty pipe joints and poor construction. Roof downspouts, foundation drains, sump pumps, and other illicit connections also tend to occur over time.

Acceptance tests for sewer exfiltration as defined in 'Standard Specifications', Washington State Department of Transportation, Section 7-17.3(2) provides a guide to the quantity of extraneous wastewater to be expected typically in the sewer after some period of service. The criteria indicate about 150 GPD per acre will occur for ¼ acre developments. Wet weather I/I will be larger, of course.

Storm water will enter manhole lids and saturated ground will cause pipe joints to leak. Infiltration and inflow quantities are estimated for this Study at three levels based on measured flows in new sewer systems constructed in various Western Washington communities in recent years:

- Average annual I/I is the extraneous water additional to sewage that leaks into the sewers on typical days through the year. Most of this water is infiltration and is estimated to average 150 GPD per acre.

- Wet weather infiltration will add 400 GPD when it is not raining during the winter months while the ground is saturated and some surface ponds remain between storms.

- Storm induced flow during periods of significant rain may be an additional 500 GPD per acre, and the Peak Hour contribution may be about double that rate.

The quantity of storm water entering a well-managed sanitary sewer system is usually a small fraction of the total precipitation recorded. Even so, the quantity is usually significant. Sanitary sewer systems are not expected to contain all extraneous water that may enter under any extreme condition. However, overflows or significant surcharging should be rare and unusual in a sanitary sewer. Accordingly, the infiltration and inflow allowances described are believed adequate to accommodate a 10-year storm event.

Annual Average Day Flow is computed for the connected development at the annual average domestic sewage rate defined above, plus the average annual I/I flow of 150 GPD per acre.

Average Day Flow during the Maximum Month is the usual design parameter for many wastewater treatment components. The maximum month for wastewater flow is usually related to the wettest month of the year, and particularly to the period when the groundwater is highest or most saturated. It also accounts for seasonal and peak organic loads. For hydraulic

computations, the average day during wet months (on days without rain) is the average domestic sewage flow plus the wet weather infiltration at 400 GPD per acre.

Peak Day Flow is related to major storm events occurring when the ground is essentially saturated. Peak wastewater flows are not usually in direct response to peak potable water demands. Peak day flow is estimate as average wet weather day plus storm induced flow for a day experiencing a 10-year storm event.

Peak Hour Flow forms the criteria used in defining the maximum hydraulic capacity required, such as for the sewer collection pipes. Peak domestic sewage is assumed to be double the average day rate, and is added to the average wet day flow plus twice the storm induced daily flow for a 10-year event.

Projected wastewater flows for the Carlsborg UGA are computed from the above parameters as summarized in Table 10 for anticipated connections to the initial sewer system by about 2020.

Table 10
Projected Wastewater Flows for 2020

Land Use	Units	Unit Flow GPD	Total Flow GPD
Single Family Residences	20 homes	125	3,000
Multifamily Residences	-0-	---	---
Mobile Homes	180 homes	125	23,000
Commercial employees	100	25	3,000
Industrial employees	80	25	2,000
Public	20 ERU	125	3,000
Subtotal	---	---	34,000
Acreage & average day I/I	160 acres	150	24,000
Average Day Total Flow	---	---	58,000
Wet Month Infiltration	160 acres	400	64,000
Average Day Wet Month	---	---	122,000
Storm Induced Flow	160 acres	500	80,000
Peak Day Flow	---	---	202,000
Peak Hour Flow	---	---	292,000

Conceptually, it was envisioned for Table 10 that all home within Parkwood and about 20 existing residences along or near Carlsborg Road would be connected to the sewer by the year 2020. These 200 residences with occupancies averaging 1.9 persons would result in a served population of about 380 persons, which is the projection shown in Table 9. Connection of other land uses is less certain. Several commercial property owners have expressed support for building a sewer system, though that does not assure connection, and site specific employment data is not available. Consequently, the units of other land uses shown as served are assumed.

No attempt has been made to identify the actual properties that will be developed and served with sewers by 2030. However, using the values shown in Table 7, 9, and 10, the projected wastewater flows for 2030 were developed as summarized in Table 11.

Table 11
Projected Wastewater Flows for 2030

Land Use	Units	Unit Flow GPD	Total Flow GPD
Single Family Residences	60 homes	125	8,000
Multifamily Residences	80 homes	80	6,000
Mobile Homes	300 homes	125	38,000
Commercial employees	200	25	5,000
Industrial employees	150	25	4,000
Public	50 ERU	125	6,000
Subtotal	---	---	67,000
Acreage & average day I/I	240 acres	150	36,000
Average Day Total Flow	---	---	103,000
Wet Month Infiltration	240 acres	400	96,000
Average Day Wet Month	---	---	199,000
Storm Induced Flow	240 acres	500	120,000
Peak Day Flow	---	---	319,000
Peak Hour Flow	---	---	470,000

Residential connections shown in Table 11 are projected to average occupancies of 1.9 persons for single family and mobile home, while multifamily residences will average about 1.5 people. The resulting population served by sewers thus approximates the 800 people projected in Table 9 for 2030. Non-residential connections were projected from similar land uses in other cities.

Sewers will be available for all parcels within the UGA by 2050; however, not all are expected to be served, or fully developed. Flow projections for 2050 are summarized in Table 12.

Table 12
Projected Wastewater Flows for 2050

Land Use	Units	Unit Flow GPD	Total Flow GPD
Single Family Residences	300 homes	125	38,000
Multifamily Residences	500 homes	80	40,000
Mobile Homes	360 homes	125	45,000
Commercial employees	740	25	19,000
Industrial employees	360	25	9,000
Public	80 ERU	125	10,000
Sewage Subtotal	---	---	161,000
Acreage & average day I/I	430 acres	150	65,000
Average Day Total Flow	---	---	226,000
Maximum Month I/I	430 acres	400	172,000
Average Day Max Month	---	---	398,000
Storm Induced Flow	430 acres	500	215,000
Peak Day Flow	---	---	613,000
Peak Hour Flow	---	---	978,000

Many things will change by the time the year 2050 arrives. Land uses may not be as described in Table 7, and population growth may be different than shown in Table 9. The UGA boundary may be revised too. However, the flow values shown in Table 12 are a reasonable basis for evaluating the feasibility of sewers for the Carlsborg community, based on the data now available.

As noted in Section 4.3, it is possible that Carlsborg economics and demographics may change dramatically by 2050 and beyond. Many new Western Washington developments are being built at 6 or 8 single family units per acre. Some low-rise multifamily developments achieve 20 or 24 units per acre. It is not likely that these higher densities can be achieved throughout the 211 residential acres within the current UGA; however, if sewers are built in Carlsborg, Clallam County is likely to revise the allowed land use densities in some manner not yet defined.

Treatment facilities for an Initial Service Area can be sized based on the flow projections shown in Tables 10, 11, and 12. These facilities can be modular with capacity added as needed at various future dates. However, it may be appropriate to consider whether a larger sewer interceptor is a prudent investment for future possibilities.

Figure 9 shows that essentially all residential development may be routed through the Carlsborg Interceptor, with essentially all of the industrial flow routed through the Industrial Park sewer. Changed economics and demographics could mean increased residential occupancy. Conservation efforts should keep per capita water use at about current levels though. The interceptor would serve about 430 acres within the presently defined UGA as shown in Tables 10, 11, and 12. Hence, the infiltration and inflow components would remain as shown in those tables. However, in considering possibilities that might generate higher peak flow for defining the interceptor size, it is possible that peak domestic sewage generation could coincide with a peak storm event as might happen at Thanksgiving or a similar winter holiday.

If so, then domestic sewage flow would be about 4 times the annual average day flow and the storm induced component would be about double the 10-year 24-hour value as shown in Tables 10, 11, and 12. This possible approach in developing an approximate interceptor hydraulic capacity is summarized in Table 13.

Table 13
Affect of Higher Occupancy on Interceptor Capacity

Land Use	Units	Per Capita Occupancy	GPD	Total Flow GPD
Single Family Homes	570	2.3	66	87,000
Multifamily Homes	576	2.0	66	76,000
Mobile Homes	400	2.0	66	53,000
Commercial Employees	740	---	25	9,000
Public ERU	80	---	150	12,000
Sewage Subtotal	---	---	---	237,000
Average Day I/I (acres)	430	---	150	65,000
Maximum Month I/I	430	---	400	172,000

Storm Induced Flow	430	---	500	215,000
Peak Day Flow				689,000
Peak Hour Flow				1,615,000

The flows estimated in Table 13 are not likely to occur in the next several decades. However, conditions could change, and it may be felt prudent to plan for the possibility.

4.5 Projected Pollutant Loads

Fats, oils, and grease are a challenge for all wastewater treatment facilities. These materials also congeal in the pipe system and cause maintenance problems. Accordingly, the new sewer system for Carlsborg should have a stringent grease trap program for all commercial, industrial, and public facilities that connect to the sewer system. This is particularly important for any facility that prepares food, or services machinery. The program should extend to periodic inspections that the grease traps are properly maintained with penalties through the sewer rate structure for failing customers.

With the above program in place, pollutant loadings for the Carlsborg wastewater treatment facilities are projected in Table 14 from data shown in previous tables.

Table 14
Projected Pollutant Loads

Pollutant Parameter	2020	2030	2050
Estimated ERU	272	808	1,244
BOD5 average pounds per day	110	320	540
Average Day Max Month pounds	140	400	700
TSS average pounds per day	120	340	600
Average Day Max Month pounds	150	420	750
Nitrate average pounds per day	1.7	5.1	7.8

Several standards exist to regulate discharge through a percolation system and prevent degradation of groundwater. The requirements differ, depending on the expressed intent for the discharge as summarized below:

- On-site septic systems discharging through a drainfield or mound (both being types of percolation systems) are governed by public health regulations. These generally provide prescriptive dimensions, but not effluent standards; except in cases like Carlsborg where Clallam County Code mandate that new or repaired systems must demonstrate greater than 50 percent reduction in nitrates as compared to conventional treatment systems.
- Land application of any wastewater effluent requires a State Waste Discharge Permit with the water being of ‘Class A’ quality. Disinfection must achieve an average of 2.2 coliforms per 100 milliters with no sample above 23 coliforms. Nitrates must be less than 10 mg/L and can not increase the groundwater nitrates by more than 2 mg/L above the background concentration measured at the property line.

- Direct Injection in a potable aquifer is regulated under the Safe Drinking Water Act and Section E1-8.42 of the 'Criteria for Sewage Works Design' by the Department of Ecology. The minimum treatment process allowed is reverse osmosis.

The baseline concept should meet the land application requirements.

5 Baseline Wastewater System

5.1 Collection System

Gravity sewers are the traditional sewerage collection system. These pipes are usually at least 8-inch diameter and installed at least 8 feet below the ground surface to allow extension of side sewers to fully serve the adjacent properties with 4 and 6-inch lateral sewers. The 8-inch mains are normally installed with a sufficient slope to convey the wastewater at 2 feet per second, which is the velocity found through experience to be able to move sewage solids through the system and minimize potential for odor. For 8-inch pipes, the resulting pipe slope is 0.40 percent, or 0.004 feet of pipe fall per 100 feet of pipe length.

Pipes size is selected to be adequate for the peak hour flow at build-out development with the pipe flowing full. For the Carlsborg UGA, a conceptual sewer running west from Parkwood to Hooker Road, then north across US 101 in Carlsborg Road and south to the southerly UGA boundary, then east to the PUD Operations Center is a reasonable interceptor for the entire UGA. Table 15 summarizes the approximate parameters comprising this pipe alignment.

Table 15
Conceptual Carlsborg Interceptor

Location	2050 Peak Hour GPD	Pipe Slope	Depth Feet	Length Feet	Diameter Inches
Valley Center Pl & Mill Road (Ext)	147,000	---	8	---	8
Hooker Road & US 101	367,000	0.00819	12	1,812	8
Carlsborg Road & Smithfield Drive	418,000	0.00897	8	669	8
Carlsborg Road & Runnion Road	572,000	0.00914	8	2,187	8
Carlsborg Raod & Olympic Trail	810,000	0.01701	19	2,528	8
Carlsborg Road & Windy Way (Ext)	920,000	0.00387	12	1,032	12
PUD Operations Center	978,000	0.00369	13	813	12

In Carlsborg, 8-inch pipes are hydraulically adequate to carry to the peak hour build-out flow projected for the entire UGA, except for about the last 1,850 feet at the north end of Carlsborg Road. The pipe depths for that 12-inch diameter stretch would be 12 to 19 feet below the road surface, which is expensive construction though not unreasonably so for an interceptor sewer. A 12-inch pipe on a 0.369 percent slope has a capacity of 1,350,000 GPD when flowing full. Such a pipe carrying the 1,615,000 GPD peak hour flow shown in Table 13 would surcharge 4 to 6 inches. That would not be noticeable to any served customers, and should not cause any operating problems for the sewer system.

For comparison, a 15-inch pipe laid on a slope of 0.359 percent would have a capacity of about 2,500,000 GPD, which means that the pipe would be about 2/3 full at the peak hour condition projected above.

Some portions of the collector sewers described in Table 15 and shown in Figure 10 would also require deep trenches for gravity service. Alternatives to gravity sewers do exist for Carlsborg, and warrant serious consideration. These are summarized below:

- Grinder Pumps reduce sewage solids to a slurry that is pumped at modest rates (about 20 GPM) through small diameter force mains (1-1/2 inch and larger) in shallow burial of 3 or 4 feet below the ground surface. Relatively high head (50 to 150 feet) can be achieved using up to 7-1/2 horsepower when needed. Pump units can serve individual homes or buildings, or can serve small communities up to several dozen homes.

- Vacuum Sewers use a central vacuum pump station to create below atmospheric pressure in 4 to 6-inch sewer manifolds buried 3 to 5 feet deep. One to four homes are connected by gravity side sewers to vacuum valve chambers. The vacuum system can 'lift' sewage up 12 to 15 feet of adverse grades.

- STEP Systems (Septic Tank Effluent Pump) place an effluent pump in a septic tank to transmit the septic tank effluent to a central treatment and disposal facility using small diameter force mains. The septic tanks require management just like any other septic tank, but the drainfield is eliminated on the individual properties.

- Low Head Pumps similar to sump pumps can be considered for limited service to a few homes. The facilities would resemble grinder pumps, only with less expensive pump units. However the vertical lift available is usually only about 20 feet and the force mains need to be at least 4-inch diameter.

- Combinations of the above systems are commonly employed. Small satellite pump stations can be grinder pump installations with a tributary gravity sewer system. STEP systems can be connected to a gravity system as well.

Two technical challenges are apparent in preparing the layout for a sewer system in the Carlsborg UGA:

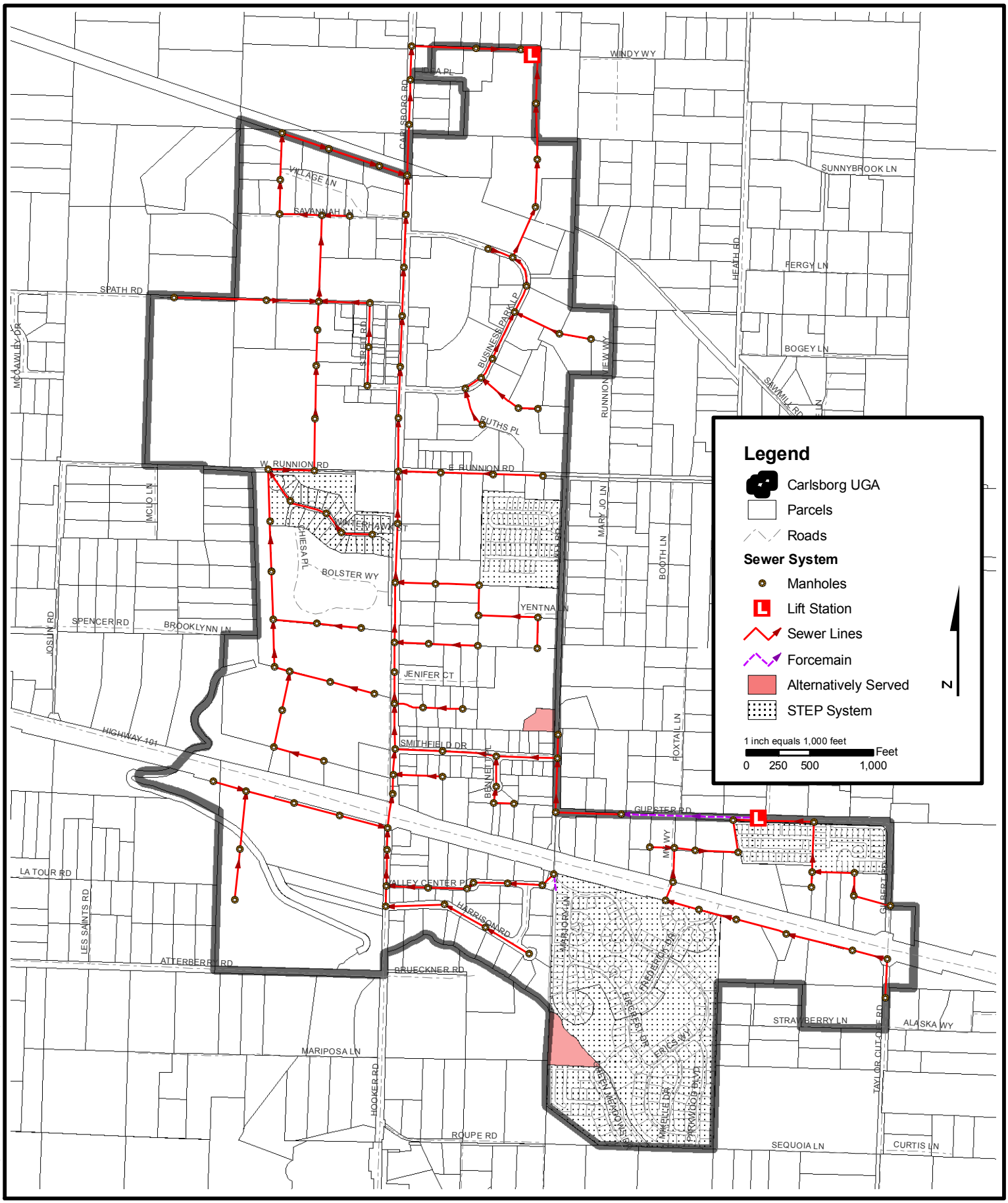
- A low spot exists north of US 101 and east of Mill Road. A local sewage lift station will be needed to serve the properties along Gupster Road.

- Soils beneath US 101 are reported to include some large cobbles or even boulders due to past glacial activity that may pose some difficulties to constructing a sewer across the highway. This may be a construction cost issue, but is not an insurmountable barrier.

The most appropriate sewerage collection system appears to be a combination, which was the conclusion reached during the 1994 study and also used in the 1998 approach, as follows:

- A gravity interceptor would run north in Carlsborg Road across US 101 to the north edge of the UGA then east to the PUD Operations Center.

- A local pump station would serve the low area on Gupster Road at about Gullis Road and be built after the initial phase is in operation.



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Conceptual UGA Sewer System

Sewer Feasibility Study
April 2007

Figure 10

- STEP systems would serve the existing mobile home communities like Parkwood, Green Acres, Carlsborg Estates, and Alta Vista.

If implementation of a sewerage system is found feasible, a more detailed evaluation of sewerage facilities will be prepared for the General Sewer Plan. That evaluation may revise the sewerage collection concept described here, should the actual initial service area be different or the cost-effectiveness of the collection system components be found to be different.

5.2 Wastewater Treatment

Treatment Objectives are basically two:

- 'Class A' Water is desired so the wastewater can be reused in some economical and environmentally accepted manner rather than requiring an NPDES permit for discharge to some receiving waters.

- Modular design of the treatment facilities would allow the facility to be constructed in phases as additional capacity is needed, thus reducing the cost to initial customers and allowing growth customers to pay for their capacity needs.

Of course other levels of wastewater treatment can be considered during the development of a facilities plan. 'Water Reclamation and Reuse Standards', September 1997, allows irrigation with reclaimed water meeting only Class D standards; however, irrigated sites with public access like a golf course, playfield, or private lawns must use 'Class A' water. Consequently, 'Class A' water is used as the baseline condition for development of this Feasibility Study.

Previous sewerage concepts developed for Carlsborg envisioned some form of point discharge of the treated wastewater effluent to some local surface water body, generally an irrigation ditch or the Dungeness River. A point discharge requires a National Pollution Discharge Elimination System (NPDES) permit from the Department of Ecology. These permits are only being issued now under exceptional circumstances, and only after exhaustive study of other disposal options. Present regulations require land application and reuse options be explored and used if technically possible. Simple economics is no longer adequate justification for a new NPDES permit.

Accordingly, most wastewater systems now try to find opportunities to reuse the treated water. Four classes have been defined for reclaimed water quality: Class A, B, C, and D. Some opportunities exist for using all classes; however, when all of the wastewater collected must be reused, year around, the opportunities are more limited – meaning, management of the reclaimed water is usually the determining factor in developing the wastewater treatment facility.

Generally speaking, 'Class A' reclaimed water allows more flexible reuse options that may be feasible through the year, in wet seasons as well as dry period. However, more stringent treatment is required to produce 'Class A' water, and the treatment process must be redundant as well as reliable with provisions to store up to one day of flow should the process fail.

'Class A' reclaimed water is defined by 'Water Reclamation and Reuse Standards', Departments of Ecology and Health, September 1997 as 'oxidized, coagulated, filtered, disinfected wastewater'. The current state-of-the-art wastewater treatment process to produce 'Class A' water is the membrane bioreactor.

Membrane Bioreactors (MBR) combine conventional biological treatment with membrane filtration to achieve an advanced level of organic and solids removal. These systems can also provide nutrient removal. Photos 1 and 2 illustrate two sizes of this process. The process works by maintaining the mixed liquor concentration in the 10,000 to 12,000 mg/L range, and draws the liquid filtrate through membranes submerged in the mixed liquor with pore sizes ranging from 0.1 to 0.4 microns.

The process eliminates the sedimentation step in wastewater treatment while resulting in a structural size and footprint much smaller than conventional activated sludge plants, such as an oxidation ditch or sequencing batch reactor. Without the clarifier step to limit concentration, the mixed liquor can be much higher with fewer process controls. Then, the membrane provides a physical barrier to prevent inadequately treated wastewater from passing through the process into the plant discharge. However, the technology does have costs: membranes are expensive, use considerable power, require periodic cleaning, and presently have a life expectancy of about a decade. Two basic types of membranes are available, both readily able to produce 'Class A' reclaimed water:

- Flat plate membranes have pore openings of about 0.4 microns; which produces removals an order of magnitude better than conventional sand or fabric filters and even provides some bacterial removal.

- Hollow fiber membranes have pore openings of about 0.1 microns and produces even better removals; however the process is more complex, requires more intensive cleaning, and a larger structure to accommodate the equipment.

Comparative cost evaluation has demonstrated that the flat plate membranes cost less to install and less to operate. Since the water quality produced from a flat plate MBR is more than adequate for the possible uses foreseen in Carlsborg, this is the treatment process used to establish the baseline estimated cost for the Carlsborg sewer feasibility. As membranes gain popularity, more manufactures are producing a greater variety of membrane products and prices are declining. This trend is expected to continue for some years to come.

Because of the small membrane pore size, all MBR facilities require a fine screen ahead of the membranes to remove as much solids and debris as is practical. Otherwise the debris will plug the membrane pores and require more frequent cleaning.

Flat plate membranes are packaged by the manufacturer in cassettes or modules of 50 to 400 membrane plates. Each cassette can be removed individually for cleaning, maintenance, or replacement. The cassette approach allows the treatment process capacity to be expanded by adding cassettes as the flow and pollutant load increases. The cassettes can be designed to be stacked two high in the same membrane tank, and the structural tank can be sized for future conditions with membranes added as needed.

Photo 1 – Kwina 100,000 GPD Treatment Facility using Kubota Flat Plate MBR Modules

Photo 2 – Kubota 3,000 GPD Flat Plate MBR Module

The treatment process occurs through three structural chambers; which can be described as the anoxic tank, the membrane tank, and the pre-aeration tank. Various manufacturers use various arrangements to achieve treatment. One example of the resulting treatment process is illustrated schematically by Figure 11. The Anoxic Tank, as shown in Figure 11, has more volume than necessary for the treatment process so this chamber can provide influent flow equalization. The Membrane Tank has two chambers with space for three MBR modules each that can be stacked two-high, though only the lower level MBR modules would be installed initially. Phase 2 treatment capacity would be provided by adding the second stack of MBR modules.

The nitrification-denitrification process in relation to Figure 11 occurs in the following steps:

1. Influent enters the Anoxic Tank for flow equalization.
2. Wastewater is pumped into the Pre-Aeration Tank for the nitrification process to occur in the presence of organic matter and oxygen.
3. Wastewater flows into the Membrane Tank with permeate drawn out and the excess flowing back to the Anoxic Tank where detrification occurs in the absence of oxygen.

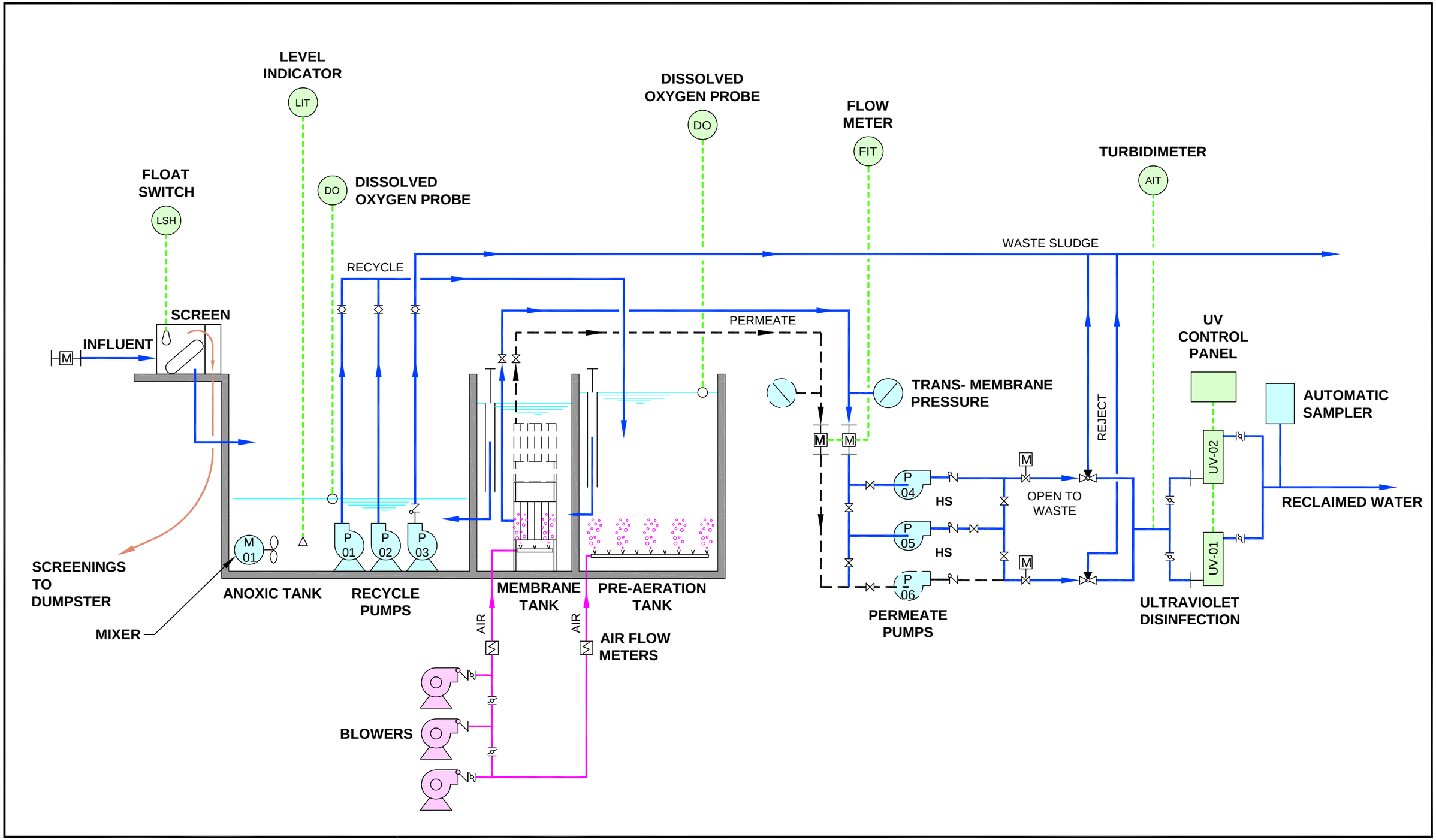
The recycle flow rate is in the range of 3 or 4 times the average influent flow rate. The resulting nitrate concentration in the permeate will be less than 10 mg/L, though more than 5 mg/L. This level should be adequate for land application through a percolation system. Should a lower nitrate concentration be needed or desired, then an additional nitrification-denirification stage will be needed for the permeate with additional tanks and methanol addition to provide the carbon source. The resulting nitrate concentration would then be about 3 mg/L.

Pharmaceuticals have been identifies as potential pathogens of emerging concern. No risk to human health has been identified due to the presence of these products in receiving waters, which are widely present in trace amounts. Some studies indicate a link may exist with abnormalities noticed in aquatic life, though this remains unproven. Wastewater treatment effectiveness is largely a matter of detention time and sludge age. The MBR process offers potential pharmaceutical treatment advantages because the process operates at high mixed liquor concentrations, which mean the sludge age can be designed to be very long in a small volume.

Figure 12 shows a conceptual layout on a hypothetical site totaling about 0.6 acres for the initial wastewater treatment facilities with additional components to be added in phases out to the year 2050. Several points can be noted from the figure:

- Two treatment structures would both be built initially. One would contain the treatment train sized for the initial service area. The tanks or chambers in the second structure would initially be used for emergency storage, sludge holding and thickening, and storage of reuse water. Subsequent phases would add capacity by converting the second structure into a treatment train too.

- The Operations Building would initially contain little more than the electrical and mechanical equipment needed for the initial service area. The building would be expanded in future phases to offer more functions.



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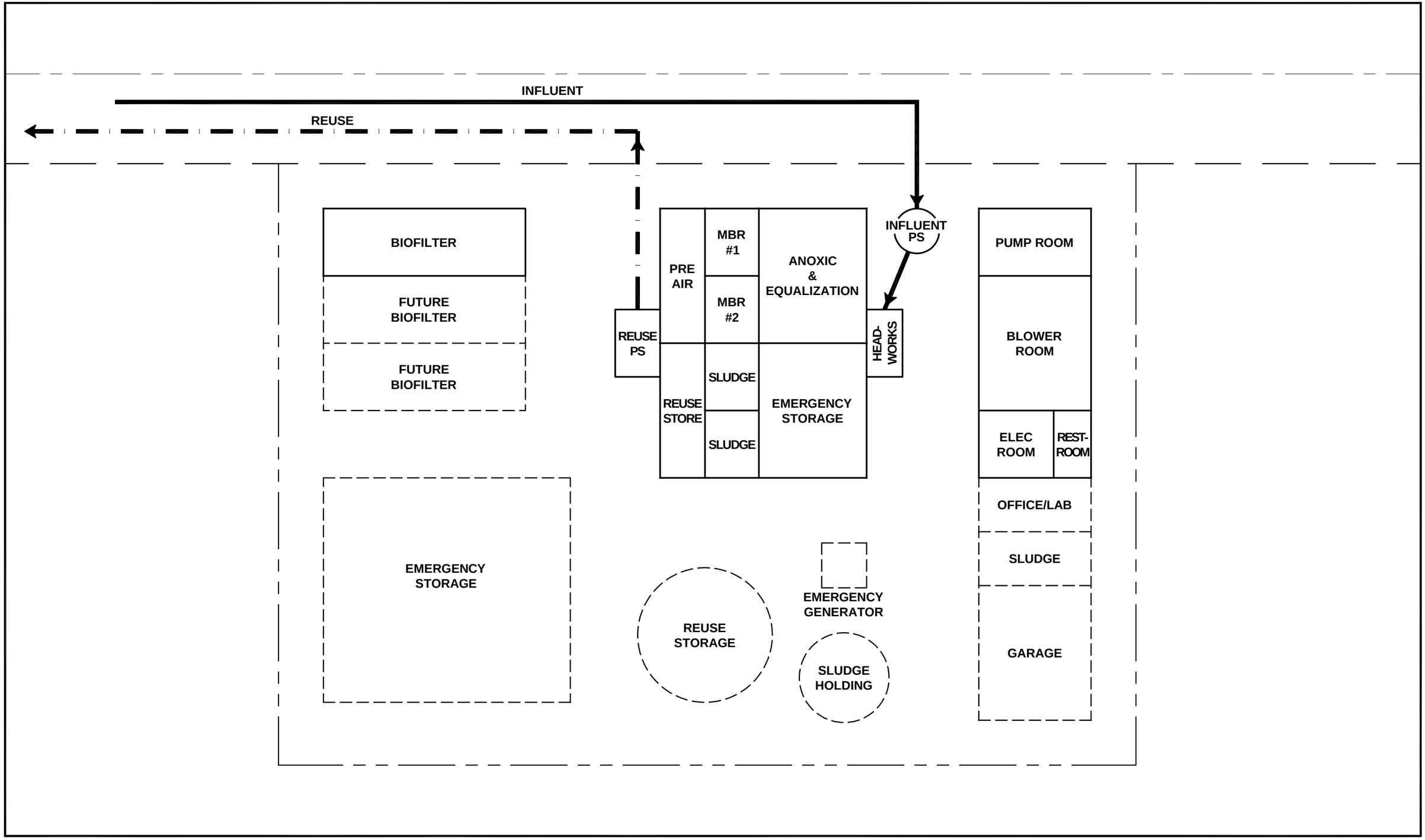
MBR Treatment Schematic

Sewer Feasibility Study
April 2007

Figu

11



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Scale: 1" = 20'-0"

PUD #1 of Clallam County

Treatment Facilities Conceptual Site Plan
Sewer Feasibility Study
April 2007

Figu
12

- All treatment components would be covered and the air would be pumped through a Biofilter for odor control. Subsequent phases would receive added biofilters.

- Future Emergency Storage is shown as a structure able to contain one average day of the maximum month flow in the year 2050, or about 400,000 gallons. Emergency Storage provided for the Initial System is sized for one day of the average annual flow projected for 2020, which meets the requirement for producing 'Class A' water.
  Emergency power would initially be provided from the PUD Operations Center, and a dedicated Emergency Generator would be provided in a future phase.

- Reuse Storage as shown could be 200,000 gallons in a 30 feet diameter tank about 40 feet high.

- Sludge processing is more variable. Space is shown in the Operations Building for a sludge processing room, which could include a sludge press and perhaps other equipment. A future Sludge Holding Tank is shown, though the size depends on what is done with the sludge as the haul economics will determine the storage volume needed.

All MBR processes have specific limitations as to the flux rate, or rate of flow through the membranes. Excessive flux rates will plug the membrane pores and may tear the membrane. Manufacturers limit the flux rates to no more than twice the design flow rate, and usually provide detailed limitations of how much time the design flux rate can be exceeded in defined steps and for stated reoccurrence intervals. As a result, each MBR plant requires flow equalization provisions; which usually means an attenuation chamber. For Carlsborg, flow equalization would initially be provided by sizing the three treatment tanks for the 2030 flow condition while only installing membranes for the 2020 projected flow condition. The 2050 flow condition would require a duplicate structure, and probably a separate equalization tank.

Disinfection is normally provided by ultraviolet light, which would occur in the Reuse Pump Station. Chlorination is an acceptable alternative; however, safety issues with chlorine gas and the byproducts resulting from chlorination limit the appeal. Even so, provisions to apply chlorine in some form may be desirable for periodic cleaning of the membranes, piping, and other facilities. Dilute chlorinated water can be discharged into most receiving water, including groundwater, though some surface water may require dechlorination to protect the habitat. The reuse distribution system may require a chlorine residual.

State regulations for producing 'Class A' water require that treatment facilities be more reliable than conventional secondary treatment processes. Accordingly, all processes must be redundant, meaning at least one standby unit must be provided for each process. Emergency power must be provided. And the facility must have emergency storage for 24 hours of the effluent flow in the event that a failure occurs despite the redundant provisions.

Control of the MBR process is largely a matter of mechanical and electrical management, in contrast to conventional activated sludge processes which require extensive biological sampling,

testing, and monitoring by a hands-on skilled operator. Accordingly, the MBR process would be managed by a supervisory control and data acquisition (SCADA) system through a computer.

No site has been formally designated for the treatment facilities. As it happens, the PUD Operations Center is located at the northern extremity and lowest elevation of the UGA. Wastewater will be collected at this property into a pump station. The area is zoned for commercial-industrial and the parcel may have sufficient space to accommodate the MBR facility. This would place the process components in close proximity to existing staff facilities, which may mean that some initial operations could be housed within existing structures. However, the pump station could also transmit the wastewater to a more remote site for treatment if that is found desirable.

Alternative Treatment Processes to the MBR do exist, and may even be cost-effective for Carlsborg. It is certainly possible to produce 'Class A' water through a sequencing batch reactor (SBR) process, or several other activated sludge variations, when followed by some form of filtration such as sand or fabric filters. These alternatives were not explored for this Feasibility Study, which only identifies a baseline sewerage system to establish whether any sewer system may be feasible in Carlsborg.

Recirculating sand filters are another alternative treatment process that is frequently used in small on-site or decentralized wastewater systems. These systems can be designed to remove nitrates and to provide an effluent quality suitable for some reuse applications.

If sewers are found feasible, then these and other alternatives will be evaluated in a General Sewer Plan and one selected, as required for approval by the Department of Ecology to begin implementation. An Engineering Report or Facilities Plan will be further required to develop the preliminary design for the treatment and reuse facilities. These documents will be required to evaluate alternatives to the MBR process to identify the facilities most suitable for Carlsborg. These tasks can be combined into a single document if desired.

5.3 Solids Management

Sludge will be produced by any wastewater treatment process. Management of these residual solids to produce biosoliods suitable for disposal is a significant challenge for most wastewater utilities. However, initiating wastewater treatment in a small satellite facility does not have to include complete solids management provisions in the initial facilities.

For the initial facilities, the Feasibility Study assumes the new utility will minimize initial costs by sending the solids elsewhere for processing and disposal. At least four options are believed initially viable:

1. City of Port Angeles has facilities that could accommodate the quantities produced at Carlsborg and a limited term contract might be negotiable.

2. City of Sequim offers a similar option, which means the cost of solids management can be made competitive.

3. City of Forks also provides solids management and may be a viable option, though the travel distance is greater.

4. Contract Hauling can arrange for the residual solids to be taken to existing sites that manage such material, as exist in Mason County.

Investing in some level of sludge processing will still be cost-effective. This initial investment may be only dewatering equipment to reduce the volume that is hauled away. It could include the purchase of a dedicated sludge truck. Sludge is produced in the MBR process at about 60 percent of the of the influent BOD in pounds per day. Sludge will be withdrawn or wasted at about one percent solids from the MBR process periodically into a sludge holding tank. It will thicken by gravity in the sludge holding tank to about 1.5 percent solids with the remaining liquid decanted back to the MBR process.

The projected influent pollutant load shown in Table 13 for 2020 is for an annual average of 110 pounds of BOD every day. Thickened to 1.5 percent solids, the sludge volume will average about 527 gallons daily, which is a lot to be hauled away.

A mechanical thickener will produce 3 percent solids, which will half the daily volume to about 270 gallons in 2020. This volume will still require hauling away in a tanker truck once each week. Sludge hauled to another treatment facility will be considered the same as septage since it is not digested. The tipping fee may be $ 0.15 per gallon, or about $ 41 daily for 270 gallons at 3 percent solids. Initial volumes and costs will be much lower, of course.

Various forms of sludge presses can also be considered. These devices cost several hundred thousand dollars each however. A press is not cost-effective for the initial sewer system, though may become so as the sewer service is expanded and flows increase producing more solids.

In the future, sludge facilities might include stabilization equipment to produce compost or another biosolids derivative. It may be that the future sludge facilities will be developed jointly with either the Lower Elwha or Jamestown Tribes; or the Sunland Sewer District; or with another satellite sewer system yet to be identified.

STEP systems are envisioned in this Feasibility Study as serving the existing mobile home communities. The STEP units would be owned and managed by the PUD as part of the sewer system. These units will produce septage, which can be managed as sludge in two ways:

a. The Clallam PUD, as the wastewater operating agency, can own the septic tanks with the effluent pump units and be responsible for maintenance and operation, including pumping septage. The septage can be combined with the solids produced at the MBR treatment facility, thickened, and hauled away for disposal.
b. The owners of the mobile home communities can retain ownership of the STEP units, and be responsible for operation and maintenance including the septage – subject to oversight by the PUD.

These STEP decisions will largely be an economic matter for the mobile home park owners, and their tenants based on what is believed cost-effective for their community. These decisions need not be made now, and do not have to be the same for each mobile home community.

5.4 Air Quality

Odors are a concern with the design, operation, and maintenance all wastewater facilities. It may not be practical to design, build, and operate a complete wastewater system without some odor being noticed by some people at some point in time. A variety of design and maintenance techniques would be employed to minimize odors, some of which are summarized below:

1. Gravity sewers would have minimum grades sufficient to produce wastewater flows of at least 2 feet per second, which is sufficient to move the sewage solids and minimize accumulations that produce odor.
2. Sewer mains would be cleaned on a regular basis to remove such solids and scum that does accumulate in the pipes.
3. Fats, oils, and grease would be regulated through the Sewer Use Resolution so most is removed by grease traps at facilities likely to produce significant quanties, such as food handling facilities.
4. Pump stations would be designed with appropriate wet well dimensions; and for the pumps to cycle at regular intervals to minimize dwell time in the wet well.
5. Pump stations would be serviced at regular intervals to include cleaning that removes scum and solids that may accumulate.
6. Treatment components would be designed to modern standards with most wastewater units covered or enclosed so any odors produced are captured and processed through a biofilter or air scrubber.
7. Reclaimed water has very little organic content and little potential to produce odor while irrigation as with a sprinkler would dissipate even that potential; and disposal of the remainder is envisioned as being below ground through percolation to minimize potential contact with people or the atmosphere.

Most people are familiar with gravity sewers laid beneath streets and realize that odor is rarely noticeable. However, warm weather tends to speed up the decay of organic matter, including sewage, so odors may be noticeable in the immediate vicinity of some wastewater facilities like pump stations, or rarely at manholes.

Treatment facilities have greater quantities of wastewater present, and more odor potential. Considerable design attention is devoted to minimizing odor. Maintenance and operating procedure also stress odor control. As a result, odor is not usually noticeable outside of the treatment facility site, which is usually located in an industrially zoned area to further minimize impacts to the public.

Certainly some individuals are more sensitive to odor than others. Problems do occur with wastewater facilities, and upsets happen. A good staff will work hard to minimize these events.

5.5 Decentralized Sewer Systems

It is technically feasible to construct several small sewerage systems, each with a separate collection, treatment and reuse or disposal system; instead of a single centralized system for all of Carlsborg, or connecting to the City of Sequim sewer system. Such decentralized facilities could be managed by a single agency, such as the PUD.

The barrier posed by US 101 makes the idea of decentralized systems inherently attractive. Separate facilities could be constructed for several areas, some obvious examples are indicated below:

- Commercial area south of US 101
- Parkwood Moble Home Park (or combined with the commercial area south of US 101)
- Carlsborg Industrial Park

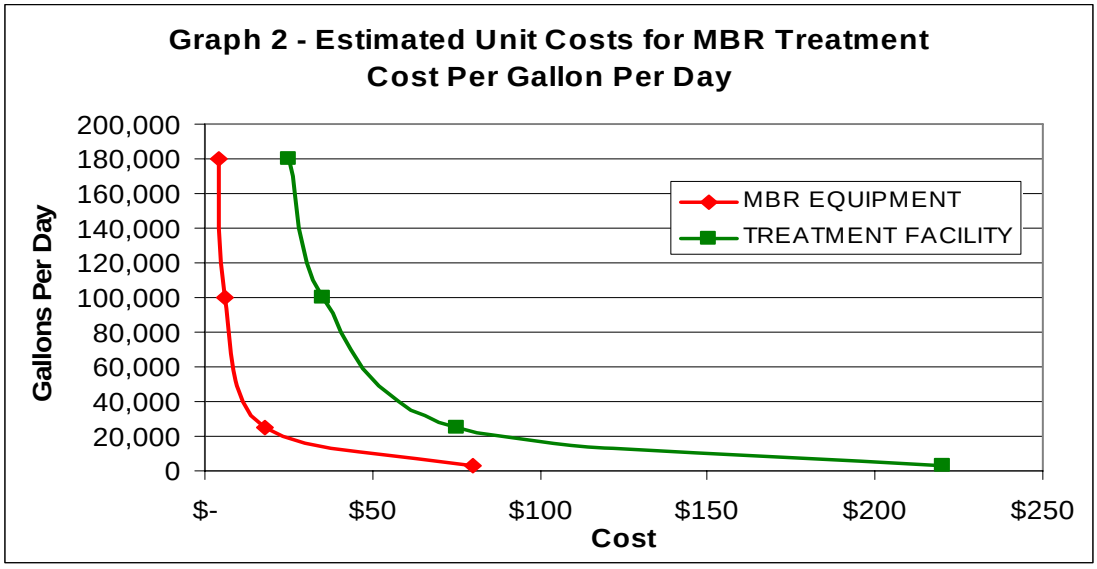
Satellite sewer systems currently exist in Carlsborg to a degree in that 'large on-site systems' (LOS) exist for the former Costco site, for the Greywolf School, the Parkwood Mobile Home Park, and several other developments. The current problem is that none of these systems provide very effective treatment or effluent disposal in relation to the usual standards of public wastewater facilities. Smaller versions of the sewerage facilities described in previous sections could be implemented through a phased program serving just those parts of Carlsborg that wanted sewer service in a particular time frame.

The issue is cost, and the economy of scale achieved by centralized sewer systems. The actual cost of four facilities estimated or bid during 2006 are shown in Table 16, first just for the MBR equipment, and then for the entire treatment facilities including the MBR equipment.

Table 16
Economy of Scale in Wastewater Treatment
Equivalent Residential Unit is 125 GPD

	MBR Equipment Cost		**Treatment Plant Cost**	
Capacity in GPD	**Cost per GPD**	**Cost per ERU**	**Cost per GPD**	**Cost per ERU**
3,500	$ 80	$ 10,000	$ 220	$ 27,500
25,000	$18	$ 2,250	$ 75	$ 9,375
100,000	$ 6	$ 750	$ 35	$ 4,375
180,000	$ 4	$ 500	$ 25	$ 3,125

The economy of scale is readily apparent for the cost of treatment facilities as shown in Table 15. Only costs for treatment are shown in the table. Reuse or effluent disposal costs are not included, nor are the costs of collection sewers. Graph 2 displays these estimated costs for treatment facilities in two graphic curves.



It is certainly true that less expensive treatment facilities can be provided. However, for the degree of treatment required to achieve 'Class A' water for reuse, the costs shown in Table 15 are realistic. A lesser treatment level would not provide the same degree of protection for the aquifer, which is a paramount objective in providing sewers within the Carlsborg community.

6 Reclaimed Water Reuse

6.1 Regulatory Issues

The basic requirements for initiating sewer service are defined in Chapter 173-240 WAC. Before sewer service can be initiated WAC 173-240-050 requires that a General Sewer Plan be prepared and approved by the Department of Ecology. Design of wastewater treatment facilities further requires the preparation of an Engineering Report in accordance with WAC 173-240-060, which also must be approved by the Department of Ecology. Additionally, the Second Engrossed Second Substitute House Bill 1338 then requires consideration of opportunities for the use of reclaimed water in the Engineering Report. Where such opportunities exist, plans must be developed that evaluate these opportunities.

There is no federal program regulating reclaimed water use in Washington State. 'Water Reclamation and Reuse Standards', September 1997, issued jointly by the Departments of Ecology and Health provides the basic guidance for water reclamation and reuse. Chapter 173-219 WAC – Reclaimed Water Use is the basic governing state law. New rules are under development through an advisory committee that must be adopted by 31 December 2010.

Reuse of reclaimed wastewater must demonstrate a net environmental benefit. Approval will involve additional regulatory requirements, depending on how the water is used:

- A point discharge to any surface water such as the Dungeness River or an irrigation structure would require an NPDES permit under WAC 173-220.

- Discharge as a non-point source to groundwater requires a State Waste Discharge Permit under WAC 173-216.

An NPDES permit is unlikely to be granted unless it can be demonstrated that no other method is feasible, which is unlikely to be achievable. Even if received, an NPDES permit requires significant sampling and testing each week and reporting monthly to Ecology. Administration of such a permit is an expensive requirement for the permit holder.

Aquifer Recharge, which is usually described as Direct Injection, is regulated under the federal Safe Drinking Water Act.

State Waste Discharge Permits are much less onerous to administer. The requirements can be negotiated. Sampling and testing may be required only quarterly. The reporting process is also usually much simpler. Accordingly, a reuse concept that can be administered through a State Waste Discharge Permit is preferred for Carlsborg.

6.2 Reuse Concepts

Reclaimed water can be reused in many ways. Some examples of reuse applications include landscape irrigation and street washing. These water uses are a minor component of normal water demands, and may not be practical on a year-round basis.

Irrigation, particularly for crops, is currently the major water use in the Dungeness River basin. Five irrigation districts and companies distribute water withdrawn from the river. Irrigation needs are seasonal however. Dry summer months are peak irrigation needs, which is when stream flows are minimal. Little irrigation demand exists during the winter months when stream flows are substantial, so seasonal storage of a large water volume is necessary.

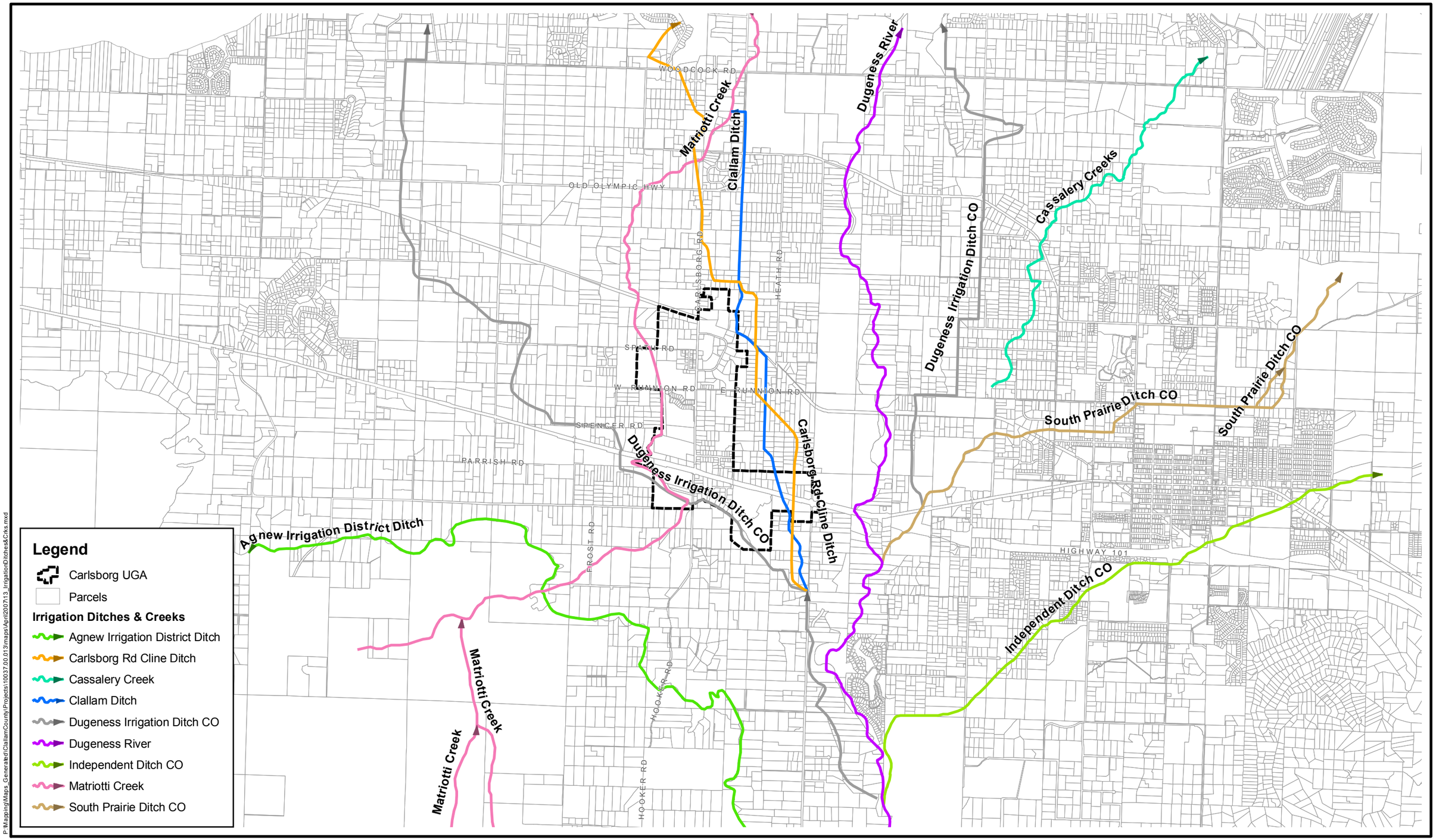
It is economically practical for reclaimed wastewater to be discharged into irrigation systems in the Carlsborg vicinity. Irrigation ditch lines are shown in Figure 13. Dungeness irrigators have not expressed interest in using reclaimed water, even though it has been used for decades in other parts of Washington State. There are several reasons for this reluctance. Irrigation water use has been declining in recent years due to changes in agricultural practices and irrigation efficiencies achieved through replacing irrigation ditches with piped systems. In addition, reclaimed wastewater is not an attractive product to most farmers since it might taint the public perception of their crops. However, it may be aesthetically acceptable for irrigation of hay fields and golf courses. A number of such uses are documented in 'Case Studies in Reclaimed Water Use', June 2005, by the Department of Ecology and similar examples can be found in other states.

Piped irrigation systems are reducing the upper aquifer water levels in the Carlsborg area. This aquifer is the principal water source for many private wells in and around Carlsborg. Declining aquifer recharge as leaking irrigation ditches are replaced with pipes also means less dilution of septic drainfield effluent, which may accelerate the increase in nitrate levels in the aquifer. These and other concerns are being studied through the on-going 'Artificial Recharge Study and Carlsborg Pilot Project' under the auspices of Clallam County.

Perforated pipes could be installed in the irrigation ditches to disperse reclaimed wastewater into the upper aquifer. Agreement with the irrigation ditch property owners would have to be negotiated. The alignments acceptable to property owners may or may not be the most beneficial to the surface aquifer. Any point discharge of reclaimed water into a ditch would require an NPDES permit, though it may be possible to provide a non-point discharge that would perform adequately while avoiding the NPDES permit requirement.

The appeal of providing reclaimed water to the irrigation system is the prospect of replacing diversions from the Dungeness River during the low-flow season. Currently, Dungeness River water is delivered to homes for watering lawns and gardens. Reducing irrigation diversions would have the same effect as directly augmenting river flow. Alternatively, the river could be augmented directly with reclaimed water.

Augmentation of Stream Flow by percolating reclaimed water into soils adjacent to the stream bank is an attractive reuse concept. Water rights for the river are over-allocated and stream flow during late summer months may be inadequate to support salmon recovery efforts as mandated



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Irrigation Ditches and Creeks

Sewer Feasibility Study
April 2007

Figure 13

under the Endangered Species Act. Likewise, augmentation of streamflow would offset river diversions during high flow periods for off-channel storage to be used during summer low-flow periods. Hydrogeologic studies have indicated that some stretches of the Dungeness River receive water draining through the local soils into the stream. Other stretches lose water out to the aquifer.

The percolation site should be purchased by the PUD for best management practices, though a long-term lease might be practical. If that river stretch receives water naturally from the adjacent surface aquifer, then the river would be recharged directly. If the river is losing water out to the aquifer where the recharge application occurs, then the reuse surcharge would reduce losses from the river. Either case would result in augmented flow in the Dungeness River, and be a net environmental benefit to the riparian habitat and aquatic life, including salmon.

A similar approach could augment flow in Matriotti Creek. Since the creek flow is much less than flow in the Dungeness River; the augmentation flow would be a much larger share of the stream flow and hence may create a more significant environmental benefit.

Aquifer Recharge requires an Injection Control Permit in accordance with Form 7520-6 under the federal Safe Drinking Water Act. As a practical matter, the treatment required will be reverse osmosis. A Hydrogeologic Study will be required to document the path expected to be followed by the injected water, the changes anticipated in the receiving groundwater, and impacts projected on other groundwater users.

This is a very stringent treatment requirement, especially when compared to septic tanks discharging through a drainfield into the same aquifer. Regulations for the two functions do not explain the rationale for the difference. Scale may play a part since septic tanks and drainfields are regulated for low density development while aquifer recharge is generally an extensive operation. On a more basic level, treatment plays a role in that a properly designed and operated drainfield provides additional treatment to the effluent received from the septic tank before the effluent reaches the aquifer. Direct injection is just that – water is injected directly into the drinking water aquifer without further treatment – so the water quality must be correspondingly high..

Reuse Pipeline in the same trench as the sewer main may be more practical for Carlsborg and reclaimed water could be used within the UGA for lawn irrigation during the summer. Such reuse would reduce the peak demands for potable water and conserve the available water rights for higher and better uses. If Clallam County desires, all new developments could be required to use reclaimed water for lawn irrigation, or other non-potable purposes. Branch reuse pipes can be extended from the initial service area as the sewer system expands.

Water in the reuse pipeline will have to be pumped; however, almost any wastewater disposal system will require some degree of pumping. A storage tank would be needed to equalize production of reclaimed water with the water use. The tank volume required depends on the uses envisioned for the reclaimed water. Initially, the volume may be small and simply be the wet well for the effluent pump station. A larger storage tank could be provided later if needed.

Dual Distribution Piping into houses and buildings with separate potable and reuse water pipes could be required by Clallam County for new development in the Carlsborg UGA. This system would allow toilets to be flushed with reclaimed water and all irrigation to also use reclaimed water, plus such other uses as can be identified. Several industrial or commercial applications may exist. Fire protection is also a possible use, at least for sprinkler systems, though that introduces the fire storage volume into the tank size and may not be cost-effective. Toilets are the largest single water use in most domestic systems. Constructing a duplicate water system, a 'purple pipe' system is usually the major obstacle, and is generally not cost-effective for most communities. For Carlsborg though, a 'purple pipe' system may be cost-effective when evaluated in terms of water and wastewater issues for the entire UGA as projected into the future.

Any of the reuse options will require a 'purple pipe' to some place, and that may well be in the trench for the sewer laid in Carlsborg Road. If so, that means that reclaimed water service will be available to every property connected to the initial sewer system, and could mean a dual system would be practical. To be so, Clallam County would have to require all new construction in Carlsborg to incorporate dual pipe systems, and some financial incentives may be necessary as well. The program could be extended to existing structures as they are sold, remodeled, or simply after the passage of a certain number of years.

The dry total flow volumes shown in Tables 10, 11, and 12 and the Dungeness River flows shown in Table 6 are compared in Table 17.

Table 17
Comparison of Dungeness River with Projected Carlsborg Reclaimed Water
Flows in Millions of Gallons per Day

Parameter	**Dates**		
Carlsborg Reclaimed Water Flow			
	2020	**2030**	**2050**
Average Annual Day Flow	0.058	0.103	0.226
Dungeness River Flows			
	2004	**2005**	**2006**
Dungeness River Median Flow	176	109	164
Dungeness River Minimum Flow	50	37	46

Clearly, the reclaimed water would add a small amount to the Dungeness River, even during the low flow periods, and even less for average flow conditions throughout the year. However, it is possible that environmental studies may show that any flow augmentation in the river, Matriotti Creek or some other local water body would be beneficial. Such benefits could include some or all of the following:

- Increased spawning beds as more gravel is covered with water
- Higher levels of dissolved oxygen as the stream flows at higher velocity
- Improved survival rates among hatchlings
- Thicker vegetation due to more water, which will lower the stream temperature.

Conceptually, augmentation of the Dungeness River appears to provide the most environmental benefit and to be the easiest to implement. Accordingly, it is the baseline concept for the Feasibility Study. Figure 14 shows a conceptual alignment for the reuse pipe, or 'purple pipe', to a generalized application site. Should it be decided to proceed towards implementing a sewer system for Carlsborg, other reuse concepts will evaluated in subsequent planning efforts. For example, a dual pipe reuse system could readily be implemented from the augmentation pipe system if desired.

6.3 Percolation System

Several types of percolation systems might work for water reuse in the Carlsborg area to augment flow in the Dungeness River. Photos 3 and 4 illustrate two approaches, and several alternatives are described below:

Drainfields similar to septic systems could be constructed. These systems require excavation of shallow trenches to install perforated pipe, which could be 2 to 4-inch diameter, and backfilled with suitable material. The drainfield system would be constructed in at least four zones initially so the application can be rotated among the zones in a planned sequence, and redundancy is provided by the capacity of each zone to absorb the reclaimed water. The system would be pressurized to optimize distribution of the water.

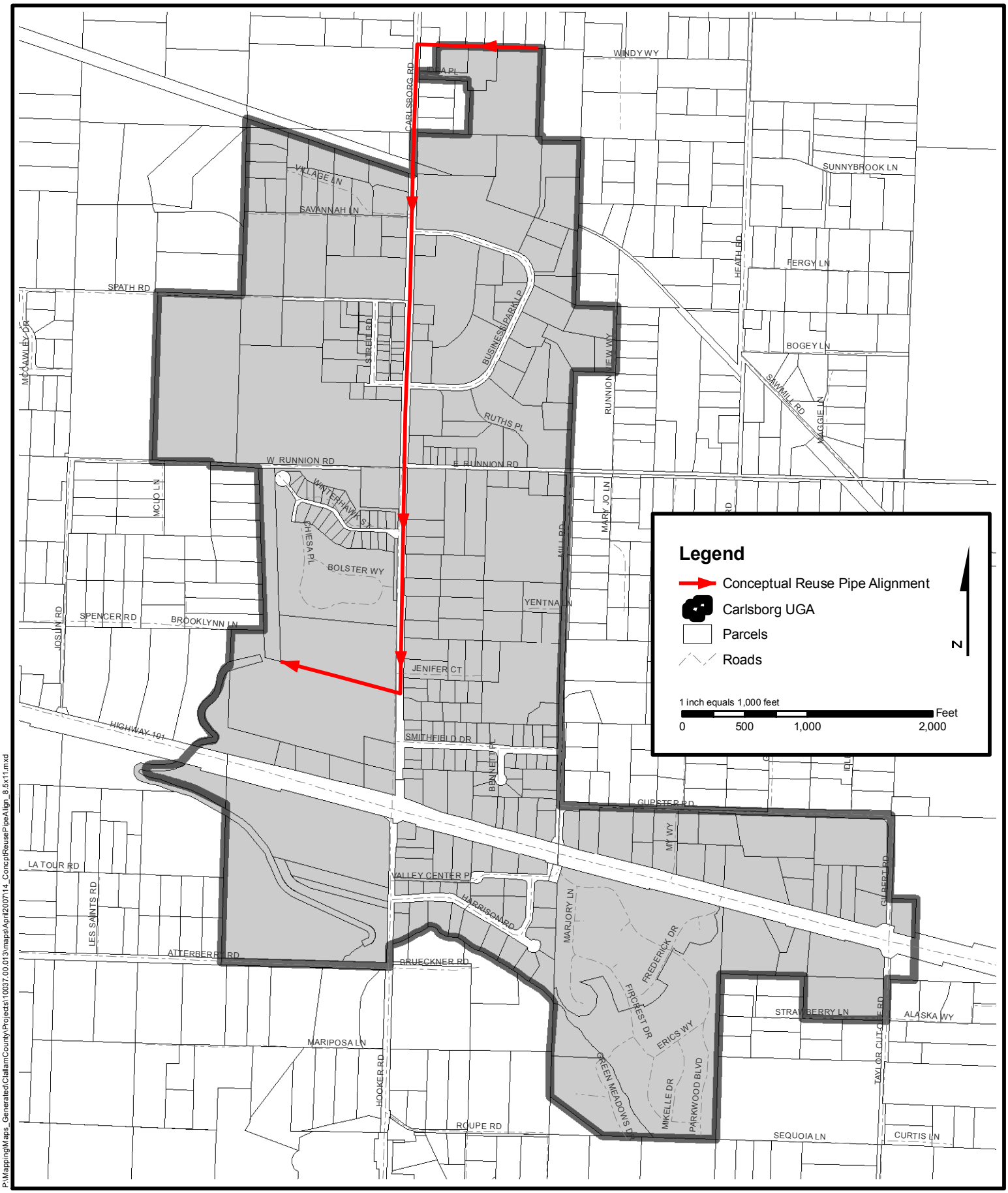
The ground surface above the piping could be used for other activities, such as crops or a playfield, though to maximize river augmentation the agronomic demands of any plantings should be minimized. Future expansions of the Carlsborg sewer system and increases in wastewater flow could be accommodated at the same site by adding zones.

Drip Irrigation uses 1-inch tubing that weeps or leaks water into the soil. Installation is simple and inexpensive. Tubing is supplied in rolls and is plowed about 6 to 10-inches into the soil. Drip tubing is laid out in irrigation zones. The reclaimed water application is rotated sequentially to the zones and redundant capacity is achieved. The distribution system would be pressurized to optimize distribution of the reclaimed water.

The surface can be used for some crops or a sports field, golf course, or a park, though the agronomical water demand of the planting should be minimized to achieve the maximum river augmentation. Future expansion at the site by adding zones could accommodate future increase in wastewater flows as the Carlsborg sewer system expands.

Constructed Wetlands could be used to percolate reclaimed water through the river bank and augment stream flow. Two general types of wetlands are feasible:

- Surface wetlands have one or more basins with at least some open water surfaces. Wetland plants grow in the water and along the banks.
- Subsurface wetlands have no open water as the basins are filled with porous material like rock, gravel, and sand that the water flows slowly through. Plants grow in the media.



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Conceptual Reuse Pipe Alignment

Sewer Feasibility Study
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Figure **14**

Photo 3 – Infiltrators (34 x 48 inches long) being installed in 21 x 80 feet long zone

Photo 4 – Completed Percolation Field using Drip Irrigation for 14,600 GPD

Wetlands do provide some treatment to the reclaimed water stream. However, 'Class A' water does not require or need additional treatment. Open water surfaces may constitute a hazard to some people. Wetland plants require harvesting, which can be expensive in shallow water bodies.

Wetlands also form an attractive habitat for various species of wildlife. However, once established, wetlands may fall under wetland regulations. This may result in requirements to establish minimum water levels regardless of the reclaimed water available.

Discharge to and through a wetland does not need to be 'Class A' water. It could be Class B, or C, or even D. In fact, the discharge stream does not have to be reclaimed water at all. Wetlands can be an integral part of the treatment process. In some applications, wetlands may be more cost-effective than a conventional treatment facility. However, wetlands have significant costs – land being only one – and treatment is dependent on a biological process that is not efficient during cold weather when little vegetation growth occurs. These are complex issues that are appropriate to evaluate during preparation of a facilities plan.

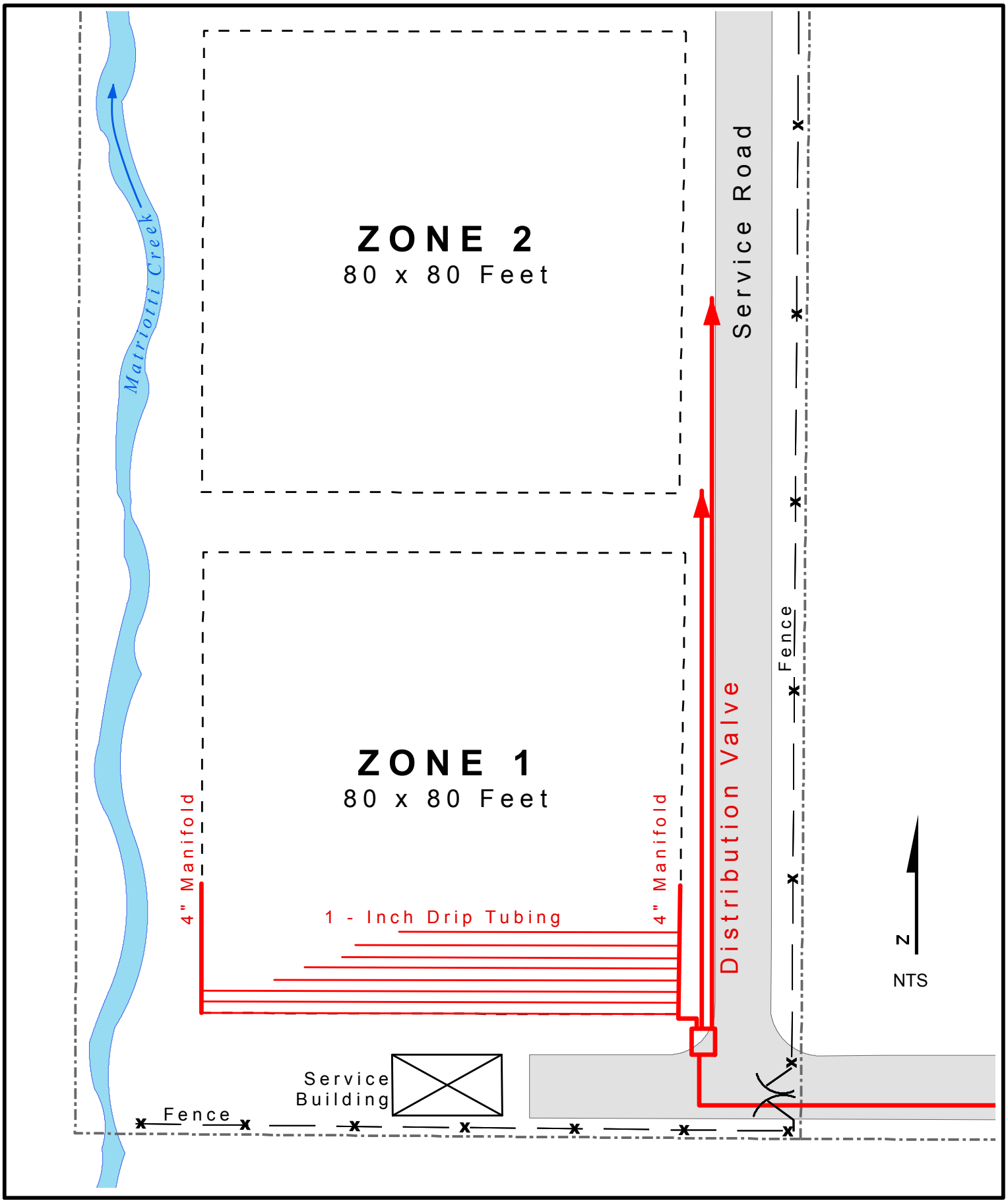
Percolation Ponds may be effective in transmitting reclaimed water into the river. However, creating of any pond may involve the risk of creating a wetland. An open water surface may be a hazard to some people. Maintenance of a pond may be more expensive than maintenance of a field for drip irrigation or a drainfield.

6.4 Evaluation

The above percolation concepts should be evaluated in more detail during subsequent planning steps should it be decided to proceed with implementing a sewer system for Carlsborg. However, drip irrigation may be the most cost-effective and beneficial to the community; so it will be used as the baseline concept to establish the feasibility of a sewer system for Carlsborg.

Figure 15 illustrates how a series of drip irrigation system might be developed within an approximately 4 acre site adjacent to Matriotti Creek using a modular system of expansion zones.

Since the reuse pipeline shown in Figure 14 passes in front of many parcels within the Carlsborg UGA, the reuse water would be readily available for summer lawn irrigation should this use be found more environmentally beneficial.



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Conceptual Drip Irrigation System

Sewer Feasibility Study
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Figure 15

7 Financial Considerations

7.1 Estimated Construction Costs

The estimated costs to construct the Initial Sewer System for Carlsborg as shown on Figure 8 are summarized in Table 18.

Table 18
Estimated Construction Costs for Initial System

Construction Element	Unit	Approximate Quantity	Estimated Cost
12-inch Sewer	LF	1,900	$ 290,000
8-inch Sewer	LF	7,100	950,000
SR 101 Crossing	LF	100	120,000
Conveyance Subtotal			$ 1,360,000
STEP Units with new Tanks	EA	60	$ 420,000
2-inch Force main	LF	7,000	280,000
STEP Subtotal			$ 700,000
Influent Pump Station	GPM	200	$ 240,000
MBR Structures (two)	GPD	200,000	750,000
MBR Treatment Process	GPD	100,000	700,000
Provision for Future Capacity	GPD	100,000	120,000
Control Building	SF	1,200	430,000
Sludge Holding & Thickening	Gal	10,000	200,000
Emergency Power & Odor Control	KW	1,000	100,000
Emergency Storage	GPD	100,000	120,000
Site improvements	SF	100,000	360,000
Treatment Subtotal			$ 3,020,000
Effluent Pump Station	GPM	200	$ 240,000
4-inch Force Main	LF	7,000	210,000
Reuse Site Acquisition	AC	4	120,000
Percolation Piping	LF	12,000	140,000
Site Monitoring Facilities	EA	8	50,000
Mitigation	SF	100,000	60,000
Reuse Subtotal			$ 820,000
Connection of Existing Buildings	EA	60	$ 240,000
Provision for Future Services	EA	100	120,000
Private Property Subtotal			$ 360,000
Construction Subtotal			$ 6,260,000
Sales Tax & Contingencies			$ 1,880,000
Estimated Total Construction Cost			$ 8,140,000

The conveyance facilities shown in Table 18 are sized to convey the peak hour flow projected for build-out of the entire UGA in 2050 as shown in Table 12 of 978,000 MGD. Table 12 in turn was based on the populations shown in Table 9 projected at 2.15 percent annually.

Clallam County will need to prepare a new land use plan defining the allowable densities for Carlsborg with sewer service available, and the rules for connecting existing development now served by on-site septic systems. That document will provide the basis for preparation of a sewer facilities plan, which may conclude that build-out wastewater flows should be larger than projected in the Feasibility Study. If so, then the interceptor sewers may need to be larger too. The project cost to increase the interceptor by one pipe size to 15-inch diameter is estimated to be less than $ 100,000.

Capacity in the treatment facilities as shown (100,000 GPD is slightly less than the 122,000 GPD projected for 2020 including 64,000 I/I, which may be too high for the first years of operation) can be easily doubled (200,000 GPD, which is about the 199,000 GPD projected for the 2030 average day during the wettest month). The reuse force main and the reuse site are also intended to be adequate through 2050. However, expansion of the UGA or substantial increases in development densities may eventually require even larger facilities.

No sludge facilities beyond a holding tank and a decant pump are included in the Table 18 estimate of construction costs. More extensive sludge management facilities will become desirable as the sewer system expands so the sludge can be processed into reusable biosolids. The rate of expansion will affect costs to some degree. As a reasonable projection from the initial facilities, expansion to provide the facilities needed for the 2050 conditions as shown in Figure 12 may require $ 5,000,000 to $ 6,000,000 in addition to the Table 18 estimated costs.

7.2 Estimated Project Costs

Implementation of the construction elements described in Table 18 will require completing a number of project activities. A preliminary list of these implementation activities, not necessarily complete, is shown below:

1. Comprehensive Land Use Plan
2. Sewer Facilities Plan
3. Conceptual Special Benefit Study
4. Hydrogeological Study
5. Funding Program
6. LUD Formation
7. Archeological Study
8. Sewer System Design Plans and Specifications
9. SEPA Determination and possible EIS
10. Environmental Mitigation Plan
11. Permit Applications
12. Property Acquisitions
13. Final Special Benefit Study
14. Final Assessment Role
15. Sewer Use Ordinance
16. Construction Administration, Start-up, and O&M Manual
17. Bond Counsel and Bond Sale
18. Project Administration by PUD and Clallam County

19. Interim Financing Arangement
20. Litigation Contingency

Scopes and budget have not been prepared for the above activities. It is possible that some may be combined. A few may be found unnecessary. Others may be needed. The PUD or Clallam County may undertake to complete some activities with their own staffs. However, allied project costs range from 45 to 55 percent of construction costs. As a budget estimate the above project activities are estimated to cost about $ 2,500,000 to $ 3,500,000 by the time the sewer system becomes operational.

Many unknowns exist for projects of the complexity involved with developing a sewer system for Carlsborg that also includes water rights considerations. Accordingly, a project contingency of about $ 1,160,000 is included to address these uncertainties for the initial system, in addition to the $ 500,000 contingency included in Table 18 as part of construction costs.

The resulting estimated total project costs for the Initial Sewer System for Carlsborg are shown in Table 19.

Table 19
Estimated Total Project Costs for Initial System

Project Cost Elements	Estimated Cost
Construction Costs with Tax & Contingencies	$ 8,140,000
Project Implementation Activities	3,100,000
Project Contingencies	1,160,000
Total Estimated Project Costs	$ 12,400,000

The Sewer Feasibility Study is only intended to provide a decision tool as to whether it is feasible to build sewers for the Carlsborg UGA. Prudence indicates that such a decision should be based on a minimal development prospect, which may be less than the development projected in the Study as currently written.

7.3 Estimated Annual O&M Costs

Operation of the initial sewerage facilities depend on several factors and policy decisions that can only be made as the start of actual sewer service approaches. As a conceptual estimate, Table 20 describes the key budget items that may be needed for operation of the initial sewer system once most connections have occurred, and a projection of the costs that may be involved.

Table 20
Projected Annual Operation and Maintenance Costs

Budget Elements	Description	Annual Cost
Labor	2 operators	$ 140,000
Power	20,000 KWH/month	15,000
Chemical	Membrane Cleaning	12,000
Administration & Billing	500 hours	25,000

Budget Elements	Description	Annual Cost
Professional Services	Engineering & Legal	24,000
Collection Maintenance	Pipe cleaning & repairs	10,000
Treatment Maintenance	Electrical & Mechanical	24,000
Reuse Maintenance	Site Upkeep	8,000
Membrane Replacement Fund	10 year cycle	20,000
Sludge Disposal – contract haul	320,000 gallons	48,000
Miscellaneous		25,000
Estimated Annual Cost		$ 351,000

The estimated annual cost shown in Table 20 equates to $ 29,250 per month for the entire Carlsborg sewer system. Start-up operating costs would be considerably less annual cost, perhaps only $ 100,000 to serve about 100 ERU for the initial several years.

The estimated annual costs would be distributed to the served customers through a rate structure that has yet to be adopted. Rate structures usually incorporate a differential between residential and non-residential customers. The resulting cost per customer depends heavily on how many customers are served during the initial years. If few customers connect during the initial year of sewer operation, several of the Table 20 costs will be less or can be deferred.

As a conceptual estimate, monthly sewer service charges may be in the $ 55 to $ 65 range for single family residences. Commercial customers with different pollutant loads would pay higher rates.

It may be noted that depreciation is excluded from annual costs shown in Table 20, though routine system maintenance costs are included. Since the initially participating property owners are buying the initial sewer system, it is believed equitable to defer depreciation funding for 20 years until the LUD construction debt is retired. Depreciation charges could then be added to the O&M costs for funding through the monthly service charges.

7.4 Construction Financing Options

The PUD and Clallam County recognize that some of the project costs associated with implementing a sewer system for Carlsborg will have to be financed by the agencies, and that many of these costs cannot be directly recovered from the initial customers. However, it is anticipated that as the Carlsborg community develops and grows, these public investments will be recovered over time.

Funding for the sewerage facilities is expected to involve a mix of sources. Funding for some agencies originates from the federal government. Use of such money, as through the State Revolving Fund for example, requires preparation and approval of a Facilities Plan. Facilities Plans are often prepared to address the requirement of WAC 173-240-060 as well as the federal requirements.

Several low-interest rate loan programs exist through various state and federal agencies. A sewerage program for Carlsborg may qualify for several of these. The resulting funds may allow most or all project costs to be financed at interest rates below even municipal bond rates.

Grant funds are much less available than in previous years. However, providing sewers for Carlsborg offers the opportunity to implement an integrated water resources management approach for the Dungeness River basin in a manner not done before. Such approaches sometimes qualify for pilot program funding. Applications can be made to state and federal agencies for such assistance, such as the US Department of Agriculture. A Congressional Direct Appropriation is also possible, though the current Congress has indicated that these funds will be less available than in recent years.

Benefiting property owners will be required to pay the majority of the project costs for the Carlsborg sewerage system. These costs will be assessed to the owners of specific parcels according to an assessment methodology that has yet to be developed. This methodology will be developed so no parcel assessment exceeds the benefit conferred to that parcel by constructing sewers.

Local Utility District (LUD) financing is the preferred method of funding the property owner share of the total project cost for new facilities like a sewer system. The process for the formation of a LUD is defined in RCW 54.16. This process has not yet been started for a sewer system serving the Carlsborg UGA, so actual details cannot be defined and only an estimate of how the process may work can be included in this Feasibility Study. One key question will be which property parcels are to be included within the LUD. It may be that the LUD will use a three-tiered approach generally as follows:

- All parcels within the UGA would be assessed for some sewerage facilities, even though the parcels may not be served by the Initial System.

- Those parcels which actually border the rights-of-way where sewers are installed for the Initial System would be assessed for some additional facilities.

- Those existing parcels that actually connect to and use the sewer facilities would be assessed an equitable portion of the net project costs with grants excluded – meaning parcels with more than a single family residence would pay more.

Some questions may arise at the concept of assessing parcels not connecting to the sewer in that some may feel these parcels receive no benefit from the initial sewer system. However, the concept of assessing for indirect benefit is well established. Many governmental services are funded through general taxes or assessment rather than strictly by user fees. Schools are the most prominent example in that all properties are assessed for schools whether the owners have children or not. Other examples are parks, libraries, and public transportation.

Constructing even an initial sewer system will have some benefit to every property within the UGA. A home fronting the sewer that chooses not to connect benefits in that the sewer exists

should their on-site system fail. Even a parcel not fronting a sewer has a benefit because a sewer can be extended if needed. The sewer becomes like an insurance policy.

The dollar value of these benefits will be determined through a special benefit study once the alternatives have been evaluated, the preferred system selected, and the project costs are known.

As noted in previous tables, the costs for a sewer system are large, and even though the benefits may be welcome, some property owners may simply be unable to pay their equitable share. Median household income for Carlsborg was reported as $ 28,103 in the 2000 Census. The demographics indicate that the community would qualify for low-interest loans while many property owners may meet the test of financial hardship and qualify for grants or deferments in payment of assessments. The 2000 Census also reports that about 55 percent of the residents were age 60 or older. Monthly sewer service charges could include a reduced rate for senior citizens.

Given these limitations, Table 21 summarizes a possible derivation of the costs that may be assessed through a LUD to Carlsborg property owners, with the understanding that the total amount assessed does not exceed the increase in property value of the benefiting parcels.

Table 21
Derivation of LUD Costs for Carlsborg Sewer System

Funding Source	Estimated Funding
Estimated Total Project Cost	$ 12,400,000
Clallam PUD	$ -- unknown --
Clallam County	-- unknown --
State Agencies	-- unknown --
Federal Agencies	-- unknown --
Assumed Agency Total Grants	$ 3,400,000
Amount Assessed to Property Owners	$ 9, 000,000

The funding shown in Table 21 is only an assumption for illustration of the concept. No agency has committed any funds to the project yet.

Inter-Agency Cost Sharing may be possible with other local sewerage agencies, though the feasibility of constructing sewers for Carlsborg is not dependent upon any such funding actually materializing for the initial facilities. The cost sharing concept can be explored further in the future regarding several possible participating agencies as indicated below:

- Jamestown S'Klallam Tribe
- Lower Elwha Klallam Tribe
- Sunland Sewer District
- Clallam County
- Other community sewer systems yet to be developed

For purposes of the Feasibility Study however, the costs summarized above will be used.

7.5 Conceptual LUD Assessment Methodology

LUD assessments can be distributed among benefiting properties in many ways. It is usual to begin with a Special Benefit Study that defines the value of every parcel as it is, and as it would be if sewer service was available. The cost of most home improvements is not usually reflected in an immediate dollar-for-dollar increase in the potential resale value of the property. Construction of a sewer system is no different. This is reflected in Table 21 as the difference between the estimated project cost for the sewer system and the amount assessed.

The challenge in developing most assessment formulas is to equitably distribute project cost share in relation to benefit conferred. This is particularly challenging for Carlsborg because of the wide variation is parcel ownership, size, zoning, and development potential. These challenges are usually best met by dividing project costs into several categories and using a separate assessment formula for each category. The actual assessment for each parcel is then the sum of the assessment computed for each cost category.

A conceptual assessment methodology that may be appropriate for Carlsborg is summarized through the cost categories described below:

1. Area Charge – could be used for facilities sized to benefit the entire UGA, such as the reuse system including the pump station, force main, and reuse site.

2. Front Foot Charge – would apply to the footage of a parcel fronting the collection sewer, and for many pipe segments would apply to parcel on both sides of a street.

3. Capacity Charge – for an existing developed parcel would be the cost of treatment facilities per equivalent residential unit prorated for existing structures in relation to possible future development.

4. Added Benefit Charge – would be the cost of treatment facilities for potential future developments that could be built on an existing parcel.

5. Service Connection Charge – would include the actual cost to abandon existing on-site sewage facilities and connect the structure to the sewer.

6. STEP Charge – would apply to existing mobile homes by replacing existing septic tanks with new facilities including a screened pump and the force main to the gravity sewer.

The unit assessment for the above methodology is illustrated in Figure 16 and is summarized in Table 22.

Table 22
Conceptual Assessment Methodology
Charges to be Applied in Various Combinations

Charge Category	Assessment Units	Assessment Range
Area Charge	Square feet of property	$ 0.06 to $ 0.09
Front Foot Charge	Footage on street	$ 75 to $ 90
Capacity Charge	One existing SF home	$ 2,000 to $ 3,000
Added Benefit Charge	One new equivalent home	$ 4,000 to $ 5,000
Service Connection	To existing or future	$ 1,000 to $ 3,000

Using the conceptual assessment methodology shown in Table 22, a range of approximate assessments for some parcels that may be typical of properties within Carlsborg are shown in Table 23.

Table 23
Typical Conceptual Assessments

Representative Properties	Low Range	Upper Range
Existing Single Family Home, lot not dividable	$ 12,000	$ 16,000
Existing Single Family Home on sub-dividable lot	$ 25,000	$ 100,000
Existing Small Commercial Properties	$ 18,000	$ 75,000
Existing Large Commercial Properties	$ 40,000	$ 300,000
Vacant and Undeveloped Properties	$ 60,000	$ 2500,000

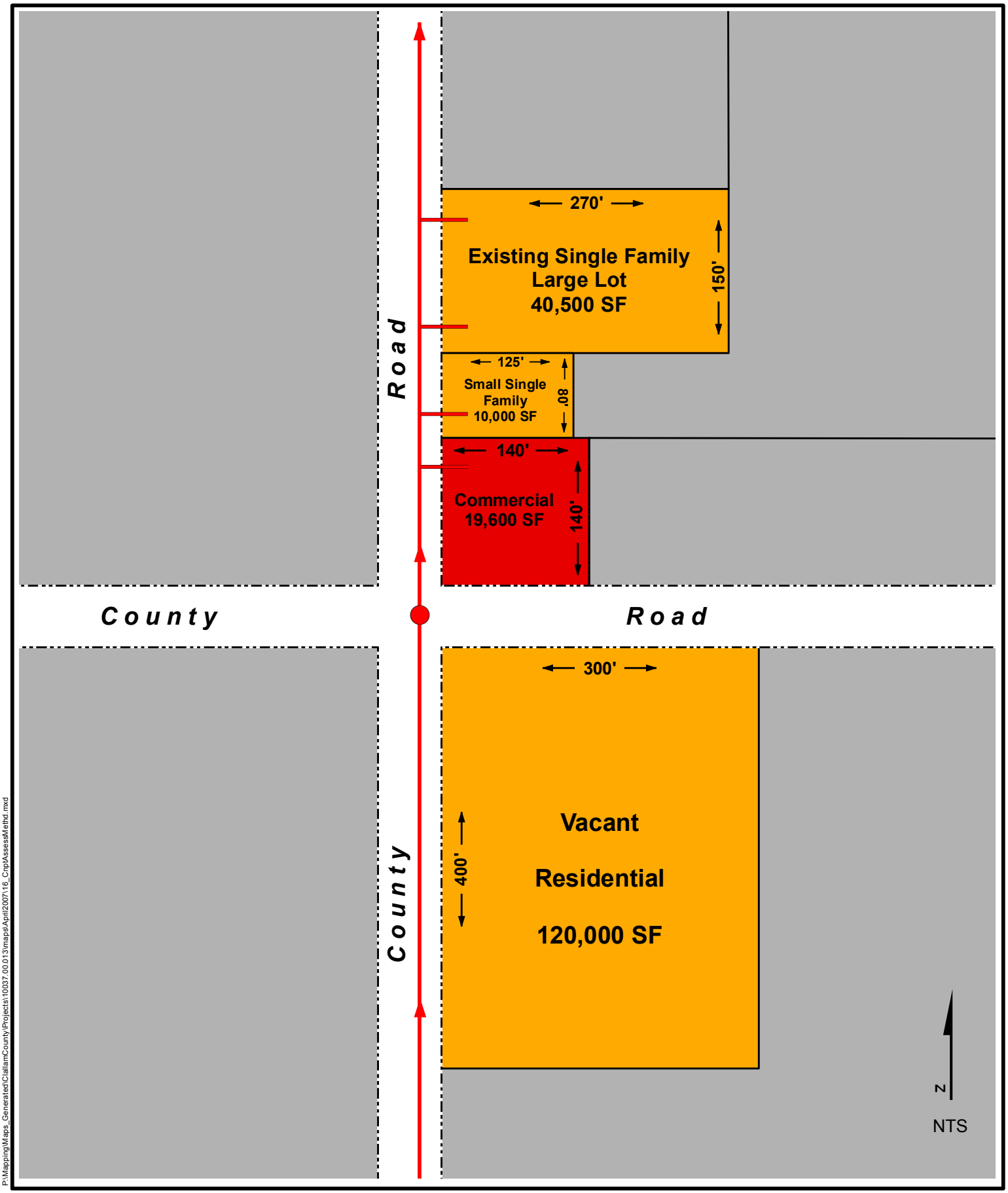
Note: Assessments vary, depending on the number of ERU actually developed

The actual conceptual assessment under the above methodology varies with the lot size and several other factors. Tables 21, 22, and 23 are only a concept. The actual assessment method that may be used would undoubtedly be different. However, Table 23 does show that small commercial properties would be assessed more than small residential parcels. And large parcels with the potential to be developed into higher density uses would be assessed more than parcels that cannot be further developed.

Recognizing the limitation of the assessment methodology shown in Table 22, a comparison with an actual sewer system assessment for 2006 is shown in Table 24.

Table 24
Comparable Assessments
City of Bainbridge Island

Community	Properties Assessed	Average Assessment
Rockaway Beach	77 SF residential lots	$ 22,869
Point White	63 SF residential lots	$ 19,989
Pleasant Beach	33 SF residential lots	$ 8,112
Emerald Heights	43 SF residential lots	$ 26,988
Blakely School	----	$ 688,195



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Conceptual Assessment Methodology

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Figure **16**

An 'Assessment Contingencies' is often provided in LUD financing as an allowance for property owners qualifying for an assessment adjustment. These adjustments could be for financial hardship, elderly owner, or that the parcel has a functional on-site sewage system and does not want to connect to the sewer system at this time.

Assembling all of the above costs into a monthly cost for a typical property necessarily involves many simplifying assumptions, many of which will not necessarily be true should the project proceed. However, recognizing these limitations, Table 23 shows one estimate of what these total costs may be on a monthly basis, assuming the assessments are financed at 3 percent annually over 20 years.

Table 25
Estimated Total Cost per Month

Property	Monthly Service	Annual Assessment	Annual Total
Single Family	$ 45 to $ 60	$ 807 to $ 1,076	$ 1,347 to $ 1,796
Small Commercial	$ 55 to $ 100	$ 1,210 to $ 5,042	$ 1,870 to $ 6,242
Large Commercial	$ 100 to $ 600	$ 2,689 to $ 20,167	$ 3,889 to $ 27,367

The costs shown in Table 25 are only an estimate. Significant changes will undoubtedly occur before the first bills are actually prepared. However, the costs shown represent the best estimate available at this stage of the project.

7.6 Alternative Systems and Costs

Many property owners may prefer to continue with on-site sewage disposal systems. As noted earlier, on-site systems meeting current Clallam County requirements for nitrogen removal cost from $ 18,000 to $ 20,000 to install plus an additional $ 3,000 to $ 5,000 for the system design and permit fees. Once installed, there are periodic operating costs, which may become more expensive as Clallam County considers how to comply the recent and stringent requirements of Chapter 245-272A WAC. The draft OSS Plan recommends that Carlsborg be included in the 'marine recovery area'. According to the WAC, requirements include yearly inspection for non-conventional systems and every three years for conventional systems. Most newer septic systems in Carlsborg are non-conventional and annual inspections are required.

On-site systems do not last forever. Mechanical and electrical components need replacement. The drainfield will require reconstruction. Even the concrete tanks decay and eventually must be rebuilt. Gordon Clemans, Senior Environmental Health Specialist with Seattle & King County Public Health, stated in April 2007 that his 30 years of experience with on-site systems indicates the following life expectancies are reasonable:

- Concrete structures are usually serviceable for 20 years in small distribution boxes to as much as 50 years for large septic tanks.
- Mechanical equipment like pumps and float switch rarely last as long as 20 years and may not reach 10 years in service.
- Electrical equipment may be serviceable for 20 years.

- Single drainfields and mounds useful lives depends largely on the loadings in that some fail within one year while others may last 20 years or more, and multiple disposal systems that allow rotation can last for decades.

Clallam County is now involved in starting an on-site septic system management program to verify that such systems are performing properly. The service lives indicated above suggest that in Carlsborg even with a community sewer system available, existing on-site septic systems that are found to be performing adequately may not need to connect to the sewer for years. However, at such time as an on-site system does fail, connecting to the sewer would be less expensive to the property owner than installing conforming repairs.

7.7 Wastewater Treatment by the City of Sequim

7.7.1 Alternative Concept

Sewer sewer in association with the City of Sequim is a possible alternative to building a separate treatment facility in Carlsborg. The draft Greater Dungeness Regional Wastewater System Plan, dated July 2004, considered sewer service by Sequim for Carlsborg, Blyn, and other communities within Sequim vicinity.

Flow projections for the System Plan are provided only for 2022 date. These used household sizes and wastewater flows per home representative of typical western Washington communities. Recent data shows household sizes in Sequim and Carlsborg to be smaller with lower sewage generation rates. The resulting values used in the System Plan may be realistic for Carlsborg during that time period, particularly as a conservative, upper range for planning purposes. However, pipe capacities are usually sized for a longer planning horizon, such as expectations for 50 years, as was used in the Feasibility Study.

A simple summary of estimated costs was provided in the System Plan which was developed using early 2004 construction costs as reproduced below:

Carlsborg Conveyance System	$ 2,300,000
Share of Sequim Treatment Facilities	$ 2,700,000
Estimated 2004 Total Project Cost	$ 5,000,000

The estimates prepared for the Sewer Feasibility Study are intended to reflect costs expected for the 2010 to 2012 timeframe. Accordingly, the estimated costs from the System Plan need to be escalated to reflect inflation. Construction costs have increased an average about 3.5 percent in the Seattle area in recent years. Consequently the 2004 costs from the System Plan must be increased 32 percent for comparison with the Sewer Feasibility cost estimates. The resulting adjusted System Plan estimated cost for service to Carlsborg is $ 6,600,000.

The System Plan estimated costs do not include the return of any reclaimed water for reuse in Carlsborg. Hence, some additional facilities would be needed for a direct cost comparison, and a more refined estimate of all facilities required would be helpful.

7.7.2 Conveyance Facilities

System Plan conveyance facilities begin with a 350 GPM (500,000 GPD) pump station. That pumping rate would be adequate for projected Feasibility Study peak hour flow in 2030, though not in 2050 without flow attenuation. Some attenuation of the flow would minimize the pumping capacity required, and the force main size. The System Plan reportedly envisioned a large wet well for the pump station, though not a specific equalization tank.

A force main alignment using the Olympic Trail to reach the point designated by Sequim for connection the existing City sewer system would measure about 10,900 feet. The force main could be 8-inch nominal diameter HDPE pipe. Head loss at 350 GPM would be 4.3 feet per 1,000 feet with a velocity of about 2.4 feet per second. Total dynamic loss for 10,900 feet would be about 47 feet, which could be managed by a single pump station with 10 horsepower motors.

It is believed possible to suspend the force main from the old railroad bridge for crossing of the Dungeness River. Some seismic concerns may exist with the old bridge structure. It might be appropriate to strengthen the existing structure, or simply accept that some risk may exist since no lives would be at risk specifically because the pipe was installed on the bridge. These factors would be addressed through an environmental impact statement regarding the entire alternative concept. Figure 17 shows the approximate alignment of the piping involved in reaching Sequim.

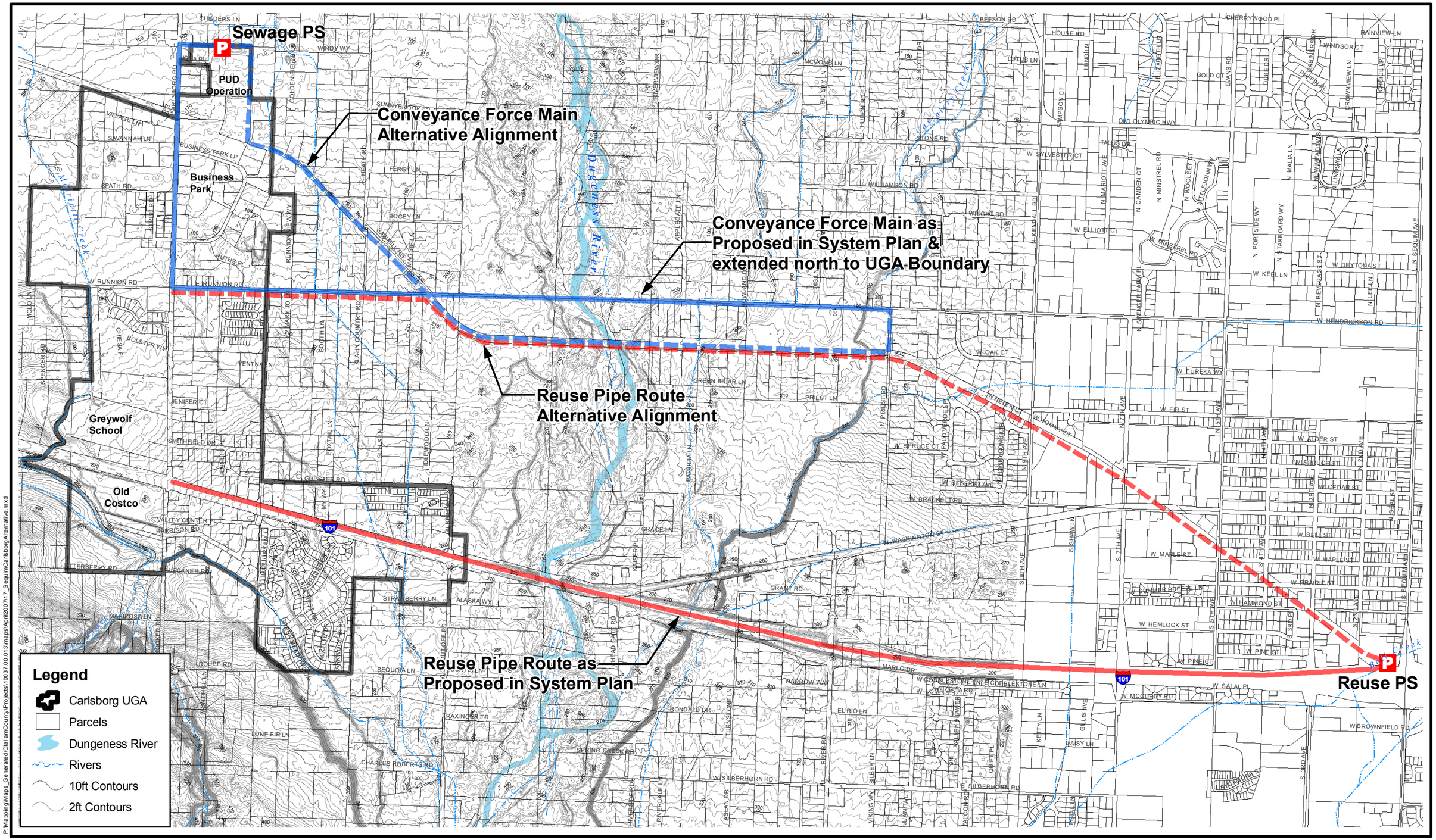
An additional 6,000 feet of gravity sewer within the existing City sewer system is identified in the System Plan to be increased from 8-inch to become 12-inch diameter. This replacement is believed to be appropriate.

7.7.3 Treatment Facilities

Information available is not sufficient to evaluate the additional treatment facilities proposed. However, there is no reason to believe the System Plan proposal is other than adequate and will continue to provide ‘Class A’ water.

Nitrate levels in the ‘Class A’ reclaimed water could be a concern. The data received from Sequim for five days in July 2007 shows nitrate concentrations averaging 1.85 mg/L with a maximum of 2.04 mg/L. These results are only slightly higher than 8 samples reported from 2005 that averaged 1.63 mg/L. These sample sizes are not believed sufficiently large to discern meaningful trends. All results are well below the 10 mg/L threshold standard for drinking water, and approximate the best results that can be expected from normal biological processes to reduce nitrogen compounds.

The System Plan indicates that current average day of the maximum month flow was 0.65 MGD in 2004, with a design capacity of 0.80 MGD. The City of Sequim is currently reported to be operating just below 80 percent of the permitted capacity and must soon begin planning for additional capacity regardless of decisions made by the regional agencies identified in the System Plan.



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PUD #1 of Clallam County

Sequim-Carlsborg Alternatives

Sewer Feasibility Study
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Figure

17

In fact, the City has made such wastewater decisions already. Engineering plans and specifications will be completed in late 2007 for treatment facilities upgrades. Construction will begin in 2008. The work will be bid as two phases. Phase 1 will involved the improvements needed immediately. Phase 2 will encompass improvements needed for conditions projected through the next 20 years, and will be built if bid prices are within engineering estimates.

7.7.4 Reuse Facilities

The City of Sequim has a goal of reusing 100% of their wastewater effluent. This is currently achieved during the summer, though not during winter conditions.

PUD discussions with Sequim indicated that 'Class A' water would be provided at the Sequim Meter Shop just north of US 101 and west of Sequim Avenue. A reuse booster pump station will be required. The capacity can be assumed as equaling the annual average day flow, which will approximate the wastewater quantity generated during the summer when reuse water is most in demand. This capacity would average about 40 GPM (58,000 GPD) in 2020, increasing to 75 GPM (103,000 GPD) in 2030, and 160 GPM ((226,000 GPD) in 2050.

The reuse force main could be placed in the same trench as the reconstructed gravity sewer and the conveyance force main, plus a portion in Runnion Road. The total length would be 18,100 feet. Force main size would be determined by an economic analysis. Clean water can be pumped at much higher heads than sewage with considerably better efficiencies. Assuming a 160 GPM pumping rate, head losses for a 6-inch diameter pile would be about 4.7 feet per 1,000 feet. The friction losses should be computed for 23,000 feet to reach a storage tank site (including footage included in Sewer Feasibility Study) and would total about 108 feet.

A storage tank within or near the Carlsborg UGA will be required at an elevation adequate to maintain sufficient operating water pressure. This is also the case envisioned for the Sewer Feasibility Study. The tank should be sized to equalize reuse water supplied from Sequim in relation to reuse demands in Carlsborg. Minimum reuse water pressure supplied to the highest elevation user should be at least 30 PSI, which may require a 60 foot tall tank foe about 200,000 gallons. However, a storage tank may not be necessary for the initial sewer system and could be added later as reuse customers begin service.

Actual pump selection remains to be determined. Pumps could be either fixed speed or variable speed. Including the dynamic losses, the tank height, and elevation differences the total head required is about 190 feet. The motors would be about 10 horsepower.

7.7.5 Estimated Project Costs

Project cost elements mentioned in the System Plan include sales tax, contingency, engineering, and administration. This indicates that no allowance is included for completing the facilities plan, an EIS, permitting, rights-of-way acquisition, environmental mitigation, financing, legal, and negotiation of the necessary inter-local agreements.

The System Plan estimates implementation would take about six years, which may be a realistic time frame. However, estimated project costs need to be increased at about 3.5 percent annually, or about 1.32 times the amount stated in the System Plan to provide a realistic comparison for the 2012 horizon used in the Sewer Feasibility Study.

Table 26 provides a comparison between the estimated cost of having Carlsborg wastewater treated by the City of Sequim, and the estimated cost of a separate decentralized treatment facility for Carlsborg. The comparison is in three columns, or parts. The first column summarizes the cost elements from the Sewer Feasibility Study that are comparable to the Sequim facilities. The second column summarizes the Sequim facilities as described in the System Plan, adjusted for inflation, which is incomplete in relation to facilities shown in the Sewer Feasibility Study. The third column adjusts the proposed Sequim facilities to be comparable with the facilities shown in the Sewer Feasibility Study.

In addition to the project activities associated with Sequim facilities included in Table 27 as Allied Costs, a number of separate or similar project activities would be required for the collection system and facilities within Carlsborg. These would begin with a general sewer plan and include environmental, permitting, rights-of-way, and similar elements. Some of these could be added to the related Sequim documents. Others would be separate activities. In addition, all of the work involved with formation of a local utility district would still be required, including preparation of sewer use, rates, and related resolutions.

Charges by Sequim would reportedly use the same rate basis as within the city limits, which currently results in $ 43.14 monthly for a single family residence. Sequim does not want to be involved in administering or billing Carlsborg customers, so this cost basis would be reduced to a bulk flow charge. Said charge would be billed according to meter readings for the wastewater quantity received at the Sequim city limit. The PUD would distribute the resulting cost to Carlsborg customers according to whatever rate structure was deemed appropriate.

Sequim also will charge for the cost of pumping ‘Class A’ water back to Carlsborg for reuse, and perhaps some O&M for any reuse facilities operated by Sequim just for Carlsborg.

The PUD would provide O&M for the sewage collection system, the conveyance pump station and force main, and the reuse system. In addition, the PUD would provide administration, engineering, legal, financial, and billing services for the sewer system. The total for all of these charges is not known at this time but is likely to approximate $ 45 to $ 60 monthly per single family home shown in the Feasibility Study.

No financing plan has been developed for the System Plan. Consequently it is not practical to estimate how costs would be distributed to benefited property owners as being any different than the assessment methodology shown in the Sewer Feasibility Study.

Future expansion of the Sequim regional sewer system and related questions could be managed through an agency similar to the Joint Solid Waste Advisory Board, as suggested by Jim Bay. This appears to be a workable approach.

Table 26
Comparison of Carlsborg Decentralized Facility with Wastewater Treatment by Sequim

Component	Feasibility Study		System Plan		Adjusted System Plan		
			2004	**Escalated @ 1.32**			
Collection	Separately Considered		Separately Considered		Separately Considered		
Conveyance	Not required		PS - 350 GPM		PS - 350 GPM x 10 hp	$300,000	$300,000
			8,000 lf x 6 in		Attenuation - provided later	$1	
			new bridge		FM 10,900 lf x 8-in	$90	$980,000
			6,000 lf x 12 in		Bridge - use existing		
			$2,300,000		Gravity - 6,000 ft x 12-in	$150	$900,000
					Estimated Subtotal		$2,180,000
				$3,036,000	Est Project Cost (x factor)	1.5	$3,270,000
Treatment		$3,020,000	$2,700,000		Escalated Facilities		$3,564,000
					Equalization	incl	
					Effluent Holding	incl	
					Outfall	incl	-
	Est Project Cost	$3,926,000		$3,564,000	Est Project Cost		$3,564,000
Reuse	Pump Station	$240,000	Not Included		PS - 160 GPM x 10 hp	$150,000	$150,000
					Pipeline - 18,100 lf x 6-in	$50	$905,000
					Estimated Subtotal		$1,055,000
	Est Project Cost	$312,000			Est Project Cost (x factor)	1.5	$1,582,500
Allied Costs	Prorated Share	$2,215,000	Not Included		Assumed Carlsborg Share		$100,000
Estimated Total		**$6,453,000**		**$6,600,000**			**$8,516,500**
Service Charges	Monthly Charge	$45 to $60	Not Included		Monthly Sequim Charge	$43.14	
					Monthly PUD Charge	15.00	
					Reuse Charge (estimate)	2.00	
					Monthly Total	$60.14	

The charge by Sequim of $ 0.10 per gallon to handle sludge for processing into biosolids is in line with the estimate included in the Sewer Feasibility Study.

7.7.6 Conclusions

Inclusion of Carlsborg into an existing sewer system operated by the City of Sequim has some obvious appeal and would relieve the PUD and the Carlsborg community of some operating concerns. However, these factors have costs.

The analysis conducted herein indicates that conveying sewage to Sequim for treatment and return for reuse is not likely to be cost effective in terms of capital facilities, nor is it likely to be less costly to operate and maintain as would be reflected in the monthly sewer service charges.

It may be that the Carlsborg share of wastewater facilities in the City of Sequim would cost a little less than building a stand-alone facility for Carlsborg. However, that savings is significantly exceeded by the cost of two miles of conveyance facilities to deliver the wastewater to Sequim, plus three miles of reuse pipeline to return the reclaimed water for benefit to the aquifer beneath Carlsborg.

It may be possible to devise some form of trade regarding use of reclaimed water in Sequim for increased withdrawal rights to the PUD in Carlsborg. If so, the estimated project cost for sewer service by Sequim is little more than a new treatment facility in Carlsborg. However, there is no assurance the Ecology would grant additional water rights. Without the return of reclaimed water to Carlsborg, the water can not be reused for irrigation to reduce the summer potable demand and stretch the availability of existing PUD water rights to support future development within the Carlsborg UGA.

8 Implementation

8.1 Next Steps

Once the Sewer Feasibility Study is completed the PUD, Clallam County, and the Carlsborg community will decide if, in fact, a sewer system for Carlsborg is feasible. If so, there are a number of additional important activities that are required before a sewer system with wastewater treatment and water reuse would be designed and built. A tentative list of these activities is included in the Section 6.2. Not all of these may be required, and not all can be defined at this time. However, some of the more immediate activities that will need to be completed are described below:

1. Comprehensive Plan for the Carlsborg UGA needs to be revised and updated to define the land uses allowed and expected with a sewer system in place, and the projected population.

2. General Sewer Plan is required by RCW 173-240-050 with projections of future populations and wastewater flows, plus an evaluation of sewer collection, treatment, and disposal alternatives. This could be an update of the 1994 and 1998 documents incorporating material from this Feasibility Study. The resulting Plan must be reviewed with affected agencies including Clallam County, the City of Sequim, and the Jamestown S'Kallam Tribe; adopted by the PUD Commissioners; and approved by the Departments of Ecology and Health.

3. Conceptual Special Benefit Study would evaluate a few properties in several land use classifications to estimate the maximum amount that can be assessed for sewer service.

4. Hydrogeological Study with an environmental review would develop the technical justification for additional PUD water rights and the appropriate potable water quantity.

5. Amended Water Right Application would update and revise the existing PUD application based on the Hydrogeological Study and the General Sewer Plan to support the development anticipated in the Carlsborg GMA.

6. Funding Program would be developed to describe funding sources for the sewer program, how such costs as may exceed the special benefit that can be assessed to the parcels benefiting from sewer service will be paid, and applications to various agencies for grants and loans.

7. Zoning changes should be considered by Clallam County to allow development densities that can only occur with sewers and provide the economics so property owners can afford the sewer system.

8. Local Utility District (LUD) would be formed with a defined boundary and a preliminary assessment of sewer costs to specific benefiting parcels within the UGA.

9. Facilities Plan would evaluate wastewater treatment alternatives, reclaimed water reuse options, and identify the preferred solution with estimated project costs plus operations, maintenance, and administration. It is typically required when federal funds are involved. A

sewer facilities plan could be prepared jointly with the general sewer plan, or it could follow latter once it becomes clear which properties will be served by the initial sewer system.

The activities described above do not include all of the actions needed to implement a sewer system, as was noted in Section 6.2. However, these seven activities do provide an indication of the immediate next steps. Completion of these steps does not guarantee that the sewer system will be built. An LUD can be formed and various plans prepared, but the decision to actually construct the facilities or not would still be in the future.

8.2 Tentative Schedule

As indicated by the number of activities listed in Section 6.2, many work elements must be completed before a sewer system can begin service. Some activities can proceed simultaneously. Other must follow in a prescribed sequence. Many of these activities involve a number of participants with lengthy process for review and approval. Some aspects proposed for the Carlsborg sewer system involve innovative ideas or applications new to the community, which may require some time to gain acceptance. Some decisions may be challenged, appealed, or even litigated. And some activities that may be required for the project may not even be recognized at this time.

Consequently, it is not possible to provide more than a tentative or conceptual schedule at this time. Given the above limitations, Table 27 represents a summary schedule based on the best estimate of the time requirements know to date.

Table 27
Tentative Project Schedule

Activity	Duration in Months	Start	Finish
1-Comprehensive Land Use Plan	5	Aug 07	Dec 07
2-General Facilities Plan & Approval	6	Dec 07	Jun 08
3-Conceptual Benefit Study	4	Jan 07	Apr 07
4-Funding Program & Applications	4	Mar 07	Jun 08
5-LUD Formation & Prelim Assessment	4	Jul 08	Oct 08
6-Sewer System Design & Approval	6	Nov 08	Apr 09
7-SEPA Determination (EIS ?)	2	Jan 08	Mar 08
8-Environmental Mitigation Plan	3	Apr 08	Jun 09
90-Permit Acquisition	5	Apr 08	Aug 09
10-Property Acquisition	3	Jul 08	Oct 09
11-Special Benefit Study	6	Nov 08	Apr 09
12-Interim Financing	2	Apr 09	May 09
13-Bond Counsel & Bond Sale	5	May 09	Sep 09
14-Construction Bid & Award	4	May 09	Aug 09
15-Final Assessment Roll	4	Sep 09	Dec 09
16-Sewer System Construction	15	Oct 09	Dec 10
17-System Acceptance & Startup	2	Jan 11	Feb 11
18-Connection of Initial Services	3	Feb 11	Apr 11

The schedule shown in Table 26 is labeled ‘tentative’ because it has many uncertainties. The durations shown are believed to be realistic estimates, if everything proceeds as rapidly as practical.

Given the uncertainties incorporated into the activities listed, the work may not proceed as rapidly as shown. About 12 months of time contingency should be allowed, which indicates the sewer system could begin operations in early 2012.

9 Feasibility Summary

9.1 Technical Considerations

The feasibility of implementing any sewer system involves the same three elements. Other alternatives for each element would be considered in preparation of a facilities plan; however the baseline system chosen for the feasibility study are summarized below:

- Wastewater collection system – gravity sewers, supplemented by STEP units, with at least one local pump station.

- Wastewater treatment – influent pump station to membrane bioreactor facility designed for expansion in phases producing 'Class A' water.

- Effluent disposal or reuse – 'purple pipe' in Carlsborg Road conveying reuse water for lawn irrigation and other purposes, with disposal site for off-season and surplus water beside Matriotti Creek that can be expanded as flows increase, which would have environmental benefit during high flow periods if off-channel storage occurs in the future.

This Feasibility Study is only intended to provide a baseline of sewerage facilities with estimated costs that could be suitable for Carlsborg. The only wastewater management alternative considered was conveying Carlsborg wastewater to Sequim for treatment, which does not appear less costly. Returning reclaimed water from Sequim to Carlsborg for reuse is clearly more expensive. Further evaluation of alternatives will be required. Selection of the actual cost-effective sewerage system to be implemented would be done through a facilities plan to be prepared in a subsequent phase.

Previous sections of this Study have shown that no serious technical problems are apparent in developing a wastewater for the Carlsborg UGA. That said, there are several interesting engineering, design, and construction challenges to be resolved:

- A local sewage lift station will be needed at least on Gupster Road. Field survey conducted for the collection system design may indicate a second or even third pump station could be cost-effective, or part of the service area could be better served by a vacuum sewer system.

- Some segments of the gravity sewer interceptor flowing north in Carlsborg Road may reach trench depths of about 19 feet. This depth is well within the range of normal construction methods, but the excavation is expensive. The depth is not required by the topography along Carlsborg Road, but by gravity sewer gradients required to serve the ground elevations to the east and west for parcels within the UGA. It may be that evaluations performed during the facilities planning process will find a more cost-effective solution, either with a pump station or two, or a different sewer route.

- The crossing of US 101 will require jacking or a horizontal directional drill and may encounter some sizable obstructions. Such difficulties are not uncommon around Puget Sound and have been overcome for other similar projects.

- Wastewater treatment to 'Class A' standards appears to be almost a requirement to implement the project. This quality can be accomplished with several readily available treatment processes. The current state-of-the-art treatment process is the membrane bioreactor. This process can be easily applied to Carlsborg.

- Standards for producing 'Class A' water require the treatment process include redundant equipment and provisions for emergency storage in the event the treatment process fails. These are not onerous technical requirements, though they do add to the cost and complexity of the facilities.

- Effluent disposal through a point discharge to a surface water body is not likely to be acceptable. Regulator agencies will encourage wastewater reuse. Several reuse options appear viable in the Carlsborg vicinity including irrigation within or outside of the UGA, augmentation of local water bodies like the Dungeness River or Matriotti Creek, and subsurface percolation through the soil to recharge the ground waters.

- Reclaimed water reuse is expected to vary seasonally with the demand greatest during the summer. However, wastewater volume is expected to be greatest during the winter. In any event reclaimed water storage will be limited. If the reclaimed water is not used within a relatively short time period, a disposal facility will be required that is functional even during wet weather. A percolation system of some sort may be the best solution.

- Solids or sludge will be produced and require disposal. However, the solids content leaving the treatment process is very low and quite liquid. Initial quantities will be small so the initial investment in sludge processing equipment need not be large; however, facilities must be included in the design to store and thicken the sludge for hauling to a site that can stabilize the decay of the organic matter. Over time, additional equipment may be justified to dewater the sludge and perhaps to process it into a reusable biosolid.

Some of the wastewater technical and management issues can be resolved in association with other local sewerage agencies. These arrangements can be expected to evolve over time as the wastewater quantities increase and the customer base expands.

9.2 Regulatory Considerations

The current regulatory climate is different than it was in 1994, or in 1998 when a sewer system was last considered for the Carlsborg community. Determining the feasibility of implementing a sewerage system for Carlsborg is now more complex. Some of the more significant regulatory issues that should be considered in deciding on feasibility, and will need to be addressed if the decision is to proceed, are outlined below:

- Facilities planning will have to develop alternatives for the principal wastewater components (collection, treatment, reuse, disposal, and sludge management), evaluate them, select the preferred combination based on cost-effective analysis, and prepare a preliminary design.

- Capacity sizing of the facilities will be determined by the highest and best use allowed under zoning and land use regulation adopted by Clallam County in support of appropriate urban densities in compliance with growth management regulations.

- Facilities design must comply with the Department of Ecology requirements as defined in the current edition of 'Criteria for Sewage Works Design'.

- Collection facilities and some structures will be governed by Clallam County through the building code, utility franchise, rights-of-way permits, grading permits, sensitive areas requirements, and related regulations.

- Reuse of water reclaimed from wastewater will be regulated under 'Water Reclamation and Reuse Standards' issued jointly by the Departments of Health and Ecology.

- Impacts to the drinking water aquifers, or the potential for impacts, are regulated under the federal 'Safe Drinking Water Act'.

- Additional water rights for Carlsborg are highly desirable, maybe even essential for the community to achieve urban development densities. Since new water rights are not being issued for the Dungeness River and the based is currently being treated as 'closed'; the process to obtain additional water rights is considerably more involved than simply making an application. It may be possible to demonstrate a net environmental benefit by withdrawal of water from a deep aquifer, reclaim the water, and use it to augment stream flow to improve the habitat for an endangered species. A hydrogeologic evaluation will be needed to establish the relationship between Dungeness River outflow, lower aquifer withdrawals, aquifer water quality improvements, and habitat benefits – all against the fact that the water is supplying new commercial and residential development.

Some of these requirements are still evolving. Others may appear before any facilities will be completed.

9.3 Environmental Feasibility

Several environmental issues exist in the Carlsborg area and provision of sewers should result in a net benefit to the environment:

- Nitrates are an increasing concern to residents and to health officials. The current Clallam County requirements for on-site sewage treatment to reduce nitrates in septic effluent will help alleviate these concerns:
    - Nitrates in drinking water
    - Nutrients and bacteria in Dungeness Bay
    - Low flow in the Dungeness River and tributary creeks

- Water quality in the surface waters

However, even if all on-site systems in Carlsborg were upgraded to the modern standard, and if all system were maintained and operated properly, nearly half of the nitrates would still be entering the aquifer to pollute the drinking water. Only a sewer system will collect the wastewater, remove the vast majority of the nitrates, and use the reclaimed water in an environmentally beneficial manner.

- WRIA 18 and the Dungeness River are an important water body for many environmental reasons; however, the river is also the principal source to replenish the drinking water aquifer and for irrigation water to local agriculture, landscaping, and native vegetation. Ecology's instream flow rule making process will establish how much water the river needs to support endangered fisheries.

- Endangered species may benefit from integrated water management through combining surface water, groundwater, stormwater, irrigation, drinking water, instream flow rules, and habitat mitigation programs into a holistic approach.

These and other more specific environmental concerns will be addressed through preparation of a SEPA Checklist and a Determination of Significance, which may require an Environmental Impact Statement.

9.4 Financial Feasibility

Implementing a new sewer system is expensive. Realistic and comprehensive cost estimates for this project have been developed in earlier section of this report. Funding and grants from government agencies of all levels will be necessary to achieve financial feasibility. The funding amount, and how much will be provided by which agencies, remains to be determined.

Section 7.7 analyzed the alternative of conveying wastewater to Sequim for treatment, and found estimated costs to be similar or slightly more than a separate decentralized treatment facility in Carlsborg. Returning reclaimed water from Sequim to Carlsborg for reuse is clearly more expensive than a decentralized facility, which is why decentralized facilities are becoming more popular.

A special benefit study will be one of the next key steps for the project. Such a study will define the maximum amount that can be assessed to all of the benefiting properties. The difference between that maximum amount and the estimated total project cost is the minimum agency funding required.

A financial program will then be needed to identify specific agency funding sources, make the applications, and secure the needed money. The amounts anticipated to be required are significant; yet are believed achievable for several reasons:

- Economic development of the Carlsborg UGA is a priority for Clallam County.
- A number of property parcels offer significant building opportunities to the owners which may qualify for investment by banks or developers.

- Many of the existing property owners are elderly with low incomes, which means the cost of sewers for many may qualify as financial hardship and create eligibility for grant and other financial assistance.
- Public health is an increasing concern due to the rising levels of nitrates in the aquifer used by many for drinking water, which may qualify for financial assistance.
- Augmenting stream flows should benefit salmon recovery efforts and may warrant funding assistance for an endangered species.
- Reuse of reclaimed water may allow better use of existing potable water resources and qualify for funding to implement such a program.

The above reasons suggest that adequate financing may be available to fund at least an initial sewer system for Carlsborg.

9.5 Public Comment

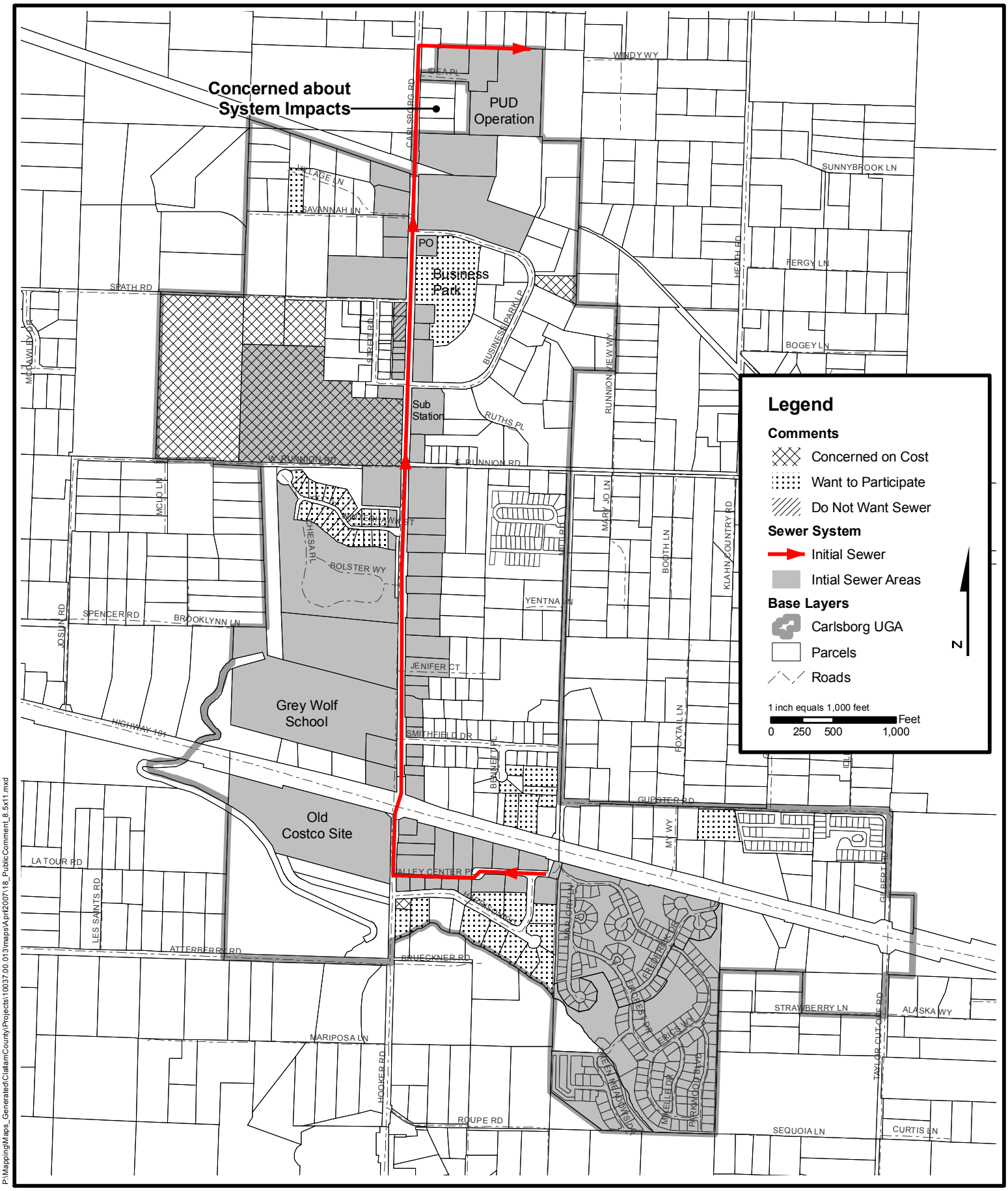
Support of the residents and property owners within the Carlsborg UGA is the critical component for implementation of a sewer system. The problems with on-site sewage systems in the Carlsborg area have been known for years. Several previous studies have attempted to form a viable plan to provide sewers to the community. Public meetings with the community during this Study have found some support for actually implementing an initial sewer system now.

The project team developed a public involvement program to provide information of the conceptual sewer system and to ask for feedback from the community. Two public meetings were held. The questions and comments received from these meetings are described in Appendix B, and summarized here. Public comment has been an important consideration in evaluating the feasibility of a Carlsborg sewer system.

Figure 18 summarizes the public comment received to date regarding the conceptual Initial Sewer Service Area. In response to comments received following the second public meeting, revisions to the Initial Sewer Service Area were considered. The scattering of parcels identified with ownership comments indicates the challenge of crafting an initial service area that satisfies most of the community at an affordable cost. Land owners expressed mixed opinions regarding their intent to connect to the initial sewer system. The initial service area concept does include those parcels that could be served by the sewers initially installed so cost can be distributed as widely as possible so the cost per parcels is as low as possible.

A revised initial service area adding the Alta Vista area on Winterhawk Street and the parcels on Harrison Road is shown in Figure 19. These additions would increase the estimated project costs shown in Tables 18 and 19 by about $ 500,000 for an estimated $ 13,000,000 total project cost. The units cost assessed shown in Tables 22 and 23 may be lower though since more parcels may benefit.

Section 7.5 described a conceptual method of distributing costs. The actual method will be different. The revised initial service area would not require connection by those property owners that do not want sewer service. However, the assessment method adopted may find that the presence of sewers benefits various parcels in different degrees. Accordingly some parcels may



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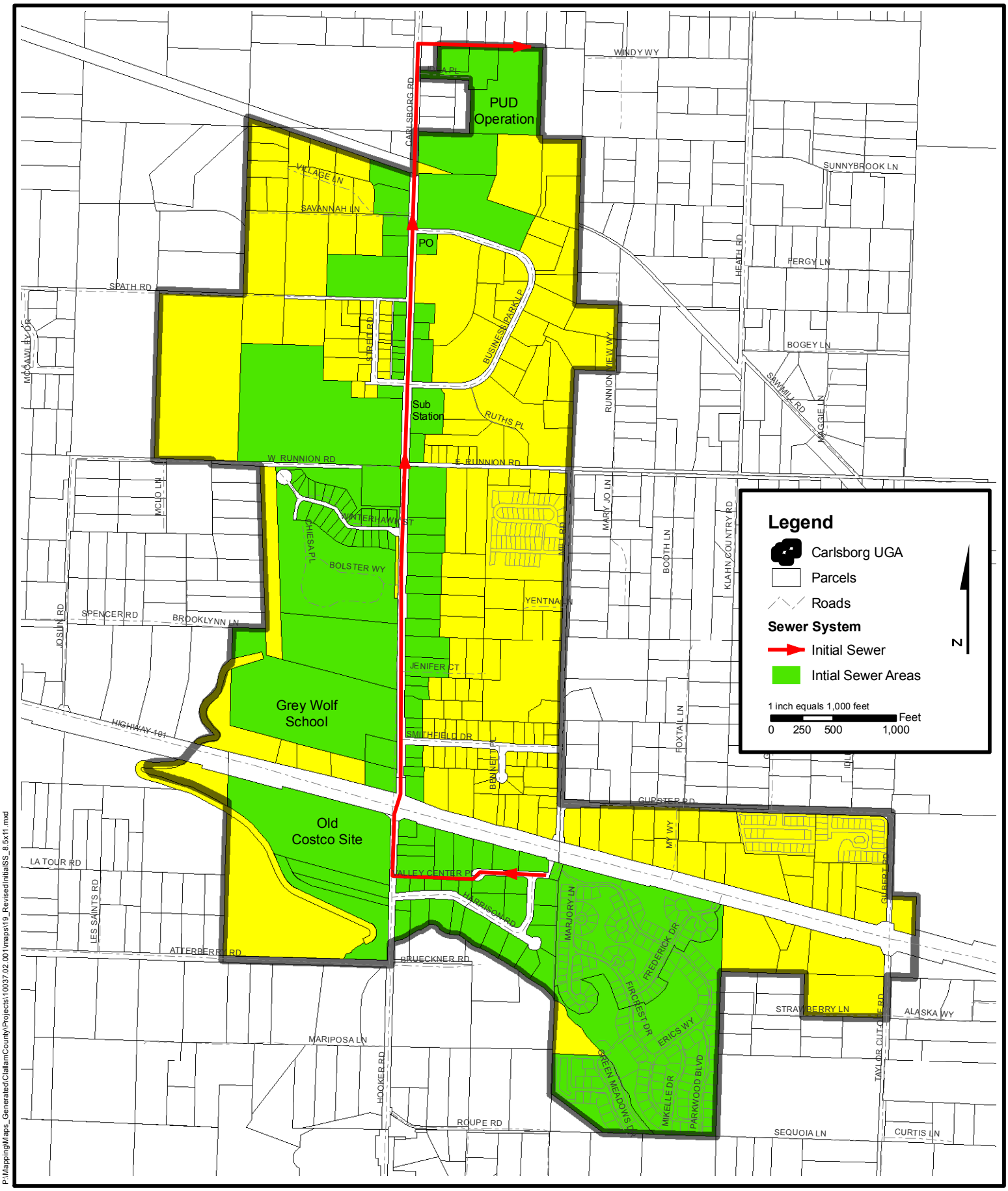
Public Comment On Initial System

Sewer Feasibility Study
April 2007

Figure **18**



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PUD #1 of Clallam County

Revised Initial Sewer System

Sewer Feasibility Study
July 2007

Figure

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be assessed some costs but not others, whether connected to the sewer or not. These are decisions to be made later.

This Sewer Feasibility Study is intended to provide the documentation necessary for the Carlsborg community, the PUD, and Clallam County to reach a decision as whether further steps towards building a sewer system in Carlsborg should be taken. As described in Section 7.2, a number of steps must be completed before a final commitment to build sewers is actually made.

A third public meeting will be held to present the results of this report to the community. If it is deemed feasible to proceed further with planning to initiate sewer service for some part of the Carlsborg UGA, the actual initial sewer service area will be determined through a public process that may occur concurrently with preparation of the revised comprehensive plan for Carlsborg by Clallam County to establish land use densities compatible with sewer service.

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ABREVIATIONS

AWWF	Average Wet Weather Flow
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
CWA	Clean Water Act
DOH	Washington State Department of Health
EOE	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
FEMA	Federal Emergency Management Act
FPS	Feet per second
FWPCA	Federal Water Pollution Control Act (“The Clean Water Act”)
GMA	Growth Management Act
GPCD	Gallons per capita per day
GPAD	Gallons per acre per day
GPD	Gallons per day
HPA	Hydraulic Project Approval
I & I	Infiltration and Inflow
JARPA	Joint Aquatic Resources Permit Application
LUD	Local Utility District
MGD	Million Gallons per Day
mg/L	Milligrams Per Liter
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
OCD	Washington State Office of Community Development
OFM	Washington State Office of Financial Management
PVC	Polyvinyl Chloride
RCW	Revised Code of Washington
SBR	Sequencing Batch Reactor
SEPA	State Environmental Policy Act
SRF	State Revolving Fund
UGA	Urban Growth Area

USFWS United States Fish and Wildlife Service
WAC Washington Administrative Code

GLOSSARY

100-year flood: The magnitude of a flood likely to occur, on average, once every 100 years.
Anoxic Tank: A tank for holding wastewater without adding oxygen
Average Wet Weather Flow: Wastewater flow during period when groundwater table is high and precipitation is at its peak, generally from October to May in the Carlsborg area.
BOD: Biochemical Oxygen Demand measures the oxygen consumed by a sample during a 5-day test period to determine the quantity of organic matter present
Class 1 Stream: A perennial or intermittent stream that is used by threatened or endangered fish or larger numbers of other fish, or that is used as a direct source of water for domestic use.
'Class A' Reclaimed Water: An oxidized, coagulated, filtered, disinfected wastewater with the median total cloiform count not exceeding 2.2 per 100 milliliters.
Denitrification: The process of reducing nitrate and nitrite, highly oxidized forms of nitrogen available for consumption by many groups of organisms, into gaseous nitrogen by depriving the wastewater stream of oxygen.
Infiltration: Groundwater entering the sewage collection system through defective joints, pipes, and improperly sealed manholes.
Inflow: Sewage flows resulting from stormwater runoff entering the sewage collection system, typically through manhole covers, roof leaders, and area drains connected directly to sewer, cross connections from storm drains and catch basins, and direct flows into broken sewers.
Instream Flow Rule-Making Process: A process guided by the Washington State Department of Ecology working with local agencies for surface water management by establishing minimum instream flows to protect aquatic habitat and resources in relation to offstream water rights.
Maximum Monthly Flow: Average daily flow during the highest flow month of the year.
National Flood Insurance Program: Federally funded program providing flood insurance to property owners in flood plains provided the local government meets certain criteria for management of flood damage risk.
Nitrates: A salt of nitric acid with an ion composed of one nitrogen and three oxygen atoms. In organic chemistry the esters of nitric acid and various alcohols are called nitrates.
Nitrification: The biological oxidation of ammonia with oxygen into nitrite followed by the oxidation of these nitrites into nitrates.
Orange Book: *Criteria for Sewage Works Design*, published by the Washington State Department of Ecology
Peak Hourly Flow: Wastewater flow during the highest flow hour.
Pre-aeration Tank: A tank for mixing air into wastewater influent to raise the dissolved oxygen content before the wastewater enters the treatment process tank.
Sensitive Area: Area in which development potential is limited by environmental factors such as steep slopes, wetlands, and valuable natural habitat.
Sewer Lateral: A sewer with no other common or public sewers discharging into it.
Sewer Submain: A sewer that receives flow from one or more lateral sewers.
Sewer Main or Trunk: A sewer that receives flow from one or more submains.

Sewer Interceptor: A sewer that receives flow from a number of main or trunk sewers, force mains, etc.
STEP System: Septic Tank Effluent Pump is a decentralized sewer system retaining septic tanks at the individual properties and collecting only the septic liquid with few solids.
Urban Growth Area: Area in which urban development must be contained, as stipulated by the Growth Management Act, and urban service must be provided, including public sewers.

APPENDICIES

Appendix A Report of Examination for Existing Clallam PUD Well

Appendix B Public Involvement

Companion Document –
'Carlsborg Treated Wastewater Disposal and Reuse Options'
Technical Memorandum, Aspect Consulting, April 6, 2007

APPENDIX A

Report of Evaluation for Existing PUD Carlsborg Well

9 2 0 0 3 0 1 0 9

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

REPORT OF EXAMINATION

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ Surface Water (Issued in accordance with the provisions of Chapter 117, Laws of Washington for 1917, and amendments thereto, and the rules and regulations of the Department of Ecology.)

☒ Ground Water (Issued in accordance with the provisions of Chapter 263, Laws of Washington for 1945, and amendments thereto, and the rules and regulations of the Department of Ecology.)

PRIORITY DATE	APPLICATION NUMBER	PERMIT NUMBER	CERTIFICATE NUMBER
January 9, 1990	G2-27681		

NAME
Public Utility District No. 1 of Clallam County

ADDRESS (STREET)	(CITY)	(STATE)	(ZIP CODE)
2419 Highway 101 East	Port Angeles	Washington	98362

PUBLIC WATERS TO BE APPROPRIATED

SOURCE
Carlsborg Well

TRIBUTARY OF (IF SURFACE WATERS)

MAXIMUM CUBIC FEET PER SECOND	MAXIMUM GALLONS PER MINUTE	MAXIMUM ACRE-FEET PER YEAR
	320	393

QUANTITY, TYPE OF USE, PERIOD OF USE		
393 acre-feet per year	Municipal Supply (1500 connections)	Year-round

LOCATION OF DIVERSION/WITHDRAWAL

APPROXIMATE LOCATION OF DIVERSION–WITHDRAWAL
800 feet north and 400 feet west of the south east corner of Section 15.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	W.R.I.A.	COUNTY
SE¼SE¼	15	30N	4W	18	Clallam

RECORDED PLATTED PROPERTY

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

Area served by Clallam County Public Utility District No. 1 within Sections 7-11, 14-18, 19-23, T. 30 N., R. 4 W.W.M., all west of the Dungeness River.

DESCRIPTION OF PROPOSED WORKS

Carlsborg well is 8" x 159' with screens to 176'. Well is equipped with a 10 h.p. pump. Two 30 h.p. booster pumps discharge to a 300,000 gallon reservoir and are distributed to service area through 10" and 12" diameter pipes.

DEVELOPMENT SCHEDULE

BEGIN PROJECT BY THIS DATE:	COMPLETE PROJECT BY THIS DATE:	WATER PUT TO FULL USE BY THIS DATE:
Started	August 1, 1994	August 1, 1995

REPORT

BACKGROUND:

The priority date of this application is January 9, 1990. On that date, Clallam County Public Utility District No. 1 (the PUD) filed for a permit under the provisions of Chapter 90.03 and 90.44, Revised Code of Washington (RCW) to appropriate public ground water from a well in the amount of 400 gallons per minute (gpm) for municipal supply.

A legal notice of the applicant's proposed appropriation was prepared by staff and mailed to the applicant with publication instructions. Public notice was duly published and appeared in a local newspaper. No objections were received as a result of the public notice.

On May 22, 1990, a temporary permit was issued to allow the PUD to drill the well and conduct an aquifer test. Test results were reviewed by staff hydrogeologist, Kirk Sinclair, who determined that use of this well should not adversely affect other water right holders, or instream flows on the Dungeness River or its tributaries.

On June 28, 1990, a temporary permit was issued to allow the PUD to use 200 gpm and 229 acre-feet for municipal supply. This temporary permit expired on June 28, 1991.

INVESTIGATIONS:

I conducted a field examination of this project on March 28, 1991. Michael Kitz, Water Systems Supervisor for the PUD, showed me the well site and pump house. Investigations included a thorough review of state water right records, well logs, and a report entitled Carlsborg Water Supply Well Construction and Testing Report prepared by Northwestern Territories, Inc. June 1990.

The project site is located at Carlsborg, Washington approximately one-quarter mile north of Highway 101 and one mile west of Sequim, Washington. The well is located at the former site of an old sawmill and log sorting yard which will be developed into an industrial park about 57 acres in size. Because the well is located within this industrial area it will be somewhat isolated from the nearest domestic wells. The PUD proposed service area to the west of Sequim is semi-rural in nature and growing.

The PUD intends to serve a large area of approximately 15 square miles. This PUD area is presently within the service area of four irrigation districts and companies that serve irrigation water from ditches that divert water from the Dungeness River. Also within the proposed service area are ten isolated domestic water systems served by wells which may eventually be incorporated into the PUD system. The rest of the area is served by single domestic wells.

The PUD well is completed to a depth of 176 feet and taps a gravel and sand aquifer (the upper confined aquifer as described below) between 155 and 176 feet below the surface. The surface elevation is 185 feet above sea level. The well is equipped with a 10 horse power pump capable of 320 gpm.

Ecology has on file 162 well logs for wells shown to be within a one mile radius of the PUD well. The well logs and hydrogeological reports for this area indicate there are three separate aquifers arranged as follows:

1. A shallow water-table aquifer with the bottom at approximately 50 feet above mean sea level. The wells are completed in glaciomarine and alluvial sands and gravel.

2. An upper confined aquifer the top of which is approximately 25 feet to 0 feet above mean sea level. This aquifer is isolated from the water-table aquifer by a 25 to 50 foot thick aquitard composed of clay, silt, and till. The wells in this aquifer are also completed in glaciomarine sands and gravel.

3. A lower confined aquifer starting approximately 50 to 100 feet below mean sea level.

Report Continued

On June 15, 1990, a 48-hour aquifer test was conducted at a constant rate of 320 gpm. Water levels were monitored in several nearby wells during the test. The monitoring wells were completed in both the water-table aquifer and the upper confined aquifer. Drawdown of less than one foot was observed in a well completed in the water-table aquifer approximately 25 feet from the production well. However, it was determined that this drawdown was not significant. The aquifer test for this well indicates that the upper confined aquifer is isolated from the water-table aquifer to the extent that no depletion of Matriotti Creek (one-half mile away) or the Dungeness River (one-mile away) will occur.

Within a one mile radius of the PUD well there are 23 recorded wells that appear to be completed in the upper confined, aquifer as is the PUD well. Most of the other wells appear to be completed in the shallow water table aquifer, and eight are completed in the lower confined aquifer.

There are 21 ground water rights on file with Ecology for wells located within the one-mile radius of the PUD well. These rights authorize a withdrawal of 1035 gpm and 480 acre-feet per year. Of those 21 water rights eight are for wells that appear to be located in the upper confined aquifer; a combined withdrawal of 500 gpm and 205 acre-feet per year is authorized from these wells.

Pumping of the PUD well will probably not affect wells in the water table aquifer but may affect the wells completed in the upper confined aquifer. The PUD should be aware that their water right is junior to existing rights and if impacts do occur the PUD will have to reduce pumping and/or mitigate their impacts.

DISCUSSION:

Ecology normally allows municipalities enough water for residents to irrigate lawn and gardens. However Ecology will not allow two water rights to overlap so as to have duplication of water rights. The PUD service area falls within an area already served by the Agnew Irrigation District, The Dungeness Irrigation Company, the Cline Irrigation District, and the Clallam Irrigation Company. Because the irrigation districts cover the PUD service area, the PUD will have to be limited as to how much water can be used for irrigation. Many PUD water customers have access to irrigation ditches, many will not. At this time, it is not possible to identify all of those who will have access.

To encourage conservation and eliminate duplication of water rights the PUD will get enough water so that some customers may irrigate, but not all customers. Rather than allowing an amount including full irrigation which is normally 450 gpd per connection the PUD shall get 225 gpd per connection.

The PUD should develop into their comprehensive water plan ways to discourage customers from using PUD water for irrigation when those customers have irrigation shares. The PUD shall also be required to keep records of water usage.

The population of the PUD service area was 3,521 individuals in the 1990 census. The county predicts this area will have a 3 to 4% growth rate so that by the year 2011 the population will swell to 6,550 to 8,023. With three people per household the total number connections needed will be from 2,183 to 2,674. In addition, the PUD will serve a school with 530 children and school staff. The service area will include property zoned for light industrial and commercial uses. The PUD has not specified how much water these industrial/commercial areas will need, however, they should be covered by the water allotted for the residential customers until such time that the PUD can gage the industrial water uses.

There are several water rights for multiple domestic water systems within the proposed PUD service area. The water rights allow these small water systems 440.2 acre-feet to serve 876 connections. In addition, there are water rights for 24 single domestic wells for a total of 900 connections. The PUD proposes to serve an additional 1500 connections for a total of 2400 connections within this service area.

The water requirement for a municipal domestic system of this nature should not exceed an average daily use of 75 gallons per capita or 225 gallons per residence. This does not include sufficient water to sprinkle lawns and/or gardens for every residence. At 225 gpd per connection for 1500 connections, the PUD will need 378 acre-feet of water per year. A school with 530 student and faculty will need approximately 25 gpd per person which amounts to 15 acre-feet per year. The total amount of water needed by the PUD will be 393 acre-feet per year.

Because there are many wells and small water systems in the area that use an uncontrolled amount of water, it is advantageous to manage the water resource of this area with a large water system over a large area. As the PUD expands and provides water to customers with existing wells, they will have to do one of the following:

Report Continued

1. The old wells not covered by water rights should be abandoned when the customer is hooked up to the PUD system. If the old well has water rights and the well is abandoned Ecology shall be notified to relinquish the old water right.

2. If the well is incorporated into the PUD system a change application will need to be filed to add the existing water system to the PUD service area.

CONCLUSIONS:

In accordance with Chapter 90.03 and 90.44 RCW, I find there is water available for appropriation from the source in question, the appropriation is a beneficial use and will not impair existing rights or be detrimental to public welfare.

RECOMMENDATIONS:

I recommend approval of this application and issuance of a permit to allow appropriation of 320 gpm from a well for municipal supply. The period of use is year-round. The total annual withdrawal shall not exceed 393 acre-feet.

Approval is subject to the following conditions and provisos:

Water levels and water use meter readings for the Carlsborg well shall be monitored and recorded at least monthly and reported to Ecology annually. The water level measurements shall be made in a consistent manner in accordance with accepted industry practice.

The old wells not covered by water rights shall be abandoned when a customer is hooked up to the PUD system. If the old well has water rights and the well is abandoned, Ecology shall be notified to relinquish the old water right.

If an existing well is incorporated into the PUD system a change application shall be filed by the PUD to add the existing water system to the PUD service area.

The use of the waters to be appropriated under this application will be for a public water supply. The State Board of Health rules require every owner of a public water supply to obtain written approval from the Office of Water Supply, Department of Health, Mail Stop LD-11, Building 3, Olympia, Washington 98504, prior to any new construction or alterations of a public water supply.

The Water Resources Act of 1971 specifies certain criteria regarding utilization and management of the waters of the state in the best public interest. Favorable consideration of this application has been based on sufficient waters available, at least during portions of the year. However, it is pointed out to the applicant that this use of water may be subject to regulation at certain times, based on the necessity to maintain water quantities sufficient for preservation of the natural environment.

CONSERVATION AND WATER USE EFFICIENCY

Under RCW 90.03.005 and 90.54.020(6), conservation and improved water use efficiency must be emphasized in the management of the state's water resources, and must be considered as a potential new source of water. Accordingly, as part of the terms of this permit, the applicant shall prepare and implement a water conservation plan approved by Ecology. The standards for such a plan may be obtained from either the Department of Health or Ecology.

This permit is subject to the implementation of the minimum requirements established in the Interim Guidelines for Public Water Systems Regarding Water Use Reporting, Demand Forecasting Methodology and Conservation Programs, July 1990, which is attached.

REPORTED BY: Eric [illegible] DATE: january 8, 1992

The statutory permit fee for this application is $20.00.

Copy

NORTHWESTERN TERRITORIES, INC.

Engineers ■ Land Surveyors ■ Planners
Construction Coordination ■ Materials Testing

NTI
Clark Associates

CARLSBORG WATER SUPPLY WELL CONSTRUCTION AND TESTING REPORT

Prepared For

CLALLAM COUNTY PUD NO. 1
Local Utility District No. 10

Prepared By

NORTHWESTERN TERRITORIES, INC.

June, 1990

717 SOUTH PEABODY, PORT ANGELES, WA 98362 (206) 452-8491 1-800-654-5545

CARLSBORG WATER SUPPLY WELL

CONSTRUCTION AND TESTING REPORT

BACKGROUND

During the period from June 10, 1990 to June 18, 1990, NTI supervised the construction and testing of a new well for the Clallam County Public Utility District No. 1. The new well, located in the southeast quarter of Section 15, Township 30 North, Range 4 West, W. M., is intended to be the cornerstone of Local Utility District #10, a water utility. The new utility district will encompass a new school, as well as residential properties just west of Sequim, Washington.

The Local Utility District well, known as the Carlsborg Water Supply Well, is intended to have an intermittent draft of about 200 gpm. The well lies some 4,200 feet west of the axis of the Dungeness River on an fluvial-alluvial delta known as the Sequim Dungeness Peninsula.

Prior to the construction of the well, the Public Utility District (PUD) notified the Department of Ecology concerning the question of water rights for the well. At that time, it was the intent of the PUD to develop water from permeable gravels thought to occur at a depth of about 60 to 80 feet below the surface at the site. After objections to the development of the water table aquifer were forwarded by the Point No Point Treaty Council and reviewed by the Department of Ecology, the PUD directed that drilling and well completion be carried to a greater depth below a confining strata that was believed to exist in the area.

The well was completed on June 12, 1990 and pumping tests were prescribed and begun almost immediately after completion and development. Generally speaking, the well has met all our expectations as a water source for the project. Drawdown in the pumped well was limited to just over 13 feet during several days of pumping at rates of 320 gallons per minute. We encountered and penetrated a conspicuous impermeable clay-silt member at a depth of 112 to 124 feet that we believe provides substantial isolation to the lower aquifer. Water quality data and monitoring well observations tend to confirm the isolation of the production zone located from about 158 to 177 feet in depth. Water quality is excellent. A more detailed review of the construction and testing regime is presented below and in the various attachments to the report.

WELL CONSTRUCTION

Construction of the Carlsborg Water Supply Well was begun on June 10, 1990. Initially, a surface seal zone 40 feet in depth was prepared and 12-inch casings set in the upper section to allow for the later installation of Baroid bentonite grout. Drilling in the uppermost 40 feet was hampered by the presence of large boulders in a matrix of silt-sand soils. After some difficulties, surface casing was set in preparation for rotary-percussion drilling of an eight-inch production casing. By the night of June 13, 1990, casing had been advanced to a depth of approximately 177 feet through a series of deposits illustrated in the attached geologic log of the well. Drilling was terminated when it had been determined that a sufficiently thick sequence of water-bearing gravels and sand had been penetrated. Completion was also controlled by the occurrence of a clayey hardpan at a depth of 177 feet and our choice to avoid a pocket of fine sands at a depth of 147 to 155 feet. By late evening of the 13th, a preliminary screening diagram had been agreed upon. Later that night, selected formation samples were screened and gradations developed for verification of slot sizes for the stainless steel well screens used. Four well screens of five feet nominal length were selected for the well completion. These screens were installed the following afternoon in accordance with the construction diagram that is attached. Development work the following morning showed rapid development to a clear water condition indicating that screen selections were conservative. Surface seals were also completed the same day as the surface casing was withdrawn. The static water level was measured and found to be 32 feet 3-3/4 inches on June 15, 1990. At the same time, static levels in the nearby Port of Port Angeles well showed an apparent static level of just over 29 feet.

PUMPING TEST RESULTS

After preliminary planning, pumping tests began on June 15, 1990. The test began with two steps of discharge, one at 100 gpm and another at 175 gpm, prior to bringing the test pump to its ultimate capacity of about 320 gallons per minute. (Please refer to the attached graphic and tabular results of the test.) At the same time, five monitoring wells were observed in the immediate vicinity of the pumped well. Water discharging from the well was piped overland to a receiving area about 800 feet downgradient from the well site.

The first step of the pumping test required four hours of pumping at a rate of 100 gpm. The new well easily accommodated this draft and appeared to stabilize with a drawdown of about four feet. After the first step, a brief recovery observation was made showing nearly complete recovery within 30 minutes. The second step of the test was begun immediately by increasing the

draft to a rate of 175 gpm. Three additional feet of drawdowm were observed and the well nearly stabilized after four hours of testing.

After a brief recovery test, the test pump discharge was increased to 320 gpm and held constant for a period of 48 hours. After several hours, the well approached stable conditions at a total drawdown of about 14.5 feet. Of much concern was the behavior of the several monitoring wells observed during the testing period. Five wells were monitored prior to and during the pumping of the new well. (Please refer to the attached data summary and layout map of the monitoring wells.) One of the monitoring wells lies at a distance of only 25 feet from the pumped well. That well, know as the Port of Port Angeles well, showed what appeared to be a drawdown of less than one foot. The Port of Port Angeles well is completed in the upper aquifer and the lack of drawdown at the very close position suggests the hydraulic separation of the two water-bearing zones encountered during the drilling.

The Schmuck Well is the only other well in the vicinity of the new well that actually penetrates the clay-silt member we encountered at a depth of 112 feet. This well showed no sign of perturbation due to the continuous pumping of the new well. The remaining three monitoring wells that penetrate only the water table aquifer showed no sign of interference during the test. Their positions and drawdowns are shown on the attached layout map.

WATER QUALITY OBSERVATIONS

Water quality from the pumped well was tested using high resolution Hach field test kits. Several tests of the water from the new well showed iron concentration at about .02 mg/l and total hardness at about 138 mg/l. Manganese was about .0175 mg/l during the testing period. All of these results are better than expected. At the same time, we tested the water from the nearby Port of Port Angeles well. There, iron content and manganese where much higher with iron at 0.5 mg/l and manganese at about .0275 mg/l. The total hardness in the nearby existing well was somewhat over 170 mg/l, far greater than water from below the clay-silt formation being developed by the new well.

Generally, the water from the pumped well appears to be of an excellent quality suitable for all domestic and potable uses.

POTENTIAL FOR INTERFERENCE AMONG ADJACENT WELLS

We feel confident that the continued use of the Carlsborg Water Supply Well at rates up to 300 gpm will not produce interference

with adjacent water wells. First, drilling work penetrated a strata of gray silt clay at the depth of 112 feet. This material is impermeable and data from other well logs in the area suggest that the glacial-lacustrine deposit is fairly widespread. (Please refer to the attached logs of Schmuck and Adams.) Second, we noted that there is about a five foot difference between the static levels in the water table aquifer and the lower, seemingly confined, aquifer that the new well penetrates. This isolation suggests interference will be limited since, to our knowledge, no other wells except the Schmuck penetrate the formation in the Carlsborg area. None of the three shallow wells that were monitored in the vicinity of the pumped well showed measurable drawdown.

A clear indication of the separation of the two water-bearing zones encountered stems from water quality differences. During the pumping test, the upper water from the Port of Port Angeles well was tested and contrasted to the quality water from the new deeper well. We found that the water drafted from the 160-foot level had much lower iron and manganese and the total hardness was distinctly lower than water from the shallow-sourced Port of Port Angeles well only a few feet away. Finally, although the Port of Port Angeles shallow well lies only a few feet from the new pumped well, we observed little or no drawdown in the shallower well during the testing period.

POTENTIAL FOR DIVERSION OF SURFACE WATER

The new PUD Carlsborg well lies about 4,500 feet west of the Dungeness River. Some suggestions have been made in recent weeks that pumping of ground water at this site may increase diversion from the Dungeness River.

It is our belief that the discharges from the upper courses of the Dungeness River to the fluvial gravels near the apex of the river is one of several recharge mechanisms of the several aquifers on the Dungeness Peninsula. Other significant recharge mechanisms include direct rainfall, excess irrigation from ditch water, direct feeding from fractured hardrock basalts and recharge arising from subsurface runoff over the shallow siltstones of the upland areas.

Although the Dungeness River may be an important participant in the recharge of the Sequim Dungeness aquifers, the general ground water gradients are probably mostly controlled by the natural permeability of the subsurface materials and the downstream base levels. We believe that the river has historically discharged water to the glacio-fluvial aquifers underlying the region. Uptake of water is probably more pronounced in the upper reaches of the river and the piezometric surface falls in the northerly and lateral directions from this boundary. Thus, it

seems that development of ground water at substantial distances from the Dungeness will have little or no effect on the recharge mechanisms operating along the river boundary. As a result, we do not believe the development of water at this site will reduce the observed flows in the Dungeness River. The fact that the new well draws water from a semi-confined or confined aquifer also suggests that ground water development at this site and surface water discharges are essentially independent.

SUMMARY

The Carlsborg Water Well constructed by the Clallam County PUD should prove to be a reliable source of high-quality water for Local Utility District #10. Pumping tests have shown that little or no interference will result from pumping this well at rates up to 300 gallons per minute.

We recommend that the well be initially drafted at a rate of about 200 gpm and monitored every month to obtain an accurate static-water level trace. Pumps for the well should be selected to obtain longer pumping periods and lower instantaneous drafts. Submersible pumps should be set at a depth of about 125 feet below the top of the casing. A permanent airline and air-bubble water level gage or permanent sounding tube should be installed on the well head to facilitate measurements of the well water levels.

Respectfully submitted,

Steve S. Luxton

Steve S. Luxton, MS, PE
Water Resources Specialist

J. R. Newlin, PE
Principal Engineer

STEVE S. LUXTON
STATE of WASHINGTON
REGISTERED
PROFESSIONAL ENGINEER

fc: Crlsbrg.Wel
Dir: SSL/Rpt

APPENDIX

CONTENTS

LUD #10 Carlsborg Water Well Report
LUD #10 Carlsborg Water Well - Pumping Test Data
LUD #10 Carlsborg Water Well - Well Layout
Water Chemical Analysis

Port Pump House Monitoring Well Drawdown Record
Leo Seamounds Monitoring Well Drawdown Record
Don Morrison Monitoring Well Drawdown Record
Duane Schmuck Monitoring Well Drawdown Record
Wyatt Monitoring Well Drawdown Record

Adams Water Well Report
Schmuck Water Well Report

File Original and First Copy with Department of Ecology
Second Copy—Owner's Copy
Third Copy—Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Start Card No. 064547

Water Right Permit No. _____

(1) OWNER: Name PUD #1 CLALLAM COUNTY Address PORT ANGELES WA

(2) LOCATION OF WELL: County CLALLAM NE ¼ SE ¼ Sec 15 T 31 N., R 4 W.M.

(2a) STREET ADDDRESS OF WELL (or nearest address) 200' NOE EAST of SALSBURG STORE / SOUTHERLY WELL

(3) PROPOSED USE: ☐ Domestic ☒ Irrigation ☐ DeWater Industrial ☐ Test Well ☐ Municipal ☒ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) _____
Abandoned ☐ New well ☒ Deepened ☐ Reconditioned ☐
Method: Dug ☐ Cable ☐ Rotary ☒ Bored ☐ Driven ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 177 feet. Depth of completed well 177 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 8 " Diam. from 0 ft. to 159 ft.
Welded ☒ Liner installed ☐ Threaded ☐
" Diam. from ft. to ft.
" Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used _____
SIZE of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

Screens: Yes ☒ No ☐
Manufacturer's Name JOHNSON
Type STAINLESS WIRE WOUND Model No. _____
Diam. 8" TEL Slot size 25 from 159 ft. to 167 ft.
Diam. 8" TEL Slot size 60/60 from 167 ft. to 177 ft.

Gravel packed: Yes ☐ No ☒ Size of gravel _____
Gravel placed from _____ ft. to _____ ft.

Surface seal: Yes ☒ No ☐ To what depth? 40 ft.
Material used in seal BIRCO BENTONITE
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? _____ Depth of strata _____
Method of sealing strata off _____

(7) PUMP: Manufacturer's Name N/A
Type: _____ H.P. _____

(8) WATER LEVELS: Land-surface elevation above mean sea level 185 ft.
Static level 38 ft. below top of well Date 16 JUNE 90
Artesian pressure _____ lbs. per square inch Date _____
Artesian water is controlled by _____ (Cap, valve, etc.))

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☒ No ☐ If yes, by whom? CANAL PUMPS
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" NOT AVAILABLE " "
" " " "
Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date _____

Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Airtest 1-0 gal./min. with stem set at 80 ft. for 2 hrs.
Artesian flow _____ g.p.m. Date _____
Temperature of water _____ Was a chemical analysis made? Yes ☒ No ☐

RECEIVED
JUN 15 1990
PUD No 1

(10) WELL LOG or ABANDONMENT PROCEDURE DESCRIPTION

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information.

MATERIAL	FROM	TO
Surface soil and fill sand	0	4½
Cobbles and gravel in silt matrix	4½	33
boulders	33	36
silt and gravel	36	40
silty sands and gravel - wet	40	54
w/8 gravels and sand	54	56
various gravels all w/8	56	70
hardpan	70	72
gravelly sands w/8	72	78
sand w/8	78	104
gravel and minor sand w/8	104	112
clay compact silt - clay	112	124
	124	
silty gravels no water	~~124~~	127
w/8 sand and gravel some clay	127	140
gravel in clay matrix	140	142
w/8 gravels and sand w clay	142	147
fine to medium sand	147	155
various w/8 gravel and sand	155	176
loose and much H2O		
clayey hardpan	176	177

Work started 16 JUNE, 19 90 Completed 16 JUNE, 19 90

WELL CONSTRUCTOR CERTIFICATION:

I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

NAME LOUIE'S WELL DRILLING (PERSON, FIRM, OR CORPORATION) (TYPE OR PRINT)

Address 1652 [illegible]

(Signed) [illegible] (WELL DRILLER) License No. [illegible]

Contractor's Registration No. [illegible] Date [illegible], 19 90

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20 (10/87) -1329- 3 L10 BID AND L10 A-2

CLALLAM COUNTY PUD #1...CARLSBORG WELL PUMPING TEST					
Date of start of pumping		6/15/90	Date of static observation		6/15/90
Time of start of pumping		9:22	Time of static observation		9:22
Static water level prior to start of pumping			32 ft. 3.75 inch		
NOTES					
1. Calibrate sounding equipment prior to test begin					
2. Be sure to obtain good statics on observation wells prior to start					
3. Note weather conditions and pressure if known				Overcast with slight fog	
4. Do not alter pumping rate during constant discharge phase of test					
5. Please note problems or suspected causes of irregular data					
6. Obtain water level for each time listed under "elasped time".					
7. DO NOT "spike" pump well at start of pumping period					
FIRST STEP OF TEST 100 GPM DISCHARGE RATE					
1. Obtain approximate setting of valves prior to test start allow recovery to static					
2. Note start time and date at right			June 15, 1990	9:22	
ELAPSEDTIME		CLOCK TIME	STATIC LEVEL	WATER LEVEL	DRAWDOWN	REMARKS
hours	minutes	day and time	feet and inch	feet and inch	feet and inch	
0	1	6/15/90 9:22	32ft 3.75inch	32ft 3.75inch	0ft 0inch	
0	2	9:22	32ft 3.75inch	35ft 1.5 inch	2ft 9.75inch	
0	5	9:26	32ft 3.75inch	35ft 2.25inch	2ft 10.5inch	
						Collect and test
0	10	9:32	32ft 3.75inch	35ft 4.0inch	3ft 0.25inch	water for Fe and Mn
						Mn = .02
0	15	9:42	32ft 3.75inch	35ft 6.5inch	3ft 2.75inch	Fe = .02
						Hardness = 8 gr.
0	30	9:51	32ft 3.75inch	35ft 7.25inch	3ft 3.5inch	
0	45	10:10	32ft 3.75inch	35ft 9.0inch	3ft 5.25inch	
1	0	10:22	32ft 3.75inch	35ft 9.75inch	3ft 6.0inch	
1	30	10:52	32ft 3.75inch	35ft 11.0inch	3ft 7.25inch	
2	0	11:30	32ft 3.75inch	36ft 0.5inch	3ft 8.75inch	
2	30	11:58	32ft 3.75inch	36ft 1.063inch	3ft 9.312inch	
3	0	12:21	32ft 3.75inch	36ft 1.375inch	3ft 9.6252inch	
3	30	12:52	32ft 3.75inch	36ft 1.625inch	3ft 9.8748inch	
4	0	1:22	32ft 3.75inch	36ft 2.25inch	3ft 10.5inch	STOP PUMP

FIRST STEP RECOVERY OBSERVATION						
ELAPSEDTIME		CLOCK TIME	STATIC LEVEL	WATERLEVEL	DRAWDOWN	REMARKS
hours	minutes	day and time	feet and inch	feet and inch	feet and inch	
0	1	6/15/90 1:25pm	32ft 3.75inch	33ft 7.25inch	1ft 3.5inch	
0	2	1:27	32ft 3.75inch	33ft 4.0inch	1ft .246inch	
0	5	1:30	32ft 3.75inch	33ft 3.0inch	0ft 11.25inch	
0	10	1:35	32ft 3.75inch	33ft 1.625inch	0ft 9.875inch	
0	15	1:40	32ft 3.75inch	33ft 0.5inch	0ft 8.75inch	
0	30	2:05	32ft 3.75inch	32ft 10.0inch	0ft 6.25inch	

SECOND STEP OF TEST 175 GPM DISCHARGE RATE

1. Preset values to approximately 175 gpm - wait 10 minutes
2. Start observation after turning valve to exactly 175 gpm

ELAPSEDTIME hour	minutes	CLOCK TIME day and time	STATICLEVEL feet and inch	WATERLEVEL feet and inch	DRAWDOWN feet and inch	REMARKS
0	1	6/15/90 2:21pm	32ft 3.75inch	37ft 9.0inch	5ft 5.25inch	
0	2	2:23	32ft 3.75inch	37ft 10.625inch	5ft 6.875inch	Collect sample and test for Fe and Mn
0	5	2:26	32ft 3.75inch	38ft 0.0inch	5ft 8.25inch	Mn = .0175 Fe = .02
0	10	2:31	32ft 3.75inch	38ft 3.0inch	5ft 11.25inch	
0	15	2:40	32ft 3.75inch	38ft 5.25inch	6ft 1.5inch	
0	30	2:51	32ft 3.75inch	38ft 5.75inch	6ft 2.0inch	
0	45	3:05	32ft 3.75inch	38ft 7.25inch	6ft 3.5inch	
1	0	3:20	32ft 3.75inch	38ft 8.625inch	6ft 4.875inch	
1	30	3:50	32ft 3.75inch	38ft 10.563inch	6ft 6.813inch	
2	0	4:20	32ft 3.75inch	39ft 0.5inch	6ft 8.75inch	
2	30	4:50	32ft 3.75inch	39ft 1.063inch	6ft 9.313inch	
3	0	5:20	32ft 3.75inch	39ft 2.25inch	6ft 10.5inch	
3	30	5:50	32ft 3.75inch	39ft 2.5inch	6ft 10.75inch	
4	0	6:20	32ft 3.75inch	39ft 2.875inch	6ft 11.125inch	STOP PUMP

SECOND TEST RECOVERY OBSERVATION									
ELAPSEDTIME		CLOCKTIME	STATICLEVEL		WATERLEVEL		DRAWDOWN		REMARKS
hours	minutes	day and time	feet and inch		feet and inch		feet and inch		
0	1	6/15/90 6:24pm	32ft	3.75inch	34ft	9.625inch	2ft	5.875inch	
0	2	6:26	32ft	3.75inch	34ft	5.875inch	2ft	2.125inch	
0	5	6:29	32ft	3.75inch	34ft	2.5inch	1ft	10.75inch	
0	10	6:34	32ft	3.75inch	34ft	0.0inch	1ft	8.25inch	
0	15	6:39	32ft	3.75inch	33ft	9.5inch	1ft	5.75inch	
0	30	6:54	32ft	3.75inch	33ft	6.063inch	1ft	2.313inch	

THIRD STEP OF TEST 320GPM DISCHARGE RATE OR MAX. DRAWDOWN LIMITATION RATE

1. Preset valves to approximately 320 gpm and wait 10 minutes
2. Start observation after turning valve to exactly 320 gpm

ELPASEDTIME hour	minutes	CLOCK TIME day and time	STATICLEVEL feet and inch	WATERLEVEL feet and inch	DRAWDOWN feet and inch	REMARKS
0	1	6/15/90 7:20pm	32ft 3.75inch	33ft 9.0inch	1ft 5.25inch	
0	2	7:21	32ft 3.75inch	34ft 0.0inch	1ft 8.25inch	Collect Lauk's sample (2 bottles) and refrig.
0	5	7:25	32ft 3.75inch	34ft 8.125inch	2ft 4.375inch	
0	10	7:30	32ft 3.75inch	34ft 8.25inch	2ft 4.5inch	
0	10	7:40	32ft 3.75inch	34ft 10.inch	2ft 6.25inch	
0	30	7:50	32ft 3.75inch	35ft 1.5inch	2ft 9.75inch	
0	45	8:05	32ft 3.75inch	36ft 3.5inch	3ft 11.75inch	
1	0	8:20	32ft 3.75inch	37ft 7.5inch	5ft 3.75inch	
1	30	8:50	32ft 3.75inch	43ft 11inch	11ft 7.25inch	
2	0	9:20	32ft 3.75inch	45ft 0.5inch	12ft 8.75inch	
2	30	9:50	32ft 3.75inch	46ft 3.0inch	13ft 11.25inch	
3	0	10:32	32ft 3.75inch	46ft 5.0inch	14ft 1.25inch	
3	30	10:50	32ft 3.75inch	46ft 6.0inch	14ft 2.25inch	
4	0	11:50	32ft 3.75inch	46ft 6.375inch	14ft 2.625inch	
5	0	6/16/90 12:50am	32ft 3.75inch	46ft 6.875inch	14ft 3.125inch	
6	0	1:50	32ft 3.75inch	46ft 7.25inch	14ft 3.5inch	
7	0	2:50	32ft 3.75inch	46ft 7.375inch	14ft 3.625inch	
8	0	3:50	32ft 3.75inch	46ft 7.5inch	14ft 3.75inch	
10	0	5:50	32ft 3.75inch	46ft 7.5inch	14ft 3.75inch	
12	0	7:50	32ft 3.75inch	46ft 7.5inch	14ft 3.75inch	
14	0	9:50	32ft 3.75inch	46ft 7.5inch	14ft 3.75inch	

16	0	11:50	32ft	3.75inch	46ft	7.5inch	14ft	3.75inch	
18	0	1:50	32ft	3.75inch	46ft	7.5inch	14ft	3.75inch	
20	0	3:50	32ft	3.75inch	46ft	7.5inch	14ft	3.75inch	
22	0	5:50	32ft	3.75inch	46ft	7.5inch	14ft	3.75inch	
24	0	7:50	32ft	3.75inch	46ft	7.5inch	14ft	3.75inch	
26	0	9:50	32ft	3.75inch	46ft	8.0inch	14ft	4.25inch	
28	0	11:50	32ft	3.75inch	46ft	8.5inch	14ft	4.75inch	
30	0	6/17/90 1:50am	32ft	3.75inch	46ft	8.5inch	14ft	4.75inch	
32	0	3:50	32ft	3.75inch	46ft	8.0inch	14ft	4.25inch	
34	0	5:50	32ft	3.75inch	46ft	8.0inch	14ft	4.25inch	
36	0	7:50	32ft	3.75inch	46ft	8.0inch	14ft	4.25inch	
38	0	9:50	32ft	3.75inch	46ft	8.25inch	14ft	4.5inch	
40	0	11:50	32ft	3.75inch	46ft	8.5inch	14ft	4.75inch	Collect Lauk's sample (2 bottles) refrig.
42	0	1:50	32ft	3.75inch	46ft	8.625inch	14ft	4.875inch	Collect bacterial and delivery to County
44	0	3:50	32ft	3.75inch	46ft	8.0inch	14ft	4.25inch	
46	0	5:50	32ft	3.75inch	46ft	8.375inch	14ft	4.625inch	
48	0	7:50	32ft	3.75inch	46ft	8.25inch	14ft	4.5inch	STOP PUMP

THIRD STEP RECOVERY (Up to 12 hours as directed by Engineer)									
ELAPSEDTIME		CLOCKTIME	STATICLEVEL		WATERLEVEL		DRAWDOWN		REMARKS
hour	minutes	day and time	feet and inch		feet and inch		feet and inch		
0	1	6/17/90 7:51pm	32ft	3.75inch	37ft	8.5inch	5ft	4.75inch	
0	2	7:52	32ft	3.75inch	37ft	3.0inch	4ft	11.25inch	
0	5	7:56	32ft	3.75inch	36ft	11.5inch	4ft	7.75inch	
0	10	8:01	32ft	3.75inch	36ft	7.0inch	4ft	3.25inch	
0	15	8:06	32ft	3.75inch	36ft	3.5inch	3ft	11.75inch	
0	30	8:21	32ft	3.75inch	35ft	8.0inch	3ft	4.25inch	
0	45	8:36	32ft	3.75inch	35ft	2.5inch	2ft	10.75inch	
1	0	8:51	32ft	3.75inch	34ft	11.0inch	2ft	7.25inch	
1	30	9:21	32ft	3.75inch	34ft	6.25inch	2ft	2.5inch	
2	0	9:51	32ft	3.75inch	34ft	1.5inch	1ft	9.75inch	
2	30	10:21	32ft	3.75inch	34ft	0.75inch	1ft	9.0inch	
3	0	10:51	32ft	3.75inch	33ft	9.25inch	1ft	5.5inch	
3	30	11:21	32ft	3.75inch	33ft	6.5inch	1ft	2.75inch	
4	0	11:51	32ft	3.75inch	33ft	5inch	1ft	1.25inch	
5	0	12:51am	32ft	3.75inch	33ft	4.75inch	1ft	1.0inch	
6	0	1:51	32ft	3.75inch	33ft	0.5inch	0ft	8.75inch	
7	0	2:51	32ft	3.75inch	32ft	9.0inch	0ft	5.25inch	
8	0	3:51	32ft	3.75inch	32ft	8.25inch	0ft	4.5inch	
10	0	4:51	32ft	3.75inch	32ft	7.75inch	0ft	4.0inch	
12	0	5:51	32ft	3.75inch	32ft	7.0inch	0ft	3.25inch	
		10:30am	32ft	3.75inch	32ft	5.0inch	0ft	1.25inch	

CLALLAM COUNTY P.U.D. #1

L. U. D. #10

WATER WELL PUMPING TEST - WELL LAYOUT

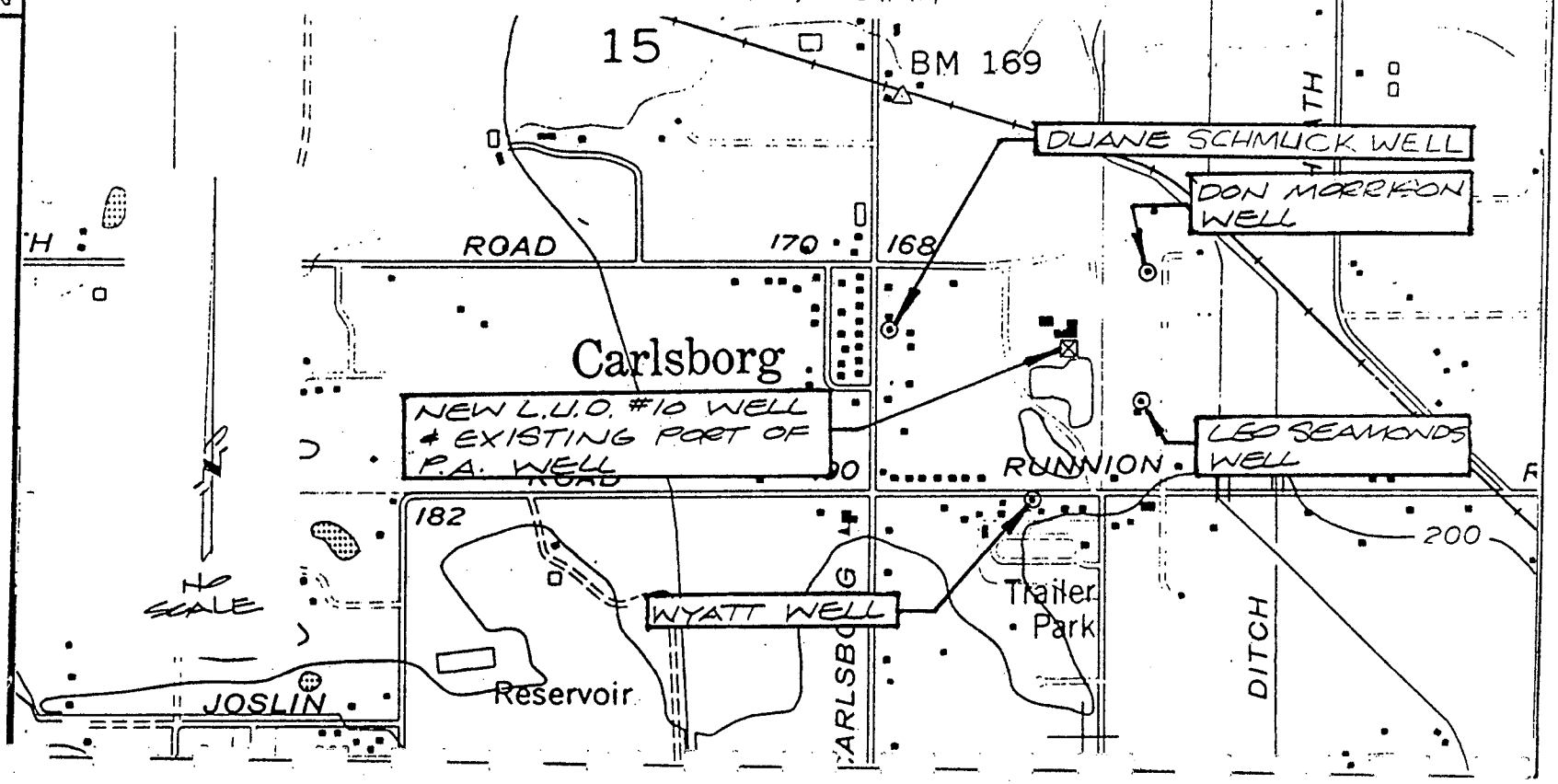
MONITORING WELL	DISTANCE FROM PUMPED WELL	DEPTH (FT.)	DRAWDOWN (FT - IN)
1. PORT OF PORT ANGELES	25' N.E.	60'(?)	0'-7" ±
2. DON MORRISON	600' N.E.	70'	NONE
3. LEO SEAMONDS	600' S.E.	50'	NEGLIGIBLE
4. WYATT	900' S.	UNK	NONE
5. DUANE SCHMUCK*	1050' W.	140'	NONE

* SCHMUCK WELL PENETRATES LOWER AQUIFER

LEGEND:

⊠ PUMPED WELL

⊙ MONITORING WELL



S	
T	
R	
DATE:	6-19-78
DESIGNED BY:	GGL
PROJECT:	L.U.D. No. 10
FOR:	CLALLAM COUNTY PUD #1
SHT. 1 OF 1	

NTI Own Associates

NORTHWESTERN TERRITORIES, INC.

Engineers • Land Surveyors • Planners

Construction Coordination • Materials Testing

717 SOUTH PEABODY • PORT ANGELES, WASHINGTON 98362 • (206) 452-8491

CANAL PUMPS & SERVICE, INC.
1550 HWY. 101 W., SEQUIM, WA. 98382
683-6328 *683-4220*

ED CHARTIER *LAWRENCE BINGHAM* *DOUG REEDER*

NAME: P.U.D. WELL LUD #10 , PORT OF P.A. WELL
ADDRESS:
CITY & STATE: Carlsborg, WA 98382
DATE:
PHONE:
RE: Preliminary Water Analysis

WATER CHEMICAL ANALYSIS

	P.U.D. WELL LUD #10	PORT OF P.A. WELL
IRON	0-.02 mg/L	.5 mg/L
HARDNESS	136.8 mg/L	171 mg/L
MANGANESE	.0175 mg/L	.0275 mg/L
P.H.	Approx. 7.5	Approx. 7.5
SODIUM	25.5 mg/L	25 mg/L
TEMP	50 Degrees	51 Degrees
TESTED BY	Ed Chartier	Ed Chartier

CANAL PUMPS & SERVICE, INC.
1550 HWY 101 W., SEQUIM, WA 98382
683-6328 683-4220

DATE: JUNE 18, 1990

NAME: PUD CARLSBORG WELL LUD #10
ADDRESS:
CITY, STATE: Carlsborg, WA 98382

RE: PORT PUMP HOUSE WELL

TIME	DATE	DAY	DRAW DOWN	INITIALS
8:30 PM	6/14/90	THURSDAY	34' 5"	E.C.
4:00 AM	6/15/90	FRIDAY	26' 8.75"	E.C.
9:22 AM	6/15/90	STARTED TEST PUMPING P.U.D. WELL		
11:50 AM	6/15/90	FRIDAY	27' 4.63"	E.C.
1:34 PM	6/15/90	FRIDAY	28' 7.63"	E.C.
4:40 PM	6/15/90	FRIDAY	27' 9"	E.C.
5:54 PM	6/15/90	FRIDAY	27' 10.25"	E.C.
6:32 PM	6/15/90	FRIDAY	28' 1.88"	E.C.
(PUMP RAN 3 MINUTES EARLIER)				
8:16 PM	6/15/90	FRIDAY	28' 9.88"	E.C.
1:07 AM	6/16/90	SATURDAY	29' 2.25"	E.C.
4:35 AM	6/16/90	SATURDAY	29' 1"	E.C.
10:00 AM	6/16/90	SATURDAY	29' 1"	E.C.
4:52 PM	6/16/90	SATURDAY	29' 1"	E.C.
7:50 PM	6/16/90	SATURDAY	29' 1"	E.C.
1:50 AM	6/17/90	SUNDAY	29' 1.5"	L.B.
4:50 AM	6/17/90	SUNDAY	28' 4"	L.B.
9:46 AM	6/17/90	SUNDAY	29' 1"	E.C.
11:03 AM	6/17/90	SUNDAY	29' 1.5"	E.C.
4:45 PM	6/17/90	SUNDAY	29' 8.5"	E.C.
7:48 PM	6/17/90	SUNDAY	28' 1"	E.C.
SHUT DOWN P.U.D. WELL				
8:14 PM	6/17/90	SUNDAY	28' 5.5"	E.C.
9:07 PM	6/17/90	SUNDAY	28' 0"	E.C.

PREPARED BY: ED CHARTIER LAWRENCE BINGHAM

CERTIFICATION: # 5098 # 5095

CANAL PUMPS & SERVICE, INC.
1550 HWY 101 W., SEQUIM, WA 98382
683-6328 683-4220

DATE: JUNE 18, 1990

NAME: PUD CARLSBORG WELL LUD #10
ADDRESS:
CITY, STATE: Carlsborg, WA 98382

RE: LEO SEAMONDS WELL

TIME	DATE	DAY	DRAW DOWN	INITIALS
7:31 PM	6/14/90	THURSDAY	31' 11.5"	L.B.
4:34 AM	6/15/90	FRIDAY	21' 11.5"	L.B.
9:22 AM	6/15/90	STARTED TEST PUMP P.U.D. WELL		
4:19 PM	6/15/90	FRIDAY	21" 11"	E.C.
9:29 AM	6/15/90	FRIDAY	21' 11"	E.C.
4:10 AM	6/16/90	SATURDAY	22' 0"	E.C.
4:17 PM	6/16/90	SATURDAY	22' 2"	E.C.
4:35 AM	6/17/90	SUNDAY	22' 4.25"	L.T.
4:29 PM	6/17/90	SUNDAY	22' 0"	E.C.

CANAL PUMPS & SERVICE, INC.
1550 HWY 101 W., SEQUIM, WA 98382
683-6328 683-4220

DATE: JUNE 18, 1990

NAME: PUD CARLSBORG WELL LUD #10
ADDRESS:
CITY, STATE: Carlsborg, WA 98382

RE: DON MORRISON WELL

TIME	DATE	DAY	DRAW DOWN	INITIALS
8:00 PM	6/14/90	THRUSDAY	25' 4"	L.B.
4:29 AM	6/15/90	FRIDAY	25' 5.5"	L.B.
9:22 AM	6/15/90	STARTED PUMP TEST P.U.D. WELL		
4:34 PM	6/15/90	FRIDAY	25' 5"	E.C.
9:35 PM	6/15/90	FRIDAY	25' 6"	E.C.
4:19 AM	6/16/90	SATURDAY	25' 6"	E.C.
4:32 PM	6/16/90	SATURDAY	25' 4"	E.C.
4:41 AM	6/17/90	SUNDAY	25' 3.25"	L.B.
4:20 PM	6/17/90	SUNDAY	25' 0"	E.C.

CANAL PUMPS & SERVICE, INC.
1550 HWY 101 W., SEQUIM, WA 98382
683-6328 683-4220

DATE: JUNE 18, 1990

NAME: PUD CARLSBORG WELL LUD #10
ADDRESS:
CITY, STATE: Carlsborg, WA 98382

RE: DUANE SCHMUCK WELL

TIME	DATE	DAY	DRAW DOWN	INITIALS
12:24 PM	6/13/90	WEDNESDAY	31' 0"	L.B.
8:06 PM	6/14/90	THURSDAY	30' 9"	L.B.
4:44 AM	6/15/90	FRIDAY	30' 11.5"	L.B.
9:22 AM	6/15/90	STARTED TEST PUMPING P.U.D. WELL		
12:30 PM	6/15/90	FRIDAY	31' 0"	L.B.
4:09 PM	6/15/90	FRIDAY	31' 0"	E.C.
9:17 PM	6/15/90	FRIDAY	31' 1"	E.C.
3:57 AM	6/16/90	SATURDAY	31' 1.5"	E.C.
1:10 PM	6/16/90	SATURDAY	31' 3.13"	E.C.
4:03 PM	6/16/90	SATURDAY	31' 1"	E.C.
4:26 AM	6/17/90	SUNDAY	31' 1.5"	L.B.
4:05 PM	6/17/90	SUNDAY	31' 2"	E.C.

CANAL PUMPS & SERVICE, INC.
1550 HWY 101 W., SEQUIM, WA 98382
683-6328 683-4220

DATE: JUNE 18, 1990

NAME: PUD CARLSBORG WELL LUD #10
ADDRESS:
CITY, STATE: Carlsborg, WA 98382

RE: WYATT WELL

TIME	DATE	DAY	DRAW DOWN	INITIALS
7:55 PM	6/14/90	THURSDAY	14' 5"	L.B.
4:39 AM	6/15/90	FRIDAY	14' 3.75"	L.B.
9:22 AM	6/15/90	STARTED TEST PUMPING P.U.D. WELL		
4:15 PM	6/15/90	FRIDAY	14' 0"	E.C.
9:25 PM	6/15/90	FRIDAY	14' 5"	E.C.
4:05 AM	6/16/90	SATURDAY	14' 5.5"	E.C.
(PUMP WAS RUNNING WHEN I ARRIVED)				
4:13 PM	6/16/90	SATURDAY	15' 4"	E.C.
4:31 AM	6/17/90	SUNDAY	14' 7.25"	L.B.
4:15 PM	6/17/90	SUNDAY	14' 5"	E.C.

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT
STATE OF WASHINGTON

1258-A

Application No. .....
Permit No. 1926

(1) OWNER: Name ELMER ADAMS Address Rt. 4 Box 619 SEQUIM WA 98382

(2) LOCATION OF WELL: County CLALLAM S½, N½, SE¼, NW¼ of ¼ Sec 14 T. 30 N., R. 4W W.M.
N½, S½ of SE¼, NW¼ of
Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic [X] Industrial [ ] Municipal [ ] Irrigation [ ] Test Well [ ] Other [ ]

(4) TYPE OF WORK: Owner's number of well (if more than one) ....
New well [X] Method: Dug [ ] Bored [ ]
Deepened [ ] Cable [X] Driven [ ]
Reconditioned [ ] Rotary [ ] Jetted [ ]

(5) DIMENSIONS: Diameter of well 8 inches.
Drilled 116 ft. Depth of completed well 81 ft.

(6) CONSTRUCTION DETAILS:
Casing installed: 6" Diam. from 0 ft. to 71 ft.
Threaded [ ] ..." Diam. from ... ft. to ... ft.
Welded [X] ..." Diam. from ... ft. to ... ft.

Perforations: Yes [X] No [ ]
Type of perforator used MILLS TYPE
SIZE of perforations 3/8 in. by 2 in.
46 perforations from 66 ft. to 73 ft.
... perforations from ... ft. to ... ft.
... perforations from ... ft. to ... ft.

Screens: Yes [X] No [ ]
Manufacturer's Name JOHNSON
Type STAINLESS STEEL Model No. ...
Diam. 7 5/8 Slot size 25 from 76 ft. to 81 ft.
Diam. ... Slot size ... from ... ft. to ... ft.

Gravel packed: Yes [ ] No [X] Size of gravel: ...
Gravel placed from ... ft. to ... ft.

Surface seal: Yes [ ] No [X] To what depth? ... ft.
Material used in seal ...
Did any strata contain unusable water? Yes [ ] No [X]
Type of water? ... Depth of strata ...
Method of sealing strata off ...

(7) PUMP: Manufacturer's Name ...
Type: ... H.P. ...

(8) WATER LEVELS: Land-surface elevation above mean sea level .... ft.
Static level 24 ft. below top of well Date 4/8/66
Artesian pressure ... lbs. per square inch Date ...
Artesian water is controlled by ... (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes [ ] No [X] If yes, by whom? ...
Yield: ... gal./min. with ... ft. drawdown after ... hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test ...
Bailer test 30 gal./min. with 30 ft. drawdown after 2 hrs.
Artesian flow ... g.p.m. Date 4/8/66
Temperature of water ... Was a chemical analysis made? Yes [ ] No [X]

(10) WELL LOG:
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
open well	0	25
Boulders & Tight gravel W.B	25	31
SILTY CLAY	31	36
GRAY gravel & CLAY	36	42
Silty CLAY	42	46
GRAY gravely CLAY	46	65
BROWN Cemented gravel Some water seepage	65	66
W.B GRAVEL	66	74
W.B BROWN sand	74	82
BROWN MUDDY SAND, CLAY	82	89
GRAY CONSOLIDATED MATERIAL	89	116

RECEIVED
AUG 20 1975
DEPARTMENT OF ECOLOGY
SOUTHWEST REGIONAL OFFICE

deepened
May - 1984

Work started 3/31, 19 66 Completed 4/8, 19 66

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME STDICAN DRILLING CO. INC (Person, firm, or corporation) (Type or print)
Address P.O. BOX 161 SEQUIM WA 98382
[Signed] Valir Stucani (Well Driller)
License No. 0473 Date Aug. 19, 1975

(USE ADDITIONAL SHEETS IF NECESSARY)

S. F. No. 7356—OS—(Rev. 4-71)
ECY-070-28

2nd log well deepened

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No. .....

Permit No. 98324

(1) OWNER: Name E. A Schmuck Address Po Box 105 ~~Sequim~~ Carlsborg, Wash 98324

(2) LOCATION OF WELL: County Clallam N½ NW¼ NE¼ SE¼ Sec. 15 T 30 N., R 4 (W.M.)

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☒ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one) ....

New well ☒ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☐ Driven ☐
Reconditioned ☐ Rotary ☒ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches

Drilled 145 ft. Depth of completed well 144 ft.

(6) CONSTRUCTION DETAILS: Plus 1 ft Above Grade

Casing installed: 6" Diam. from 0 ft. to 139 ft.
Threaded ☐ 5" Diam. from 138 ft. to 139 ft.
Welded ☒ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☒
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☒ No ☐
Manufacturer's Name Johnson U. Wire
Type Stainless Steel Model No.
Diam. 5½ Slot size .030 from 139 ft. to 144 ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☒ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☒ No ☐ To what depth? 18 ft.
Material used in seal Cement And Bentonite
Did any strata contain unusable water? Yes ☐ No ☒
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name
Type: H.P.

(8) WATER LEVELS: Land-surface elevation above mean sea level Aprox 155 ft.

Static level 38 ft. below top of well Date
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? Yes ☐ No ☒ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 60 gal./min. with 30 ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water 46 Was a chemical analysis made? Yes ☐ No ☒

(10) WELL LOG:

Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

MATERIAL	FROM	TO
Brown Rocky Surface Soil	0	1
Brown Loose Sand & Gravel	1	9
Brown Clay & Boulders	9	22
Brown W/B Sand	22	56
Brown W/B Sand & Gravel	56	93
Blue Clay	93	110
Brown Clay	110	115
Brown Clay & Gravel	115	136
Brown Course Sand & Gravel W/B	136	144
Brown Fine Sand	144 →	

DEC 10 P 3:43 '85

Work started 10-7, 19 85 Completed 10-8, 19 85

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Stoccan Drilling Co Inc (Person, firm, or corporation) (Type or print)

Address PO Box 161 Sequim, Wash 98382

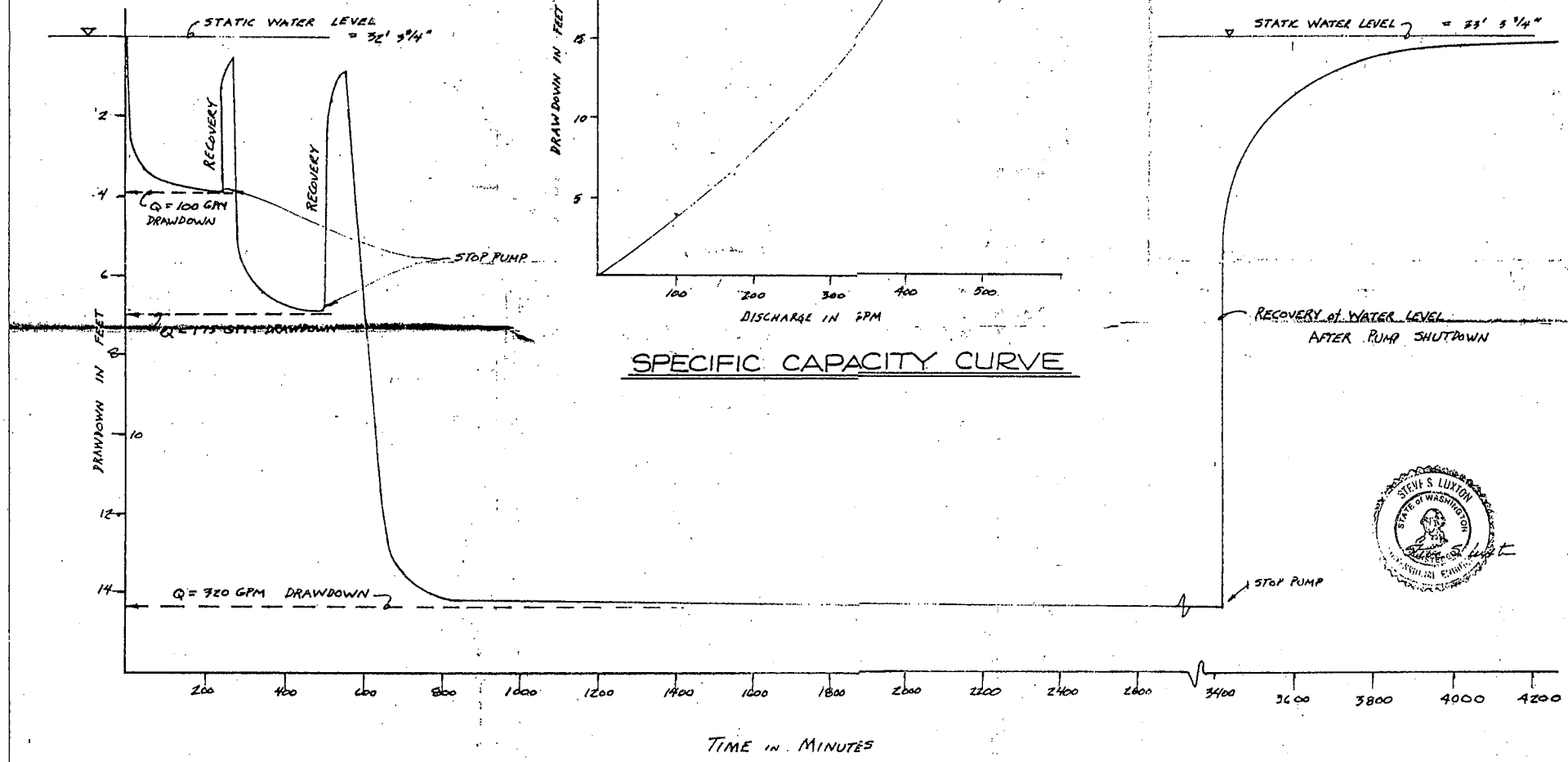
[Signed] Valeir Stoccan Secretary 6473 (Well Driller)
Robert Sillia

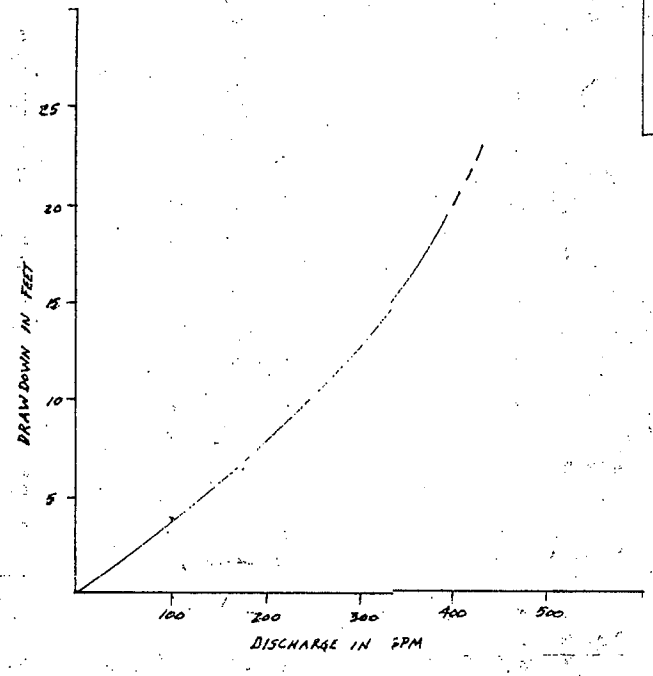
License No. 0868 Date 10-14, 19 85

(USE ADDITIONAL SHEETS IF NECESSARY)

CLALLAM COUNTY P.U.D. #1 - L.U.D. #10
CARLSBORG WATER WELL - PUMPING TEST DATA

WATER CHEMISTRY	
AGENT	CONCENTRATE
IRON	0-.02 mg/L
HARDNESS	136.8 mg/L
MANGANESE	.0175 mg/L
P.H.	7.5
SODIUM	25.5 mg/L
TEMP.	50°F





SPECIFIC CAPACITY CURVE

DRAWDOWN VS TIME FOR Q=100 GPM, 175 GPM & 310 GPM

NORTHWESTERN TERRITORIES, INC.
Engineers • Land Surveyors • Planners
Construction Coordination • Materials Testing
717 SOUTH PEABODY • PORT ANGELES, WASHINGTON 98362 • (206) 452-8491

CLALLAM COUNTY PUD #1 - LUD #10
CARLSBORG WATER WELL - PUMPING TEST DATA
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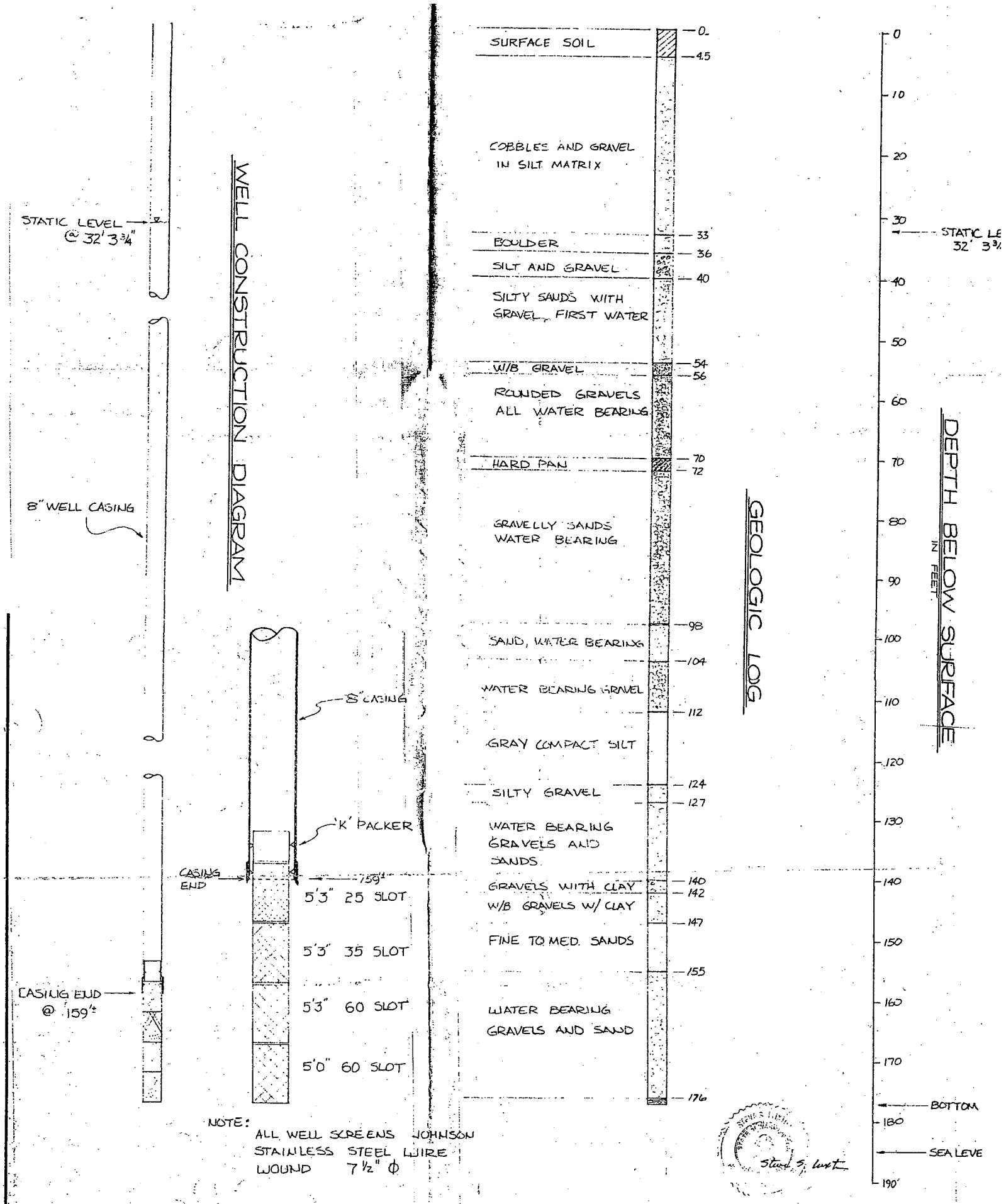
SIGNED BY: SSL / KH 6/22/78
DWN BY: KH / SSL
CKED BY: SSL
FINAL CHECK BY:



DESIGNED BY: SSL / CH 6/20/00	CLALLAM COUNTY P.U.D. #1 - L.U.D. #10
DRAWN BY: CH / SSL	CARLSBORG WATER WELL - PUMPING TEST DATA 8 (30,4)
CHECKED BY: SSL	
FINAL CHECK BY:	

NORTHWESTERN TERRITORIES
Engineers • Land Surveyors • Planners
Construction Coordination • Materials Testing
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APPENDIX B

Public Involvement Program

Initial Public Meeting

Intermediate Public Meeting

Sewer Feasibility Study for Carlsborg UGA

Public Meeting

Thursday, October 26, 2006
6:00-8:00 p.m. (Presentation at 6:30 p.m.)
Greywolf Elementary School, Multi-Purpose Room/Gym
171 Carlsborg Road, Sequim, WA

Agenda

Objectives

- Provide information on the purpose of the feasibility study
- Present the methodology of the feasibility study
- Provide information on the process for getting a sewer
- Respond to questions
- Request input on topics that are useful for the feasibility study
- Describe future opportunities for public involvement in the project

Presentation Overview

1. Welcome & Project Team Introductions (*Clallam PUD Representative*)
2. Brief Overview of Clallam County Role (*Clallam County Representative*)
3. Overview of Sewer Feasibility Study (*Bob Wheeler, Triangle Associates*)
4. Overview of Sewer Planning Process (*John Wilson, BHC Consultants*)
5. Sewer Feasibility Study Methodology (*John Wilson, BHC Consultants*)
6. Wastewater Reuse Considerations (*John Wilson, BHC Consultants*)
7. Initial Sewer Service Area Considerations (*John Wilson, BHC Consultants*)
8. Public Involvement Opportunities (*Bob Wheeler, Triangle Associates*)

Sewer Feasibility Study for Carlsborg UGA
26 October 2006 Public Meeting

Overview of Study Process

Sewer Planning Process

- Steps to implement a sewer system
- Objective for the Feasibility Study
- Future Actions

Study Methodology

- Use of Previous Studies
- Project future population & flows
- Consider potable water needs
- Estimate the Project Costs
- Sewer System Components
    - Collection System
    - Treatment Facility
    - Solids Handling
    - Reclaimed Water Use

Reuse Considerations

- Protect ground water quality
- Recharge the upper aquifer
- Augment flow in Dungeness River
- Support additional water rights

Initial Sewer Service Area

- Conceptual collection system layout
- Preferences of property owners
- Economic considerations
- Future expansion

Carlsborg Sewer Feasibility Study
NEXT STEPS

Once the Sewer Feasibility Study is completed the PUD, Clallam County, and the Carlsborg will decide if in fact a sewer system for Carlsborg is feasible. If so, there are a number additional important steps that are required before a sewer system with wastewater treatment and water reuse would be designed and built.

1. **General Sewer Plan**, or an Update to the 1994 document, with projections of future populations, wastewater flows, and an evaluation of sewer collection alternatives.

2. **Hydrogeological Study** with environmental review to develop support for additional water rights and the potable water quantity justified.

3. **Special Benefit Study** defining the maximum amount that can be assessed for sewer service.

4. **Local Utility District** (LUD) formation with preliminary assessment of sewer costs to specific benefiting parcels within the UGA.

5. **Engineering Report or Facilities Plan** evaluating wastewater treatment alternatives, reclaimed water reuse options, and identifying the preferred solution with estimated project costs plus operations, maintenance, and administration.

6. **Funding Program** to pay such costs as may exceed the special benefit that can be assessed to the parcels benefiting from sewer service.

7. **Final Assessment** of costs for the sewer system under the LUD.

8. **Plans and Specifications** to build the initial sewer collection, treatment, and water reclamation/reuse facilities.

9. **Permits, Properties, Easements, and Rights-of-Way** acquisition to build the designed facilities, plus completion of the SEPA process.

10. **Construction** of the initial sewerage and reclaimed water facilities.

An important part of sewer planning as can be seen above, is a detailed evaluation of project costs, how the costs would be distributed to users, and the financing strategies that will be used.

PUD No 1 of Clallam County
Sewer Feasibility Study for Carlsborg UGA
October 26, 2006 Public Meeting

Questions from the Public

Q1: Will the Web page have the presentation material?
A1: Not at present.

Q2: Will website be maintained to respond to questions or comments?
A2: Probably, but feel free to contact the consultant team or staff members.

Q3: Concerned about the costs and the fact that they have recently spent a considerable amount of money on repairing their septic system. Will they be forced to hook up to the sewer?
A3: The PUD has not formulated a policy on connection requirements; however, the County Health may have rules that will govern the connection to a public sewer system when it is available to adjacent properties.

Q4: Reference was made to an exhibit from the 1994 study that showed a sewer alignment. Does that exhibit reflect the current thinking of the sewer layout?
A4: That exhibit is presented as an earlier concept which will be modified.

Q5: The 1995 study identified a total of 850 people, now the population is presented as 817 people. Has the population decreased?
A5: The population projections from the earlier reports (1995) were made prior to the creation of the UGA and hence the population of 850 is associated with a larger area than the subsequent UGA boundaries. The difference in the numbers does not necessarily suggest that the population had decreased.

Q6: Concerned about costs. The questioner owns a mobile home park and is worried that the monthly service charges will be onerous.
A6: The scope of the feasibility study is to determine the total cost of a baseline investigation, not to determine or estimate the cost to each parcel.

Q7: Well water has increasing concentrations of nitrate. Will it make sense for us to modify the existing septic systems (e.g. add a sand filter)?
A7: There are some things that can be done to improve the performance of the on-site systems. These measures probably are helpful but are not the perfect solution. A community collection and treatment system will be more efficient in reducing the nitrate concentrations.

Q8: The Wastewater Treatment plant does not include the solids handling component, right?
A8: Yes. The capital costs to provide full solids handling is significant and consequently it was concluded that the solids stabilization and disposal will be handled through

contracted services. It is possible that there could be a cooperative effort in conjunction with the other local agencies to provide a regional solids handling facility.

Q9: How are we going to overcome the obstacles that stopped the previous studies?
A9: Since the previous investigations there have been several changes that have altered wastewater treatment facilities. MBRs are a new technology that allows modular expansion and which produces a much higher degree of treatment. This cleaner product will allow alternative uses of the reclaimed water, such as groundwater recharge, base flow augmentation to the Dungeness River, irrigation water and, perhaps, a credit toward supplemental water rights. There are also options in financing the improvements, available grants, agency contributions, and innovative rate structuring.

Q10: Would you estimate that the project has a 90% chance of proceeding?
A10: Much too early to prognosticate the chances of the project progressing.

Q11: Are the "hotspots" shown as high nitrate levels on the exhibit a result of development, dairy farms or some other identifiable source?
A11: There does not appear to be a clear pattern that would suggest that particular zones are hotter than others.

Q12: In the end, the costs to the property owners will be function of participation in the ULID. Can I get a credit for a good and fully functioning septic system?
A12: When the LID is formed, the cost distribution will be defined. At this point in time, it is too earlier to speculate about cost sharing and distribution.

Q13: Several properties are currently served by operating community on-site systems. I would hope that the PUD would consider incorporating the existing systems into the overall and final collection system scheme.
A13: Noted

Q14: Could land that is now being used as drainfields be redeveloped once sewers are in place?
A14: The short answer is yes. However, it must comply with zoning and building code requirements.

Q15: I live outside the UGA, but I have a question about legislative mandates that require urban services to be provided to properties within the UGA.
A15: GMA allows the extension of urban services within the UGA, but does not mandate that such services be created. UGA does, however, restrict urban services to be allowed only within the UGA envelope.

Q16: Nitrate levels appear to be trending upward. Can you extrapolate forward and tell us when our wells will be in jeopardy?
A16: Based on some limited data, it appears that in the last 15 years there has been about a 1/3 increase in reported nitrate levels in the Carlsborg area during the past 15 years.

Q17: Please look at alternative energy sources generated through the wastewater collection and treatment processes. Specific reference was made to solar panels, and DC motors
A17: Every effort will be made to select equipment that is energy efficient and environmentally responsive.

Q18: Can you design pumps that operate on solar power?
A18: Certain components can be solar powered. Generally large solids handling pumps and blowers cannot be solar powered.

Q19: Can the cost of the initial improvements be shared so that the first phase participants do not shoulder a disproportionate share?
A19: Yes. The financing mechanism will be structured so that all participants, both initial and subsequent phases, will proportionately share in the total costs.

Q20: Comment by Steve (the County Commissioners). The County is looking at different financing mechanisms. On another County project, the County fronted the costs. He also cited a Port Angeles project where the property owners were not obligated to hook up. The connection to Sequim alternative did not facilitate effluent disposal back to the Carlsborg area and hence did not meet one of the objectives of the project to retain water within the Carlsborg area.
In 1994 the costs were $14M, but now with the modular component of MBRs we will have greater flexibility.
We should also look at multiple WWTPs and phasing those plants to best match the initial and immediate needs

Q21: (Teddy Roosevelt) If we had enough good water, would we still be pursuing a WWTP? There is a huge amount of available water in the Mores Creek to satisfy all water rights. This might require a dam to be installed. The answer is in the water.
A21: Probably would still pursue the project.

Q22: What will be the nitrate levels in the MBR effluent?
A22: Probably less than 1.0 mg/l

Q23: Why was the north end of the UGA rezoned commercial? I feel like we were screwed.
A23: The County will check with the airport overlay and see if there was a misapplication of zoning.

Q24: Can you filter out nitrate?
A24: No. You need some biological activity to capture the soluble components.

Q25: Who bears the cost of subsequent expansions to the WWTP?
A25: The subsequent growth will pay for the future expansions.

Q26: Can you put water and sewer in the same trench?
A26: No. State law requires the water and sewer to be separated by a minimum of 10 feet.

Q27: Can you expand the water system along with the sewer system?
A27: It may be possible to gain a credit for future water rights if DOE will recognize and approve of the reuse of reclaimed water back into the groundwater and river systems. This theory will be further investigated as we work our way through the feasibility.

Q28: What other funding sources are there or will the property owners be expected to shoulder the entire costs?
A28: Other funding sources will be pursued. Grants, County contributions, PUD contribution, and Congressional appropriations will be investigated. The local contribution payable by the property owners will likely be financed through a 20-year LUD.

Q29: The cost of a side sewer is very expensive. Who will pay this cost?
A29: The cost of a side sewer is generally borne by the property owner. There might be an opportunity to include these costs in the LUD financing package.

Q30: What if our septic tanks were kept in place and incorporated into the final collection scheme?
A30: It is possible that the ultimate collection scheme will retain the septic tanks which will collect the solids and convey the septic tank effluent to the WWTP. If this option proves to be the cost effective solution, then the property owners would need to enter into a maintenance covenant to assure that the tanks are properly maintained.

Q31: Commercial businesses currently have to have an O&M contract for their septic tanks. All commercial should tie into a gravity system.
A31: Noted

Q32: Concern about people who live on limited finances. Will there be a low income allowance to help these people?
A32: Hardship assistance for assessment and monthly service charges might be incorporated into the financing package

Q33: Will the costs to get sewer service by proportionately distributed based on use?
A33: Yes. The large water users (and sewer generators) can expect to see proportional share of the costs.

PUD No 1 of Clallam County
In Association with Clallam County

Sewer Feasibility Study for Carlsborg UGA

SECOND PUBLIC MEETING

22 February 2007

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Cautions and Qualifiers

Only **Preliminary** Stage of Sewer Planning

Land Use Plan & Zoning Densities **will Change**

Facilities are **Conceptual**

Costs are **Estimates**

Funding & Financing is **Undefined**

Actual Assessment Method still **to be Determined**

Schedule is **Tentative**

So – Lots Can and Will Change

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Financing 101

Lots of Options are Possible – Little is Certain

Grants – money that will not have to be repaid

Low-Interest Loans – money to be repaid at less than market rate

Contributions – costs to be recovered from future development

Future Development – will pay higher fees & charges

User Charge – more sewage volume pays higher rate

Adjustments – hardship, elderly, functional on-site system

All of these Policies Remain to be Set

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Principal Previous Studies

Dungeness Area River Watershed Management Plan	1993
Carlsborg Comprehensive Sewer Study	1994
Carlsborg Capital Facilities Plan	1998
Carlsborg Community Advisory Council Recommendation	2003

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

What Costs Include

Capital Costs

Construction Costs

- Collection System
- Treatment Facilities
- Reuse System
- Sales Tax
- Contingencies

Project Costs

- Sewer Feasibility Study
- Facility Plan
- Local Utility District (LUD) Formation
- Financing
- Engineering Design
- Construction Permits
- Environmental Review & Mitigation
- Construction Oversight

Operations & Maintenance

- Salaries
- Electric Power
- Chemicals
- Equipment Replacement
- Billing & Management
- Professional Services
- Taxes

Many Variables to Consider

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

What Has This Sewer Feasibility Study Done?

Considered Future Land Use

Projected Future Population & Economic Development

Developed Expected Wastewater Flow & Pollutant Loads

Conceptualized Sewer Facilities

Studied Reuse Opportunities

Estimated Total Project Costs

Assumed Funding & Financing

Described One Assessment Method

Distributed Costs to Typical Parcels

Described Operation & Maintenance Program

Projected Monthly Charge to Customers

Even so, this is just a Feasibility Study
It is NOT an actual Sewer Plan
Nor was it intended to be

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Assessment Assumptions

KEY – Funding Received from Agencies

Equitable Assessments Require **Mix** of Charges

Distribution of Project Costs among Charge Types

Estimated Units Comprising Type of Charge

The Assessment Method used is Only an Assumption

Actual Assessment Method still to be Developed

Public Input will be Important

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Ranges of Cost for Different Properties

Most Carlsborg properties are unique

So costs for each parcel are different

Bringing costs down is an "Art"

How much money can be obtained from outside sources?

People need to think of potential financing sources

People need to be involved if costs are to be reduced

What land uses are appropriate?

Where can facilities best be located?

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

What All This Means

Cautions – Keep in Mind the MANY Assumptions Made

Choices to be Made – Sewers for Carlsborg have been studied before

Are Sewers Now Feasible?

Are Further Steps Appropriate?

Next Steps – What should be done next?

It is still possible,
and certainly the intent,
that costs can be decreased

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Estimated Funding

Estimated Total Project Cost	**$ 12,500,000**
PUD #1 of Clallam County Contribution	$ -- unknown --
Clallam County Contribution	$ -- unknown --
WA Department of Ecology Contribution	$ -- unknown --
Federal Agencies Contribution	$ -- unknown --
Assumed Total Agency Funding	**$ 3,400,000**
Amount Assessed to Property Owners	**$ 9,100,000**

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Properties within Initial Phase

Category	Parcels
Residential	28
Commercial	20
Industrial	5
Vacant	11
Public	7
Parkwood	3
Total Properties	**74 Parcels**

Approximate Existing Equivalent Residential Units	320 to 330
Approximate Potential Additional ERU	340 to 370
Potential Total Equivalent Residential Units	**660 to 690**

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Assumed Assessment Methodology

Charge	Assessment Units	Assessment Range
Area Charge	square feet of property	$ 0.06 to $ 0.09/sq ft
Front Foot Charge	footage on street	$ 75 to 90/foot ft
Capacity Charge	one existing SF home	$ 2,000 to 3,000/home
Added Benefit	one new equivalent home	$ 4,000 to 5,000/home
Service Connection	to existing or future home	$ 1,000 to 3,000/each

Each Assessment may include a computed mix of some or all charges

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Typical Total Conceptual Assessments

Existing Single Family, lot not sub-dividable
$ 12,000 to $ 16,000

Existing Single Family, sub-dividable lot
$ 25,000 to $ 100,000

Existing Small Commercial Property
$ 18,000 to $ 75,000

Existing Large Commercial Property
$ 40,000 to $ 300,000

Vacant and Undeveloped Parcel
$ 60,000 to $ 250,000

Note: **These are ONLY estimates, and based on several assumptions**

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Estimated Monthly Charge for Operations & Maintenance

Category	Monthly Sewer Service Charge
Single Family	$ 45 to $ 60
Small Commercial	$ 55 to $ 100
Large Commercial	$ 100 to $ 600

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Comparable Assessments

City of Bainbridge Island
South Island Sewer LID
City Contributed $ 609,051

Roackaway Beach	77 lots	average $ 22,869
Point White	63 lots	average $ 19,989
Pleasant Beach	33 lots	average $ 8,112
Emerald Heights	43 lots	average $ 26,988
Blakely School	total	$ 688,195

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

1994 Carlsborg Comprehensive Sewer Study

Estimated Project Cost for 680 Acre UGA
365 ERU in 1994 and Build-out of 705 ERU

Sewer Collection System	$ 3,703,000
Sewage Treatment System	$ 3,249,000
Estimated Total Project Cost	**$ 6,952,000 (in 1994)**

Only 21 % above Estimated Construction Cost
50% allowance would be more realistic

Estimated Construction Cost Escalation 1994 to 2006 = 148.8 %

Estimated Total Project Cost Escalated to 2006 = $ 10,340,000

HOWEVER

Treatment	Sequencing Batch Reactor
Surface Water Discharge	Requires NPDES Permit
Environmental & Construction Permits	Cost Omitted
Discharge to Clallam Irrigation Ditch	Not Acceptable to Irrigators
LUD Formation & Assessment	Cost Omitted
On-site Service Connection Costs	Cost Omitted

Estimated 2006 Equivalent Cost = $ 16,000,000

PUD #1 of Clallam County
In Association with Clallam County
Sewer Feasibility Study for Carlsborg UGA

Comparison with City of Sequim

Current Sewer Connection Charge $ 4,350

Comparable Conceptual Assessment Charges

Estimated Cost for Existing Home on 10,000 square foot lot
$ 2,600 to $ 3,900

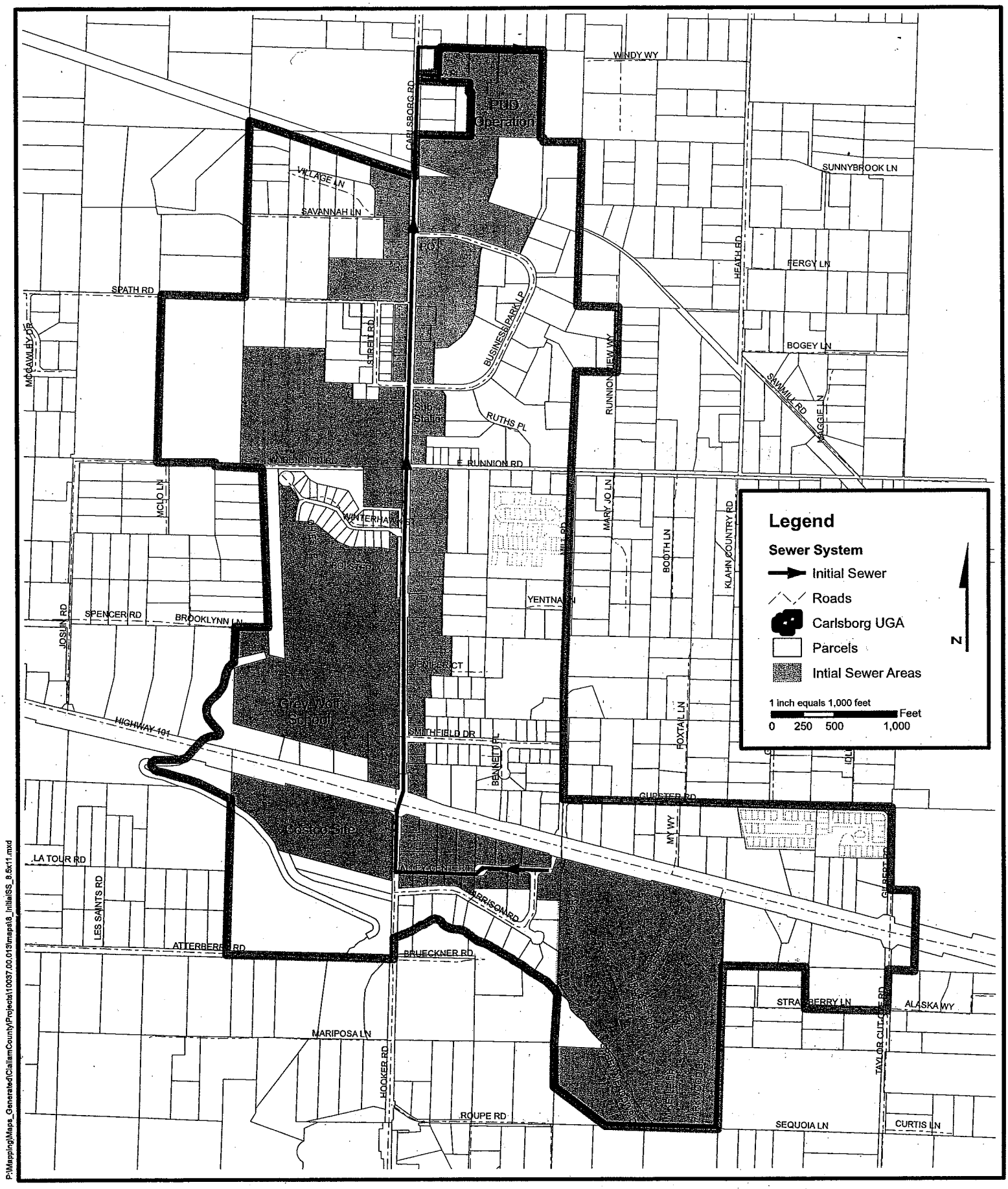
Estimated Cost for New Home on 10,000 square foot lot
$ 4,600 to $ 5,900

Sequim Surcharge Note

Monthly Charge for Sewer Service by Sequim:

Residential Inside City Limits = $43.14 per month

Residential Outside City Limits = $ 43.14 x 150 % = $ 64.71



P:\Mapping\Maps_Generated\ClallamCounty\Projects\10037.00.013\maps\8_InitialSS_8.5x11.mxd

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PUD #1 of Clallam County

Phase 1 - Initial Sewer System

PUD #1 of Clallam County

Figure **8**

PUD #1 of Clallam County
In Association with Clallam County

Sewer Feasibility Study for Carlsborg UGA

Second Public Meeting
22 February 2007

Summary of Estimated Cost for Initial Service Area

Total Estimated Project Cost $ 12,500,000

Assumed Total Assessed to Property Owners
$ 9,000,000 to $ 10,000,000

Estimated Assessment for Existing SF Home on Small Lot
$ 12,000 to $ 16,000
Payable over 20 years at $ 800 to $ 1,100 per year

Estimated Monthly Residential Service Charge
$ 45 to $ 60 per home

Advantages of Sewer System to Home Owners:

1. No drainfield or reserve area constriction on property
2. No septic tank maintenance or pumping
3. No eventual septic system replacement cost
4. Less nitrate in your drinking water
5. Increased property values

Modern Septic System Requirements for Carlsborg:

Current Cost = $ 20,000 to $25,000 per home
Monitoring required every 3 years
Replacement on-site system will eventually be required

Sewer Feasibility Study for Carlsborg Sewer
Public Meeting #2

Notes taken on Flip Charts - DRAFT

Considerations & Issues

- Pumping septic systems every 3 years may reduce the need for a sewer system.

- Who is the ultimate decision maker?
- People in the UGA working with the PUD and the County

- Are the governments contributing any money?
- That will need to be determined.

- How can people with lower incomes afford a sewer system?
- The sewer system may not go forward, or there may be programs to assist people on lower incomes, or other options.

- Can the County mandate sewers?
- The County is not inclined to do that.

- Would nitrogen removal technology on septic systems be a cheaper alternative?
- It is necessary to compare the long term costs

- The initial participants pay a certain cost; what happens to those connecting later?
- As later participants join the system, they will need to pay to expand the wastewater facilities.

- Cost overruns happen, so how much will it really cost?
- The cost would be publicly bid.
- There is a contingency built into the cost estimate for unforeseen cost increases.

- What is the likelihood of finding Native American artifacts? What will happen if they are found?
- There will be an archaeological evaluation at the time system design.
- If artifacts are found, they will have to be dealt with in the appropriate manner.

- Who would vote on a sewer system? The people along the pipeline?
- That has not yet been determined.

- How would a vote be set up?
- There are options defined by State law.

- If the assessment can be paid off over a period of time (e.g. 20 years), when a home is sold does the cost stay with the property or is it still the owner's responsibility?

- The seller may pay off the assessment, or the assessment may stay with the property.

- Why are we pursuing a sewer system? Is this the best option?
- In a broad sense, yet, this has been determined to be the best option.

- What will the cost be in 20 years?
- The cost has increased 3.4%/year over the last 20 years, so it's possible to escalate the cost over the next 20 years based on that rate.

- What kind of assurance do we have that a sewer system will work?
- There is a lot of past experience that shows that a sewer system treats wastewater better than septic systems do.

- Is reuse into Matriotti Creek possible?
- It would likely be approved.

- What happens with the chlorine used for disinfection?
- It binds to other chemicals during the disinfection process to form new compounds and it also dissipates.

- How long will it take to build from beginning to end?
- More than three years. Probably four to five years.