# Belfair/Lower Hood Canal Water Reclamation Facility Plan Supplemental Information

May 2007

## MASON COUNTY, WASHINGTON

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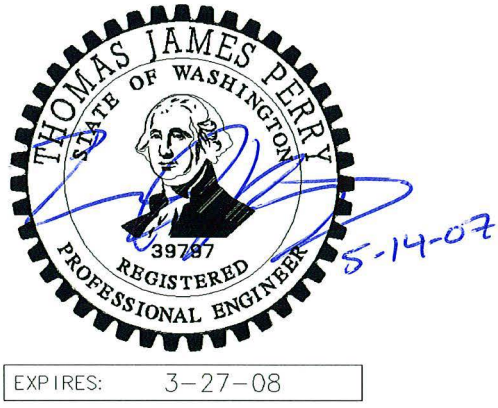
# BELFAIR/LOWER HOOD CANAL
# WATER RECLAMATION FACILITY PLAN
# SUPPLEMENTAL INFORMATION

## FOR

## MASON COUNTY, WASHINGTON

**May 2007**

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# TABLE OF CONTENTS

## ES. EXECUTIVE SUMMARY


Introduction ..... ES-1
Background and Purpose ..... ES-1
Study Area ..... ES-1
Population Projections ..... ES-2
Wastewater Flows and Loadings ..... ES-3
Alternatives ..... ES-3
Program Cost ..... ES-6
Plan Summary ..... ES-8
Project Schedule ..... ES-9
Financial Impact ..... ES-9


## 1. INTRODUCTION


Purpose ..... 1-1
Background ..... 1-1
Approach ..... 1-2
Scope of Work ..... 1-2
Previous Documents ..... 1-3


## 2. SUPPLEMENT TO CHAPTER 2 STUDY ENVIRONMENT


Belfair Sewer Service Area ..... 2-1
Belfair Urban Growth Area ..... 2-1
Lynch Cove/North Shore Area (Belfair State Park) ..... 2-3
*Lynch Cove/North Shore Service Area Delineation Study* ..... 2-3
*Parcel Analysis* ..... 2-4
*Enhanced Parcel Analysis* ..... 2-4
*Wastewater Management Alternatives Memorandum* ..... 2-6
*Mason County Directive* ..... 2-6
*Limited Areas of More Intense Rural Development (LAMIRD) Boundary Justification* ..... 2-7


## 3. SUPPLEMENT TO CHAPTER 3 LAND USE AND POPULATION


Belfair Urban Growth Area ..... 3-1
Lynch Cove/North Shore Area ..... 3-2
Potential Service Area Population ..... 3-3

## 4. SUPPLEMENT TO CHAPTER 4 WASTEWATER FLOWS & LOADINGS


Wastewater Flows and Loadings ..... 4-1
Wastewater Projections ..... 4-1
Additional Wastewater Flow Considerations ..... 4-4
*Mission Creek Corrections Center for Women* ..... 4-4


## 5. SUPPLEMENT TO CHAPTER 9 WATER RECLAMATION SITING ALTERNATIVES


Land Area Requirements ..... 5-1
Siting Considerations ..... 5-2
Possible Sites for Land Application (Belfair Area) ..... 5-3
Washington State DNR (Areas 1 & 2) ..... 5-3
Belfair/South Belfair (Area 3) ..... 5-5
Overton & Associates – Section 33 (Area 4) ..... 5-5
Recommended Alternative ..... 5-6
Expanded North Bay/Case Inlet Water Reclamation Facility ..... 5-6
Summary ..... 5-7


## 6. SUPPLEMENT TO CHAPTER 10 TREATMENT ALTERNATIVES


Design Criteria ..... 6-1
Treatment Alternatives ..... 6-3
Alternative 1 – Sequencing Batch Reactor located near Belfair ..... 6-4
Alternative 2 – Membrane Biological Reactor located near Belfair ..... 6-7
Alternative 3 - Expansion of North Bay/Case Inlet ..... 6-8
Alternative 4 - South Kitsap Industrial Area (SKIA) ..... 6-12
Discussion ..... 6-16
Summary ..... 6-17


## 7. SUPPLEMENT TO CHAPTER 11 COLLECTION SYSTEM ALTERNATIVES


Belfair Urban Growth Area ..... 7-1
Development of Basins and Basin Flows ..... 7-2
Alternatives for UGA Sewer Service ..... 7-2
Alternatives for Belfair Commercial Area Sewer Service ..... 7-4
Lynch Cove/North Shore Area ..... 7-8
Alternatives for Sewer Service ..... 7-8
Recommended Collection Alternative ..... 7-9
Belfair Urban Growth Area ..... 7-9
Lynch Cove/North Shore Area ..... 7-11
Additional Sewer Service Areas ..... 7-13

## 8. SUPPLEMENT TO CHAPTER 13 COST OF SYSTEM ALTERNATIVES AND FINANCING OPTIONS


Capital Cost Summary ..... 8-1
Annual Operation and Maintenance Costs ..... 8-3
Annual Replacement Costs ..... 8-4
Present Worth ..... 8-5
Available Funding Sources ..... 8-5


## 9. SUPPLEMENT TO CHAPTER 14 PUBLIC PARTICIPATION


Public Meetings ..... 9-1
- November 8, 2005 ..... 9-1
- October 11, 2006 ..... 9-1
- November 15, 2006 ..... 9-1
- Programmatic Environmental Impact Statement ..... 9-2


## 10. SUPPLEMENT TO CHAPTER 15 PLAN SUMMARY


Recommended Plan ..... 10-1
Plan Highlights ..... 10-2
Design Summary ..... 10-3
Cost Summary ..... 10-8
Project Schedule ..... 10-8


## 11. FINANCIAL IMPACT EVALUATION


Introduction ..... 11-1
Capital Cost and Inflationary Projections ..... 11-1
Equivalent Residential Unit (ERU) Data and Projections ..... 11-2
Available Funding Sources for Capital Projects ..... 11-2
- Government Programs ..... 11-3
- Public Debt ..... 11-5

Capital Financing Assumptions Used for the Financial Impact Forecast ..... 11-6
Cost Recovery Scenarios Evaluated ..... 11-7
- Scenario 1 ..... 11-8
- Scenario 2 ..... 11-8
- Scenario 3 ..... 11-9

Annual Revenue Needs Forecast (20-year) ..... 11-10
List of Assumptions Used in the Revenue Needs Projection ..... 11-12
Capital Facilities Charge ..... 11-13
List of Utility Formation Financial Issues to Consider ..... 11-14
- Start-up Cash Flow Management ..... 11-15
- Requirement for Connection to System ..... 11-15
- Customer Costs to Connect to the System ..... 11-15

Regulating Interim Development ..... 11-16
Development of Financial Administrative System..... 11-16
Recommended Financial Strategy..... 11-16

**REFERENCES**

**APPENDICES**

A. Declaration of Severe Public Health Hazard
B. Belfair Urban Improvements Project Feasibility Report Executive Summary
C. Lynch Cove/North Shore Sewer Service Area Delineation Study
D. Enhanced Parcel Analysis
E. Evaluation of North Shore Wastewater Management Scenarios
F. Mason County Directive
G. Potential Site Identification Study for Land Application of Treated Wastewater
H. SKIA Memo
I. Wastewater flow calculations
J. Detailed Program Cost Estimates
K. Public Meeting minutes & sign up sheets

**LIST OF FIGURES**

| No. | Title | Page |
|---|---|---|
| 2-1 | Sewer Service Area | 2-2 |
| 2-2 | Delineation Study Potential Impact Map | 2-5 |
| 5-1 | Potential Land Application Sites | 5-4 |
| 6-1 | Alternatives 1 & 2 - Belfair Reclamation Facility | 6-6 |
| 6-2 | Alternatives 3 - North Bay/Case Inlet | 6-11 |
| 6-3 | Alternatives 3 - SKIA | 6-14 |
| 7-1 | Belfair UGA Service Area | 7-3 |
| 7-2 | Belfair UGA Collection System | 7-10 |
| 7-3 | Lynch Cove/North Shore Collection System | 7-5 |
| 10-1 | Belfair Sewer Collection System Components | 10-4 |
| 10-2 | Belfair WRF Process Flow Schematic | 10-7 |

**LIST OF TABLES**

| No. | Title | Page |
|---|---|---|
| ES-1 | Potential Service Area Population Forecast | ES-2 |
| ES-2 | Potential Belfair Sewer Service Area Design Flows and Loadings | ES-3 |
| ES-3 | Land Area Requirements | ES-4 |
| ES-4 | Capital Cost Summary | ES-7 |
| ES-5 | Present Worth Summary | ES-8 |
| ES-6 | Summary of Current Available Funding | ES-10 |

**LIST OF TABLES (CONT'D)**


ES-7 Funding Scenarios ..... ES-11
3-1 Belfair UGA Population Forecast Summary ..... 3-2
3-2 Lynch Cove/North Shore New Home Building Permits 2000-2004 ..... 3-3
3-3 Potential Service Area Population Forecast ..... 3-3
4-1 Population and Average Daily Flow Projections ..... 4-2
4-2 Population and Wastewater Load Projections ..... 4-3
5-1 Land Area Requirements ..... 5-2
6-1 Wastewater Treatment Facility Average Daily Flow Projections ..... 6-2
6-2 Secondary Effluent Design Criteria ..... 6-3
6-3 NB/CI Expansion Average Daily Flow Projections ..... 6-9
6-4 Estimated Treatment Program Costs ..... 6-16
8-1 Capital Cost Summary ..... 8-2
8-2 Annual Operation & Maintenance Cost Summary ..... 8-3
8-3 Annual Replacement Cost Summary ..... 8-4
8-4 Present Worth Summary ..... 8-5
10-1 Design Summary: Projected Flows and Loadings ..... 10-3
10-2 Design Summary: Secondary Effluent Design Criteria ..... 10-3
10-3 Design Summary: Collection System ..... 10-5
10-4 Design Summary: Transmission System ..... 10-5
10-5 Design Summary: Treatment – Belfair MBR ..... 10-6
10-6 Recommended Plan Cost Summary – Belfair UGA ..... 10-8
11-1 Capital Program Summary ..... 11-2
11-2 ERU and Growth Summary by Area ..... 11-2
11-3 Summary of Current Available Funding ..... 11-7
11-4 Annual Financing Assumptions for Financial Impact Projections ..... 11-7
11-5 Annual Financial Impact Summary ..... 11-10
11-6 Capital Facilities Charge Calculation ..... 11-14

# EXECUTIVE SUMMARY

# EXECUTIVE SUMMARY

## Introduction

Mason County retained the services of Murray, Smith & Associates, Inc. to provide supplemental information to the Belfair/Lower Hood Canal Water Reclamation Facility Plan (Gray & Osborne, 2003), amended December 2003. This document will reflect recent population forecasts and the proposed sewer service area boundary for the Belfair sewer project.

## Background and Purpose

The Belfair/Lower Hood Canal Water Reclamation Facility Plan (Facility Plan) was originally submitted in final form to the Washington State Department of Ecology (DOE) in July 2001 and was approved in March 2002. The Facility Plan was amended to further review site selection for the treatment facilities and consider service to the Belfair State Park area to address a declaration of severe public health hazard in Lynch Cove which was issued by the Washington State Department of Health in March 2002. The amended Facility Plan was approved by DOE on April 15, 2004.

The Belfair Urban Improvements Feasibility Study (Perteet/MSA, 2005) was initiated in 2004 to assist Mason County in defining urban improvements for the Community of Belfair. The Feasibility Study uncovered two limitations of the current Facility Plan: population projections for the Belfair Urban Growth Area (UGA) did not reflect the most recent projections developed by Mason County; and the Facility Plan did not directly correlate the extension of the sewer services to the conditions that led to the declaration of the severe public health hazard in the Lynch Cove/North Shore area of Lower Hood Canal.

The purpose of this document is to provide supplemental information and amend the Facility Plan based on current population projections for the Belfair UGA and potential sewer service area for the Lynch Cove/North Shore area.

## Study Area

The proposed Belfair Sewer Service Area is comprised of two distinct areas; the Belfair UGA and the Lynch Cove/North Shore area. Mason County has designated Belfair as an Urban Growth Area (UGA) and identifies the need for sanitary sewers in Belfair as "an essential first step in upgrading water quality while accommodating growth" (Belfair Urban Growth Area Plan, Mason County).

On March 6, 2002, the Washington State Department of Health (DOH) declared a severe public health hazard in the Lynch Cove area of Lower Hood Canal. The DOH identified on-site septic systems as contributing to the conditions that have led to the declaration. In response to the declaration, Mason County has implemented a process to evaluate and develop strategies for wastewater management in the Lynch Cove/North Shore area of the

Lower Hood Canal. The Lynch Cove Delineation Study, Parcel Analysis, Enhanced Parcel Analysis and Wastewater Management Alternatives Memorandum were developed to assist the Mason County Board of Commissioners in providing direction for the Belfair sewer project and its relationship to Lynch Cove/North Shore. A working direction was defined by the Board of Commissioners to consider service to the Belfair State Park and the existing near-shore development.

Concurrent with the preparation of this document, Mason County considered a Limited Area of More Intense Rural Development (LAMIRD) Boundary Justification for the Lynch Cove/North Shore area. The LAMIRD designation would allow very limited sewer service for existing development in the Lynch Cove/North Shore area. The County has not acted on the proposal for the LAMIRD Boundary Justification for the Lynch Cove/North Shore area.

**Population Projections**

The Mason County Department of Community Development projected the Belfair UGA population for year 2025 to be 5,600. With a current population estimated at 879, this equates to an annual growth rate of 9.7%. The Lynch Cove/North Shore potential service area includes approximately 293 residential units, or an equivalent population of 750. This area lies outside the Belfair UGA and would not typically be served by a sewer system except for the need to address the severe public health hazard. Therefore, no future development within the North Shore service area will be allowed to connect to the sewer and there will be no growth component associated with the Lynch Cove/North Shore population forecast.

Table ES-1 presents the potential sewer service area population projections.

**Table ES-1**
**Potential Service Area Population Forecast**

| Year | Belfair UGA Service Population | Lynch Cove/ North Shore Service Population | Total Service Population |
|---|---|---|---|
| 2005 | 594 | 750 | 1,344 |
| 2010 | 1,041 | 750 | 1,791 |
| 2015 | 1,824 | 750 | 2,574 |
| 2020 | 3,195 | 750 | 3,945 |
| 2025 | 5,600 | 750 | 6,350 |

## Wastewater Flows and Loadings

Based on the updated population projections and new service area boundaries, it was necessary to derive new flows and loadings for the Belfair UGA and the Lynch Cove/North Shore Area. Table ES-2 presents a summary of the 20-year projections of wastewater flows and loadings for the potential service area.

**Table ES-2**
**Potential Belfair Sewer Service Area Design Flows and Loadings**

| Design Flows (mgd) | 2005 | 2010 | 2015 | 2025 |
|---|---|---|---|---|
| Average Daily | 0.18 | 0.26 | 0.40 | 1.07 |
| Maximum Daily | 0.36 | 0.52 | 0.80 | 2.14 |
| Peak Hourly | 0.63 | 1.91 | 1.40 | 3.74 |
| **Design Loadings (lbs/day)** | | | | |
| Average Daily BOD | 226 | 325 | 499 | 1,344 |
| Average Daily TSS | 226 | 325 | 499 | 1,344 |

## Alternatives

Alternatives for siting facilities, wastewater treatment and collection are evaluated in Sections 5, 6 and 7 to supplement the information presented in the Facility Plan. The evaluation of alternatives considers the current growth projections for the Belfair UGA and potential sewer service area in the Lynch Cove/North Shore area.

### *Water Reclamation Facility Siting Alternatives*

A review of potential siting alternatives for water reclamation and effluent utilization facilities to handle the flows from the potential service area was conduced. The review of siting alternatives was limited to water reclamation and slow-rate land application and treatment by spray irrigation as recommended in the Facility Plan. Land application rates and area requirements, as defined in the Facility Plan, were used in the evaluation.

Table ES-3 presents the estimated land area requirements for the potential Belfair Area Sewer System. The land area required is separated into two components, land required for irrigation and land required for the reclamation facilities.

**Table ES-3**
**Land Area Requirements**

| | 2015 Projected Flow (0.40 mgd) | 2025 Projected Flow (1.10 mgd) |
|---|---|---|
| Land Area Required for Irrigation | 33 acres | 84 acres |
| Land Area Required for Reclamation Facilities | 15 acres | 30 acres |
| Total Land Area Required | 48 acres | 114 acres |

Using updated planning criteria, a preliminary evaluation of potential land application sites surrounding Belfair was conducted by Associated Earth Sciences, Inc. (AESI). The preliminary evaluation was limited to the North Shore/Belfair area of Lower Hood Canal within Mason County. Four sites were identified in the Belfair area as potentially having adequate soil type, topography, geology/hydrogeology, and distance to surface water to site the facilities.

A preferred site was identified adjacent to the southeast corner of the Belfair UGA on property owned by Overton & Associates, in Section 33. The site was selected based on its suitability to accommodate land application of reclaimed water, proximity to the Belfair UGA and it is a managed commercial forest, compatible with the application of reclaimed water.

The expansion of the North Bay/Case Inlet (NB/CI) Water Reclamation Facility site was discussed in detail in the Facility Plan and was the second site carried forth for further evaluation. The Facility Plan identified that 34 acres are available for the expansion of the water reclamation facility and 120 acres are available for the expansion of the sprayfield.

***Treatment Alternatives***

The review of treatment alternatives within this supplemental information is limited to centralized wastewater treatment alternatives that have been identified in previous planning efforts and alternatives brought to the County's attention since the conclusion of the Facility Plan. The original Facility Plan (2001) recommended a Sequencing Batch Reactor facility near Belfair. The Facility Plan was amended in 2003 and concluded that wastewater should be conveyed to an expanded North Bay/Case Inlet facility.

The following treatment alternatives were reviewed as part of this supplemental information:

Alternative 1 – Sequencing Batch Reactor facility located near Belfair

Alternative 2 – Membrane Biological Reactor facility located near Belfair

Alternative 3 – Expansion of the North Bay-Case Inlet Reclamation Facility

Alternative 4 – Participation in the South Kitsap Industrial Area System

Normally a 20-year planning period is used to develop a Facility Plan, however, with a projected growth rate of 9.7%, planning and constructing facilities with capacity equal to the 20-year flow projections would require significant capital investment, placing an unrealistic financial burden on the initial project and customer base. In addition, sizing system components for the 20-year flow projections would create operational difficulties during start-up and initial years of service. For the initial phase of the sewer improvements the design criteria to size treatment system alternatives presented in this supplement will be based on the 10-year flow and loading projections.

The evaluation of treatment alternatives for the Belfair area based on updated design criteria resulted in the identification of two viable treatment alternatives: a membrane biological reactor adjacent to the Belfair UGA (Alternative 2) and expansion of the North Bay/Case Inlet facility (Alternative 3). The development of these two alternatives is similar to the conclusion of the Facility Plan, however treatment technologies proposed for the two alternatives significantly differ from what was presented in the Facility Plan.

***Collection System Alternatives***

Based on the potential sewer service area and wastewater flow projections, collection alternatives were evaluated. The review of collection alternatives was limited to the use of a combination of conventional gravity and low-pressure sewers as recommended in the Facility Plan. Alternatives considered the general layout of the collection and conveyance system and sizing of specific sewers, force mains and pressures sewers to accommodate build-out flow conditions in the Belfair UGA and current development in the Lynch Cove/North Shore area.

For the Belfair UGA, a collection system is proposed for the core commercial area, sized to accommodate current services and future phases extending into the UGA. Primarily, gravity sewers and pump stations will serve the core area, along the SR-3 corridor. Pressure sewers are proposed for the area south of Sweetwater Creek and for services west of SR-3 that may be down gradient of the proposed sewer. To accommodate future growth, gravity sewers and low pressure sewers are sized in accordance with Ecology guidelines, for full build-out conditions. Pump stations and force mains will be sized to accommodate the 10-year growth projections, similar to the reclamation facilities, to minimize the initial cost of the project and facilitate the proper operation of the facilities during the initial years of operation.

The shoreline homes, flat topography, stream crossings and high groundwater in the potential Lynch Cove/North Shore service area favor the use of a low-pressure sewer collection system. To ensure operation and maintenance consistency, it is recommended that a low-pressure collection system be similar to those already in service at other County maintained systems.

**Program Cost**

A summary of the updated siting, treatment, and collection alternative costs was developed. The two treatment alternatives were carried forward for further analysis, a membrane biological reactor facility near Belfair at the Overton & Associates site and expansion of the North Bay/Case Inlet facility. The costs are separated into two components: the Belfair UGA; and the Lynch Cove/North Shore service areas. Costs for the Lynch Cove/North Shore service area are dependent on the implementation of the Belfair UGA sewer system. Transmission and treatment costs for the Lynch Cove/North Shore area are incremental costs associated with the need to increase the capacity the Belfair UGA transmission and treatment components to accommodate the increase in flow from the potential Lynch Cove/North Shore service area. These incremental costs are solely for the purpose of defining costs for the Belfair UGA sewer system with and without the Lynch Cove/North Shore service area.

The estimated probable capital costs were developed and are presented in Table ES-4. These costs represent complete program costs for the installation of the sewer components as described. They account for all known costs associated with the proposed Belfair Sewer project, both public and private costs.

**Table ES-4**
**Capital Cost Summary**

| Sewer Component | Belfair MBR | North Bay-Case Inlet Expansion |
|---|---|---|
| **Belfair UGA** | | |
| Collection | $7,900,000 | $7,900,000 |
| Transmission | $3,300,000 | $9,300,000 |
| Treatment | $13,400,000 | $8,700,000 |
| **Belfair UGA Subtotal** | **$24,600,000** | **$25,900,000** |
| **Lynch Cove/North Shore** | | |
| Collection | $8,500,000 | $8,500,000 |
| Transmission (1) | $200,000 | $600,000 |
| Treatment (1) | $500,000 | $400,000 |
| **Lynch Cove/North Shore Subtotal** | **$9,200,000** | **$9,500,000** |
| **Total Capital Cost** | **$33,800,000** | **$35,400,000** |

Note:
(1) Transmission and Treatment capital costs for the Lynch Cove/North Shore area are incremental costs based on the need to increase the capacity of the Belfair UGA transmission and treatment components to accommodate the additional flow.

Annual operation and maintenance costs were developed for each alternative as well as an annualized replacement cost components. Replacement costs represent future capital expenditures associated with the replacement of equipment, systems, structures and other facilities that are at the end of their service life and have no additional value. For comparison, the 20-year present worth value of each alternative was calculated using the three costs components and is presented in Table ES-5.

**Table ES-5**
**Present Worth Summary**

| Sewer Component | Belfair MBR | North Bay-Case Inlet Expansion |
|---|---|---|
| **Belfair UGA** | | |
| Total Capital Costs | $24,600,000 | $37,500,000 |
| Annual O&M Costs | $363,000 | $356,000 |
| Annual Replacement Costs | $441,000 | $432,000 |
| **Belfair UGA 20-Yr Present Worth** | **$36,500,000** | **$37,500,000** |
| **Lynch Cove/North Shore (1)** | | |
| Total Capital Costs | $9,200,000 | $9,500,000 |
| Annual O&M Costs | $144,000 | $122,000 |
| Annual Replacement Costs | $113,000 | $120,000 |
| **Lynch Cove/North Shore 20-Yr Present Worth** | **$13,100,000** | **$13,200,000** |
| **Total 20-Year Present Worth** | **$49,600,000** | **$50,700,000** |

Note:
(1) The present worth evaluation of the Lynch Cove/North Shore presents incremental costs that are an addition to those costs of providing sewer service to the Belfair UGA.

## Plan Summary

Based on the evaluation of the viable alternatives and working direction from Mason County, a reclamation facility, using membrane technology and land application near the Belfair UGA is recommended to serve the Belfair UGA. Based on direction from the Board of Commissioners, the initial sewer service area will be limited to the Belfair UGA. Service to the Lynch Cove/North Shore area, which includes the Belfair State Park, will not be provided at this time but may be considered as a future project phase. The following are key elements of the recommended Facility Plan:

- As the initial phase of sewer service within the Belfair UGA, provide a combined gravity and low-pressure sewer system to serve the core commercial area, along SR-3, and provide facilities that can accommodate future phases as development occurs in the UGA.

- Convey collected wastewater via a transmission force main to a reclamation facility utilizing membrane biological reactor technology located adjacent to the UGA.

- Treat wastewater to Class A standards and provide effluent reuse by land application at the Belfair Water Reclamation Facility located on Overton & Associates property in Section 33.

Based on the preliminary design criteria, costs were developed for each component of the recommended plan. As presented in Table ES-4, the total capital cost of the recommended plan is approximately $24,600,000. Annual operation and maintenance (O&M) and replacement costs for the plan are approximately $363,000 and $441,000, respectively.

**Project Schedule**

It is expected that upon initiation of the design phase it will take a minimum of three years to implement this plan, 18 months to complete design, permitting and acquire easements/property and 18 months to complete construction of the proposed wastewater facilities.

**Financial Impact**

Section 11 of this supplement evaluates the financial impact of completing the capital improvements program identified. Financial Consulting Solutions Group, Inc. evaluated current and available funding sources, developed funding scenarios, identified Capital Facilities Charges and recommended a financial strategy to establish a viable utility based on the program costs presented.

Mason County has already secured grants and SRF loans toward financing the project. Table ES-6 presents a summary of those available funds.

**Table ES-6**
**Summary of Current Available Funding**

| Source | Amount |
|---|---:|
| State Revolving Fund ‘04 | $518,940 |
| State Revolving Fund ‘06 | $802,352 |
| State Revolving Fund ‘07 | $1,107,814 |
| CTED Jobs/Communities | $8,000,000 |
| CTED Jobs Development | $8,000,000 |
| CTED Grant Reduction | -($4,800,000) |
| ’08 Budget | $4,800,000 |
| **Total Committed Funding** | **$18,429,106** |

Three basic scenarios for funding the initial capital costs of the system were evaluated: Scenario 1 contemplates monthly sewer rates as the primary means of funding operations, debt repayment and capital reinvestment; Scenario 2 contemplates using Utility Local

Improvement District (ULID) assessments to fund initial construction costs, with rates paying ongoing O&M costs and capital reinvestment needs, and; Scenario 3 contemplates recovery of collection system costs through ULID assessments and treatment-related costs through monthly sewer rates.

Each Scenario represents a worse case scenario, that is no addition grants will be available and funding will be though revenue bonds and SRF/PWTF loans. The following is a summary of estimated initial annual revenue needs for the first year of operation (2010) and costs impacts on a monthly equivalent residential unit (ERU) basis.

**Table ES-7**
**Funding Scenarios**

| | Scenario 1 Rate Financing | Scenario 2 ULID Financing | Scenario 3 Rate/ULID Financing |
|---|---|---|---|
| **Annual Costs (2010)** | | | |
| Non-Capital Costs (O&M) | $415,000 | $395,000 | $405,000 |
| Debt Service | $690,000 | $725,000 | $725,000 |
| **Total Annual Costs** | **$1,105,000** | **$1,120,000** | **$1,130,000** |
| **Revenue (per ERU)** | | | |
| Monthly Rate | $141.08 | $55.12 | $106.78 |
| Monthly Assessment | | $80.76 | $34.80 |
| Financing Private Costs | $13.52 | $13.52 | $13.52 |
| **Total Monthly Impact per ERU** | **$154.61** | **$149.41** | **$155.10** |

Total impact per ERU ranges between $149 and $155 per month. Based on the worse case scenarios presented, the financial impact on the rate payers is severe. It reflects the unique financial difficulties with construction of an entirely new sewer utility, recognizing the challenges of financing and managing completion of a major construction project without an ongoing revenue source. In addition, a new utility directly faces all costs of the initial system with the corresponding cost recovery burden. In contrast, the initial cost of most collection systems is imposed on development as it occurs, and is not a cost borne through utility rates. As a result, the projected rates for a new system are dramatically higher than sewer rates in other comparable utilities, and a potential obstacle to public acceptance and affordability.

In addition to evaluating funding scenarios and associated monthly rate impacts, a Capital Facilities Charge (CFC) was calculated to determine the costs that a new connection (ERU) to the utility should pay in order to buy-in ownership of the capacity in the system. The CFC for the Belfair system has been calculated to be approximately $5,800 per ERU.

The severe monthly impact per rate payer reflects the challenges of financing the formation of a new utility and stresses the need to pursue every possible traditional and untraditional funding source available, including grants and low interest loans. The recommended

financial strategy presented in Section 11, focuses on two areas of activity: pursuit of project funding assistance; and development of a cost recovery system. Toward this end, it is recommended that the County:

- Pursue all available grant funds and low cost loans.
- Consider the use of a Utility Local Improvement District (ULID) as an equitable and secure approach to allocate and recover the capital cost of the project.
- Consider the use of short-term G.O. debt for cash management during construction and initial operations, to be repaid from utility resources.
- Develop and undertake a utility formation process that considers and evaluates utility formation issues and options and assembles a cohesive policy package for developing the utility.
- Develop sound financial policies addressing utility reserves, capital improvement and replacement funding, debt policies, rate equity, financial administration, and rate equity objectives.
- Establish and adopt appropriate ordinances and resolutions to implement a system of rates and charges and execute the financial management of the utility.

# SECTION 1

# SECTION 1
# INTRODUCTION

## Purpose

The purpose of this document is to provide supplemental information to the Belfair/Lower Hood Canal Water Reclamation Facility Plan (Facility Plan), (Gray & Osborne, 2003) amended December 2003. This includes updated information related to recent population forecasts and potential sewer service area boundary changes.

## Background

The Facility Plan was submitted to the Washington State Department of Ecology in July 2001 and was approved in March 2002. The Facility Plan was amended to further review site selection for the treatment facilities and to consider service to the Belfair State Park area to address a declaration of severe public health hazard in Lynch Cove, which was issued by the Washington State Department of Health (Appendix A). The amended Facility Plan was approved by DOE on April 15, 2004.

In general, the conclusions of the Facility Plan resulted in the following recommendations:

- Construction of a sewer system to initially serve the core commercial area of Belfair, along State Route (SR) 3 and portions of SR-300 and Old Belfair Highway.

- Construct a conveyance system to transport wastewater from Belfair to the existing North Bay/Case Inlet Water Reclamation Facility.

- Upgrade the North Bay/Case Inlet Water Reclamation Facility to accommodate the additional flow from Belfair.

- Consider extending sewer service to the Belfair State Park area to address the current declaration of severe public health hazard.

The Belfair Urban Improvements Project Feasibility Report (Feasibility Report), (Perteet/MSA, 2005), was initiated in 2004 to help Mason County and the Board of Commissioners make well-informed decisions on how to move forward with needed urban improvements in the Belfair area, including roadway, storm water and sewer improvements. As part of the Feasibility Report, recommendations in the Facility Plan were implemented to develop relevant information regarding proposed sewer system improvements and to provide planning level cost estimates. During the course of the Feasibility Report, two significant limitations were revealed in the Facility Plan:

1. Population projections in the Facility Plan for the Belfair UGA did not reflect the most recent projections developed by Mason County Department of Community Development, and;

2. The Facility Plan did not directly correlate the extension of the sewer services to the conditions that led to the declaration of a severe public health hazard. Thus, the service area surrounding the state park and shoreline areas had not been defined.

The Feasibility Report addressed these limitations by updating population projections and initiating the Lynch Cove/North Shore Sewer Service Area Delineation Study (Delineation Study), (AESI, 2005) to assist the County in defining the service area likely contributing to the severe public health hazard in Lynch Cove.

Updating the population projections and defining the sewer service area have resulted in a significant increase in the service area population and associated wastewater flows and loadings than those identified in the Facility Plan. These are significant deviations in the planning criteria that were used to develop the Facility Plan recommendations. These deviations have raised concerns regarding the validity of the conclusions of the Facility Plan, mainly the type and siting of the treatment facilities. With such significant deviations from the planning criteria, Mason County concluded that an update of portions of the Facility Plan was warranted, which is accomplished by this document.

## Approach

The Facility Plan represents a wealth of information that is still valid with respect to the planning and implementation of sewers in the Lower Hood Canal area. The supplemental information developed within this document utilizes and builds upon the previous Facility Plan work.

This document is purely supplemental in nature and will add to the information and conclusions developed in the Facility Plan to reflect the impact of the revised population projections and service area boundaries. This document shall be used in conjunction with the Facility Plan to comply with the requirements of a facility plan in accordance with Chapter 173-240 of the Washington Administrative Code (WAC).

## Scope of Work

Murray, Smith & Associates, Inc. (MSA) was retained by Mason County to provide supplemental information to the Belfair/Lower Hood Canal Water Reclamation Facility Plan. The scope of work was developed to assist the County in amending elements of the Facility Plan to reflect current wastewater planning criteria.

The following is an abbreviated scope of work to provide supplemental information to the Facility Plan:

- Define service area
- Revise population projections
- Revise wastewater flows and loadings
- Review water reclamation facility siting alternatives
- Review treatment alternatives
- Review collection system alternatives
- Summarize the cost of system alternatives
- Document results of the above items
- Public participation

**Previous Documents**

Chapter 1 of the Facility Plan provides a comprehensive list of previous documents that have been prepared pertaining to the Lower Hood Canal/Belfair area prior to the completion of the Facility Plan. The following are documents that have been prepared since completion of the latest Facility Plan amendment that have a direct bearing on sewer service in the Belfair and Lynch Cove / North Shore area:

Belfair Urban Improvements Project Feasibility Report (Feasibility Report), Perteet/MSA - March 2005

The Feasibility Report was commissioned in 2004 to help Mason County make well-informed decisions on how to move forward with needed urban improvements in the Belfair area, including roadway, storm water and sewer improvements. The Feasibility Report's Executive Summary is located in Appendix B. As part of the Belfair Urban Improvements project, the County initiated the Lynch Cove/North Shore Sewer Service Area Delineation Study (Delineation Study) to assist in defining the service area likely contributing to the severe public health hazard in Lynch Cove. The Delineation Study is discussed in greater detail in Section 2.

# SECTION 2

# SECTION 2
# SUPPLEMENT TO CHAPTER 2
# STUDY AREA ENVIRONMENT

Chapter 2 of the Facility Plan defined a study area "in order to focus discussions and analysis of water quality degradation, protection, and enhancement within the Lower Hood Canal Watershed." The area evaluated included the communities of Union, Tahuya, Belfair, and both north and south shorelines of Lower Hood Canal. The purpose of this section is to define the Belfair Sewer Service Area within the study area that will meet the needs of urban growth in Belfair and address the severe public health hazard in Lynch Cove.

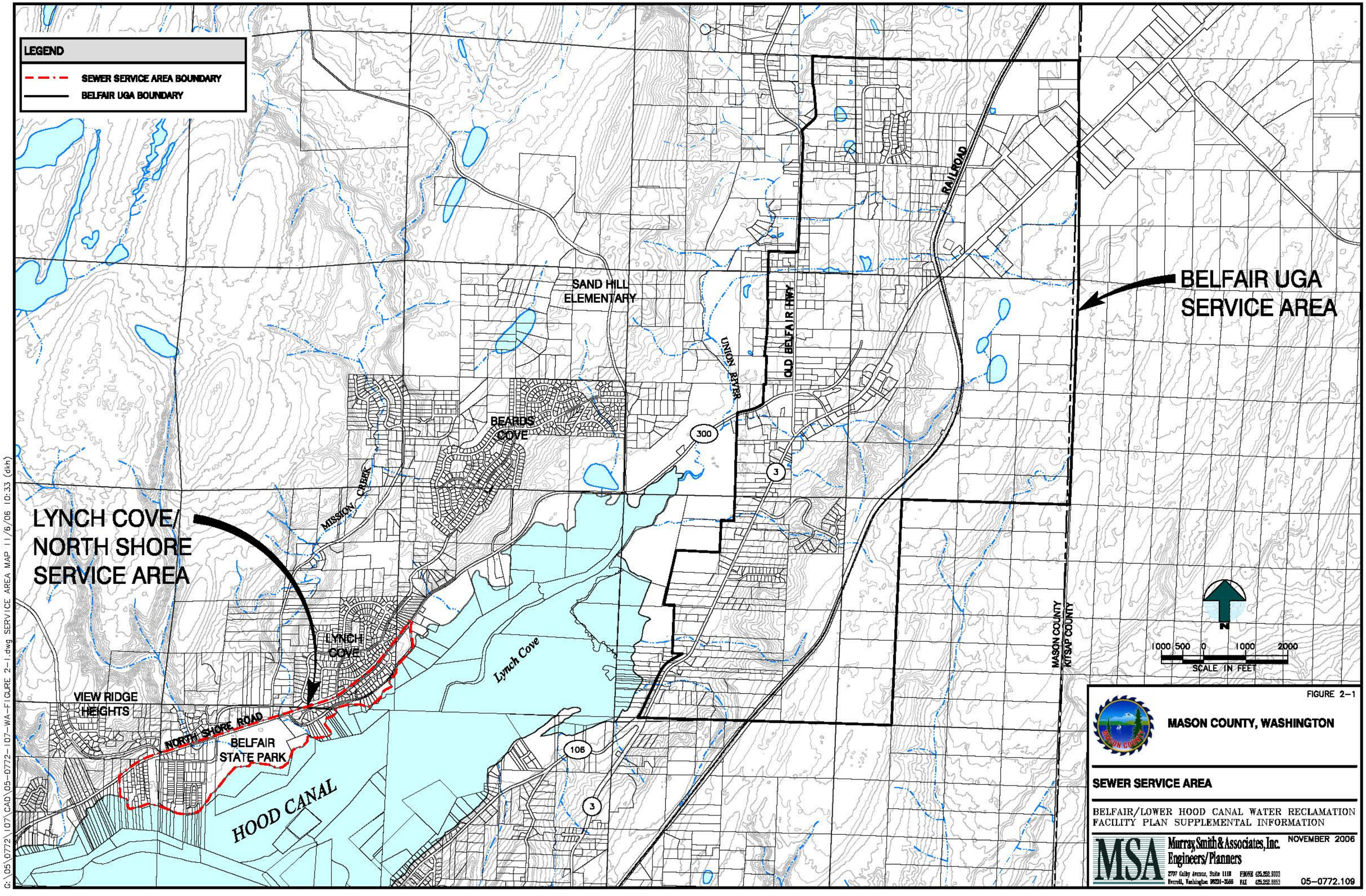
## Belfair Sewer Service Area

The proposed Belfair Sewer Service Area is comprised of two distinct areas; the Belfair Urban Growth Area and the Lynch Cove/North Shore area. A more in depth description of these two areas is presented below on the specifics of each of the two areas making up the total service area.

## Belfair Urban Growth Area

The community of Belfair is located in North Mason County at the end of Lower Hood Canal, east of the Union River. Mason County has designated the unincorporated community as an Urban Growth Area (UGA) consisting of approximately 2,400 acres. The Belfair Urban Growth Area Plan (Mason County, undated) prepared for Mason County identifies the need for sanitary sewer in Belfair as "an essential first step in upgrading water quality while accommodating growth".

As identified in the Facility Plan, the initial phase of the proposed sewer improvements will be a service area that will provide sewer service along the SR-3 corridor from the SR-106 interchange to the commercial area that includes McDonalds Restaurant (MP 36.87). Future phases of sewer improvements will extend service out into the UGA as development and local conditions require. Though only the core area will be served initially, the entire Belfair UGA will be considered in the sewer service area for planning purposes. Figure 2-1 presents the Belfair UGA Potential Service Area.


LEGEND
SEWER SERVICE AREA BOUNDARY
BELFAIR UGA BOUNDARY
BELFAIR UGA SERVICE AREA
LYNCH COVE/ NORTH SHORE SERVICE AREA
SAND HILL ELEMENTARY
BEARDS COVE
MISSION CREEK
UNION RIVER
OLD BELFAIR HWY
RAILROAD
LYNCH COVE
Lynch Cove
VIEW RIDGE HEIGHTS
NORTH SHORE ROAD
BELFAIR STATE PARK
HOOD CANAL
300
3
106
MASON COUNTY
KITSAP COUNTY
N
1000 500 0 1000 2000
SCALE IN FEET
FIGURE 2-1
MASON COUNTY, WASHINGTON
SEWER SERVICE AREA
BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION
MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
2707 Colby Avenue, Suite 1110
Everett, Washington 98201-3566
PHONE 425.252.9003
FAX 425.252.9053
NOVEMBER 2006
05-0772.109
G:\05\0772\107\CAD\05-0772-107-WA-FIGURE 2-1.dwg SERVICE AREA MAP 11/6/06 10:33 (dkh)

**Lynch Cove/North Shore Area (Belfair State Park)**

The Lynch Cove/North Shore area includes the Belfair State Park and surrounding areas west of the Belfair UGA along the north shore of Lynch Cove of the Hood Canal. The area is characterized as rural with pockets of high density development. The lowland and shoreline areas encompass the State Park and shoreline residences. Large portions of the upland and steep slope areas, particularly the stream channels and erosional gullies, are densely wooded. SR 300, also called North Shore Road, extends from east to west along the coastal lowlands. The area is zoned Rural Residential 5 (minimum 5 acre parcels), though lot sizes are generally much smaller as a result of plats created prior to the enactment of the Growth Management Act (GMA) and County zoning requirements. Lots smaller than 7,000 square feet are common.

The Washington State Department of Health declared a severe public health hazard in the Lynch Cove area of Lower Hood Canal on March 6, 2002 (see Appendix A). In response, the Facility Plan identified extending service to the Belfair State Park and surrounding shoreline areas as part of the initial, or a future phase, of the Belfair Sewer Improvements. The Plan identified an area limited to 155 dwellings, 7 commercial businesses and the Belfair State Park.

In the Facility Plan, there was no direct correlation between the proposed extension of sewer services to the area and the conditions that led to the declaration of a severe public health hazard. The Facility Plan focused on the Belfair State Park and shoreline area residences as the primary contributors to the degradation of water quality in Lower Hood Canal, but there was no basis for this conclusion. As a result, Mason County implemented a process to evaluate and develop strategies for wastewater management in the Lynch Cove/North Shore area of the Lower Hood Canal. The following is an overview of that process.

*Lynch Cove/North Shore Sewer Service Area Delineation Study*

In conjunction with the Belfair Urban Improvements Feasibility Report initiated in 2004, Mason County authorized the Lynch Cove/North Shore Sewer Service Area Delineation Study (Delineation Study), Appendix C, prepared by Associated Earth Sciences, Inc (AESI). The purpose of the Delineation Study was to evaluate the potential of on-site septic systems in the Lynch Cove/North Shore area to contribute to the conditions that have led to the declaration of a severe public health hazard. In general, the study considered the potential for fecal coliform bacteria to reach Lynch Cove from on-site wastewater systems.

The Study focused on characterizing site conditions relative to their suitability for on-site wastewater disposal and potential impacts to water quality within the Lower Hood Canal. The following factors were taken into account: effects of soil type/septic suitability, density, proximity to surface water, depth to ground water, and slope of the ground surface. Each potential factor was given a score to develop a Potential Impact Matrix. The matrix was used to define areas of “unlikely”, “possible”, or “probable” chances of septic effluent to degrade water quality in Lynch Cove and the Hood Canal. The Washington State Department of

Health (DOH), Washington State Department of Ecology (DOE) and Mason County Department of Health participated in the Delineation Study in the development of the evaluation criteria and overall review of the document.

Figure 2-2 presents the Delineation Study results on the Potential Impact Map. The map identifies three levels; unlikely potential impact (green), possible potential impact (yellow) and probable potential impact (red).

*Parcel Analysis*

Mason County prepared a parcel overlay for the Lynch Cove/North Shore area to provide a better understanding of current densities and potential future development based on current zoning and environmental/geographical constraints, steep slopes, wetlands, etc. The Parcel Analysis conducted by Mason County revealed that nearly 85% of the parcels in the area are currently developed with approximately 200 buildable vacant parcels remaining.

*Enhanced Parcel Analysis*

Adolfson Associates, Inc. (Adolfson) prepared an Enhanced Parcel Analysis of the North Shore Area of Mason County in April 2006, Appendix D. The purpose of this analysis was to review potential scenarios for wastewater management in the North Shore area and to characterize the full range of environmental impacts associated with their implementation. The scenarios evaluated were:

- Service by individual on-site systems
- Service by a centralized sewer system; flows would be collected and transported to a wastewater treatment facility to serve the region.
- Service by a combination of clustered (community) and individual on-site systems.
- A combination of centralized sewer and on-site systems. Sewers would be provided in areas determined to be unsuitable for on-site systems and community or individual on-site systems would be used in areas determined to be potentially suitable.

The scenarios were evaluated in terms of their potential effectiveness for pollutant removal, particularly nitrogen removal as well as bacterial removal, other environmental impacts, operational and maintenance facilities, effects on future development, comparative cost and policy implications. In addition to reviewing environmental impacts associated with the four scenarios, Adolfson characterized potential buildout for each of the four scenarios.

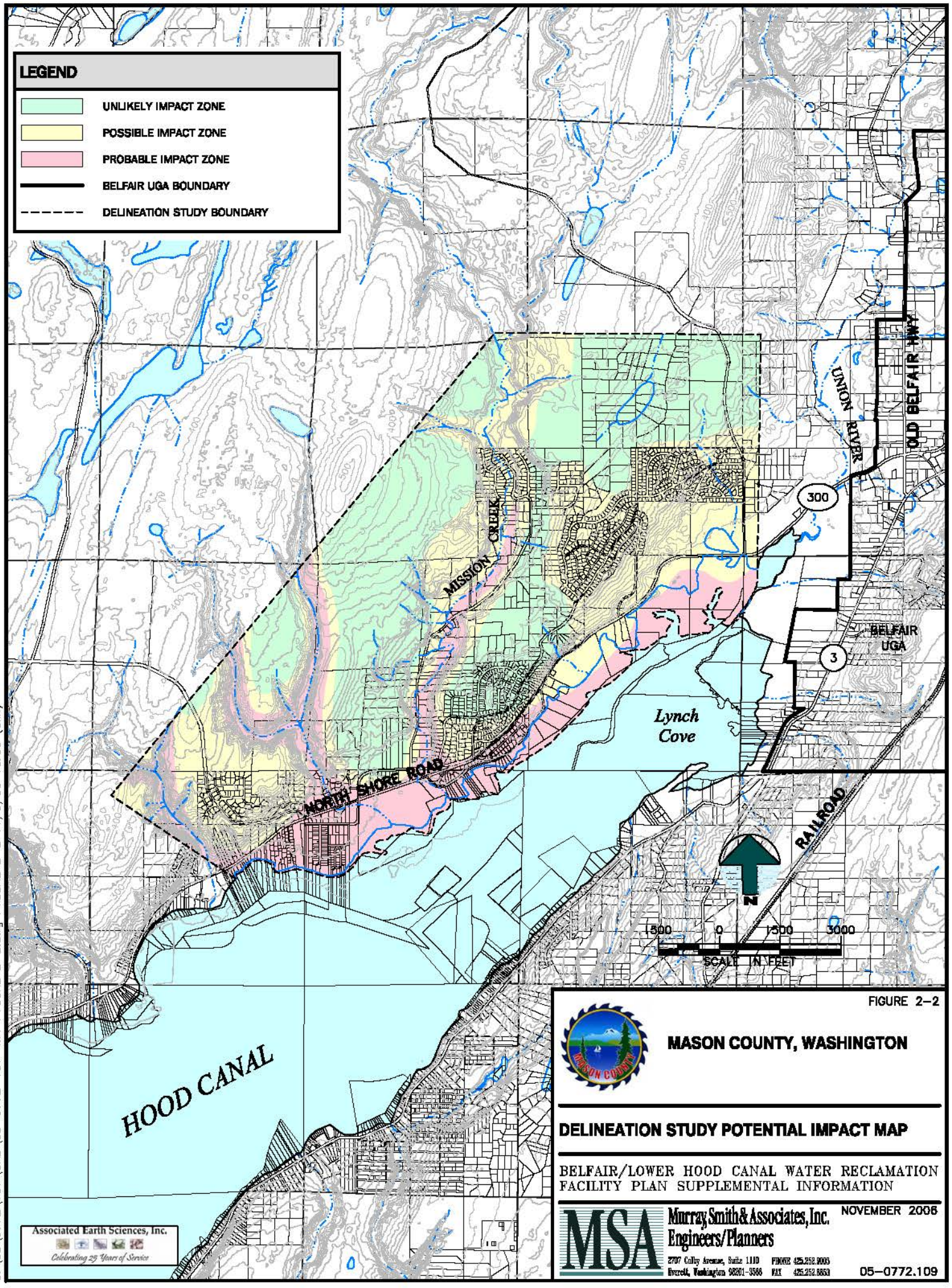



FIGURE 2–2

**MASON COUNTY, WASHINGTON**

**DELINEATION STUDY POTENTIAL IMPACT MAP**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

MSA
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NOVEMBER 2006

05–0772.109

G:\05\0772\107\CAD\05-0772-107-WA-FIGURE 2-2.dwg FIGURE 2-2 11/6/06 10:36 (dkh)

*Wastewater Management Alternatives Memorandum*

Building upon the previous documents, Murray, Smith & Associates, Inc. (MSA) prepared a technical memorandum to present an evaluation of wastewater management scenarios for the North Shore area (Appendix E). The wastewater management scenarios presented in the Enhance Parcel Analysis were further evaluated to consider type of system, installation capital costs and operation/maintenance/replacement costs. The technical memorandum concluded that there is a wide range of probable costs for the implementation of the various wastewater management scenarios. The range of costs for on-site and cluster systems varied considerably, reflecting the uncertainty associated with individual site conditions. Costs for a centralized sewer system were less dependent on specific site conditions and can be better defined.

*Mason County Directive*

The Delineation Study, Parcel Analysis, Enhanced Parcel Analysis and Wastewater Management Alternatives Memorandum were used by Mason County to assist the Board of Commissioners in providing direction for the Belfair sewer project and its relationship to Lynch Cove/North Shore. Upon consideration of the information, the Commissioners provided staff with a working direction for the continued planning for the Belfair Sewer System (Appendix F). The following is a summary of the working direction provided by the Commissioners.

- Provisions should be made for treatment and conveyance to accommodate flows from the Mission Creek Correctional Facility at some appropriate location on the Belfair UGA Boundary.

- Provisions should be made to handle limited wastewater flows from the Belfair State Park and other near-shore existing development. Specifically:

    - Consider provisions to handle wastewater from the Belfair State Park.

    - Provide for flows from existing developed near-shore structures. Near-shore meaning existing development that is within the “red zone” (Delineation Study, Figure 2-2), not including lower elevation fingers of the “red zone”.

    - Work with state agencies to determine what justification is needed to make these viable options, prepare an approach for gathering data for the Commission to make final decisions, develop approaches for suitable connection policies and implications for undeveloped near-shore parcels.

*Limited Areas of More Intense Rural Development (LAMIRD) Boundary Justification*

Concurrent with the preparation of this document, Mason County considered a Limited Areas of More Intense Rural Development (LAMIRD) Boundary Justification for the Lynch Cove/North Shore area. LAMIRDs are areas within unincorporated rural areas that have been developed prior to the Growth Management Act (GMA) at densities too intense to be considered rural development. GMA allows for LAMIRDs, including the provisions for public facilities and services to rural development. The LAMIRD designation would allow sewer service for existing development in the Lynch Cove/North Shore area. The County has not acted on the proposal for the LAMIRD Boundary Justification for the Lynch Cove/North Shore area.

# SECTION 3

# SECTION 3
# SUPPLEMENT TO CHAPTER 3
# LAND USE AND POPULATION

This section will supplement population information in Chapter 3 of the Facility Plan with updated growth numbers based on recent projections provided from Mason County's Department of Community Development.

Accurate growth numbers for the proposed and future service populations for the Belfair UGA and potential Lynch Cove/North Shore areas are necessary in order to develop wastewater flows and loads for the planning and design of wastewater collection, pumping and treatment facilities.

## Belfair Urban Growth Area

Population projections for the Belfair UGA are based on updated growth numbers provided by Mason County Department of Community Development. According to the Draft Supplemental Environmental Impact Statement for the Proposed Belfair Urban Growth Area Plan and Development Regulations (SEIS), June 2004, the current population within Belfair UGA is approximately 900. However, the service population served by the initial proposed sewer improvements is significantly less, since this phase will only serve the SR-3 corridor (Belfair Commercial Area), not the entire UGA. Based on the projections in the Facility Plan, the initial service population is approximately 594 people in 2005.

The Mason County Department of Community Development projected the Belfair UGA population for year 2025 to be 5,600. With a current population estimated at 879, this equates to an annual growth rate of 9.7%. It is anticipated that the build-out of sewers will be necessary to achieve these projected population values and, therefore, by year 2025, the majority of the UGA will have sewer service and the population served by the sewer system will equal the population of the UGA.

Using a uniform growth rate to the year 2025, population projections were calculated in five-year increments for the sewer service population and are presented in Table 3-1. This uniform growth rate represents the projected annual growth rate in the UGA, 9.7%, plus extending service to existing residents that will not be served by the initial phase of the sewer improvements.

**Table 3-1**
**Belfair UGA Sewer Service Population Forecast Summary**

| Year | Service Population |
|---|---|
| 2005 | 594 |
| 2010 | 1,041 |
| 2015 | 1,824 |
| 2020 | 3,195 |
| 2025 | 5,600 |

## Lynch Cove/North Shore Area

The Facility Plan identified a sewer expansion to the Belfair State Park area along SR-300 to serve the park and shoreline residents. A total of 155 existing residential units were identified in this service area equating to a service population of 396 - Mason County Department of Community Development assumes 2.56 people per dwelling unit for planning purposes. The State Park is assumed to have 69 equivalent residential units (ERU's).

As discussed in Section 2, the Mason County Board of Commissioners have provided working direction to consider sewer service to the majority of the probable impact area, or "red zone", the area with the highest probability of adversely impacting the water quality in Hood Canal. Based on the Commissioners' directive, there are approximately 293 ERU's in the North Shore's potential service area, plus 69 ERU's for the Belfair State Park.

Mason County's Department of Community Development was consulted regarding the growth projections for the Lynch Cove/North Shore area. It was determined that the best way to determine growth projections for the North Shore area was by evaluating building permit statistics instead of using the County's growth rate projection of 3.15%.

Table 3-2 presents the new home building permit statistics obtained from Mason County for the area. The number of building permits issued during 2000 to 2004 was subtracted from the current number of residential dwellings to obtain an average growth rate for the North Shore area for the five year period.

**Table 3-2**
**Lynch Cove/North Shore New Home Building Permits Issued 2000-2004**

| Year | New Construction Building Permits Issued |
|---|---|
| 2000 | 18 |
| 2001 | 16 |
| 2002 | 28 |
| 2003 | 27 |
| 2004 | 26 |
| **Total** | **115** |

During the 2000 – 2004 period, 115 new home building permits were obtained in the Lynch Cove/North Shore area. From the Mason County tax rolls there were 1,134 lots with residential dwellings constructed on them in the Lynch Cove/North Shore area. This results in an average annual growth rate of 2.16%.

As discussed above, the Lynch Cove/North Shore potential service area includes approximately 293 residential units, or an equivalent population of 750, predominantly along the shoreline of the Hood Canal. This area lies outside the Belfair UGA and would not typically be served by a sewer system except for the need to address the severe public health hazard. Sewer service to this area and will serve existing residences (refer to Section 2), no future development within the North Shore service area will be allowed to connect to the sewer. Because of this, there will be no growth component associated with the Lynch Cove/North Shore population forecast.

**Potential Service Area Population**

The estimated population in 2025 for the Belfair UGA and the potential Lynch Cove/North Shore service area is 6,350. Population estimates for the potential service area are presented in Table 3-3 in 5-year intervals.

**Table 3-3**
**Potential Service Area Population Forecast**

| Year | Belfair UGA | Lynch Cove/ North Shore | Total Population |
|---|---|---|---|
| 2005 | 594 | 750 | 1,344 |
| 2010 | 1,041 | 750 | 1,791 |
| 2015 | 1,824 | 750 | 2,574 |
| 2020 | 3,195 | 750 | 3,945 |
| 2025 | 5,600 | 750 | 6,350 |

# SECTION 4

# SECTION 4
# SUPPLEMENT TO CHAPTER 4
# WASTEWATER FLOWS AND LOADINGS

## Wastewater Flows and Loadings

This section updates the Wastewater Flows and Loading presented in the Facility Plan utilizing the updated service area boundaries and population projections presented in Sections 2 and 3, respectively.

In Chapter 4 of the Facility Plan, per capita sewage flows and organic loadings were calculated based on Washington State Department of Ecology's (DOE) Criteria for Sewage Works Design. The average day wastewater flow and loadings were defined in three separate components: domestic flow, infiltration and inflow (I&I), and commercial/industrial. Domestic and I&I flow contributions were defined as 65 gallons per day and 15 gallons per day (gpd), respectively. Commercial and industrial flows and loadings were calculated specifically for the Belfair area and will be used as presented in the Facility Plan. As in the Facility Plan, the average daily flow was used with a peaking factor of 2.0 to calculate maximum daily flows and a peaking factor of 3.5 to calculate peak hourly flow.

Wastewater flows and loadings for the potential sewer service area will be based on the same per capita flow rates and loadings calculated in the Facility Plan. Population growth for the Belfair UGA will be as presented in Section 3. There is no growth component to the Lynch Cove/North Shore service area, because sewer system improvements will be sized only for the service area defined in Section 2 and will not accommodate future development in the service area or other existing development in the Lynch Cove/North Shore area.

## Wastewater Projections

Tables 4-1 and 4-2 present wastewater and loading projections for the Belfair UGA and Lynch Cove/North Shore potential sewer service areas.

**Table 4-1**
**Belfair UGA and Lynch Cove/North Shore Sewer Service Area Population and Average Flow Projections**

| | 2005 (Immediate) | | | 2010 (5 yr.) | | | 2015 (10 yr.) | | | 2025 (20 yr.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Population | Flow Units gpd (1) | Total Flow gpd | Population | Flow Units gpd (1) | Total Flow gpd | Population | Flow Units gpd (1) | Total Flow gpd | Population | Flow Units gpd (1) | Total Flow gpd |
| **Belfair Sewer Projections within UGA** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Domestic | 594 | 65 | 38,610 | 1,041 | 65 | 67,665 | 1,824 | 65 | 118,560 | 5,600 | 65 | 364,000 |
| I/I | 594 | 15 | 8,910 | 1,041 | 15 | 15,615 | 1,824 | 15 | 27,360 | 5,600 | 15 | 84,000 |
| Comm/Ind (2) | | | 56,486 | | | 99,548 | | | 175,437 | | | 544,881 |
| | | | | | | | | | | | | |
| Sub-Total | | | 104,006 | | | 182,828 | | | 321,357 | | | 992,881 |
| | | | | | | | | | | | | |
| **Lynch Cove/North Shore** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Domestic (3) | 750 | 65 | 48,750 | 750 | 65 | 48,750 | 750 | 65 | 48,750 | 750 | 65 | 48,750 |
| I/I | 750 | 15 | 11,250 | 750 | 15 | 11,250 | 750 | 15 | 11,250 | 750 | 15 | 11,250 |
| Comm/Ind (4) | | | 1,435 | | | 1,435 | | | 1,435 | | | 1,435 |
| State Park | | | 14,811 | | | 14,811 | | | 14,811 | | | 14,811 |
| | | | | | | | | | | | | |
| Sub-Total | | | 76,246 | | | 76,246 | | | 76,246 | | | 76,246 |
| | | | | | | | | | | | | |
| **Total Average Daily Flow** | | | **180,252** | | | **259,074** | | | **397,603** | | | **1,069,127** |
| **Maximum Daily Flow (5)** | | | **360,504** | | | **518,148** | | | **795,206** | | | **2,138,254** |
| **Peak Hourly Flow (6)** | | | **630,882** | | | **906,759** | | | **1,391,611** | | | **3,741,945** |

**Notes:**
(1) Unit flow rates as defined in the Belfair/Lower Hood Canal Facility Plan, amended 12/2003, Page 4-10, Table 4-6. Presented as gallons per day (gpd).
(2) Commercial/Industrial flows as calculated in the Belfair/Lower Hood Canal Facility Plan, amended 12/2003, Page 4-19, Table 4-12.
(3) North Shore population does not include a growth projections component.
(4) Commercial/Industrial flows for 2005 as calculated in the Belfair/Lower Hood Canal Facility Plan, amended 12/2003, Page 4-19, Table 4-12.
(5) Based on a Peaking Factor of 2.0 and the Average Daily Flow, Belfair/Lower Hood Canal Facility Plan, amended 12/2003, Page 4-22.
(6) Based on a Peaking Factor of 3.5 and the Average Daily Flow, Belfair/Lower Hood Canal Facility Plan, amended 12/2003, Page 4-22.

**Table 4-2**
**Belfair UGA and Lynch Cove/North Shore Sewer Service Area Population and Wastewater Load Projections**

| | 2005 (Immediate) | | | 2010 (5 yr.) | | | 2015 (10 yr.) | | | 2025 (20 yr.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Population | Unit Rates TSS & BOD lb/d (1) | Load TSS & BOD lb/d | Population | Unit Rates TSS & BOD lb/d (1) | Load TSS & BOD lb/d | Population | Unit Rates TSS & BOD lb/d (1) | Load TSS & BOD lb/d | Population | Unit Rates TSS & BOD lb/d (1) | Load TSS & BOD lb/d |
| **Belfair Sewer Projections within UGA** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Domestic | 594 | 0.2 | 119 | 1,041 | 0.2 | 208 | 1,824 | 0.2 | 365 | 5,600 | 0.2 | 1,120 |
| Comm/Ind (2) | | | 143 | | | 252 | | | 444 | | | 1,379 |
| | | | | | | | | | | | | |
| Sub-Total | | | 262 | | | 460 | | | 809 | | | 2,499 |
| | | | | | | | | | | | | |
| **Lynch Cove/North Shore** | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Domestic | 750 | 0.2 | 150 | 750 | 0 | 150 | 750 | 0.2 | 150 | 750 | 0.2 | 150 |
| Comm (2) | | | 4 | | | 4 | | | 4 | | | 4 |
| State Park | | | 35 | | | 35 | | | 35 | | | 35 |
| | | | | | | | | | | | | |
| Sub-Total | | | 189 | | | 189 | | | 189 | | | 189 |
| | | | | | | | | | | | | |
| **Total Average Daily Loadings** | | | **451** | | | **649** | | | **998** | | | **2,688** |

**Notes:**

(1) Unit flow rates for Total Suspended Solids (TSS) and Biological Oxygen Demand (BOD) as defined in the Belfair/Lower Hood Canal Facility Plan, amended 12/2003, Page 4-10, Table 4-6. Presented in pounds per day (lb/d).

(2) Commercial/Industrial loadings as calculated in the Belfair Lower Hood Canal Facility Plan, amended 12/2003, Page 4-20, Table 4-13.

## Additional Wastewater Flow Consideration

*Mission Creek Corrections Center for Women*

The Mission Creek Corrections Center for Women is located approximately 3.5 miles north of SR-300 on Sand Hill Road. Wastewater flows will be estimated for this facility as it is a potential service area for the Belfair Sewer System. The current capacity of the on-site septic system located at the Mission Creek Corrections Center is approximately 14,000 gpd serving a maximum of 120 offenders. This equates to approximately 117 gpd per offender which is similar to the design guidelines for prison facilities recommended by the Environmental Protection Agency (EPA) of 119 gpd per offender. The Mission Creek Corrections Center is planned to expand to a capacity of 300 offenders by 2011. Based on an assumption of 119 gpd per offender, wastewater flows are estimated to be 36,000 gallons per day.

# SECTION 5

# SECTION 5
# SUPPLEMENT TO CHAPTER 9
# WATER RECLAMATION FACILITY SITING ALTERNATIVES

Chapter 9 of the Facility Plan reviewed potential siting alternatives for water reclamation and effluent utilization facilities to handle the flows from the Belfair/Lower Hood Canal study area. The purpose of this section is to review siting alternatives for the proposed reclamation facility based on the criteria established in the Facility Plan and the updated planning criteria defined within this supplemental information document.

The review of siting alternatives is limited to water reclamation and slow-rate land application and treatment by spray irrigation as recommended in the Facility Plan.

## Land Area Requirements

The criteria to determine land area requirements for land application practices was established in the Facility Plan, Chapter 8 and Appendices I and J, and are summarized below.

- Limiting hydraulic loading rate to be 74.83 inches/month based on the EPA's water balance equations presented in the Process Design Manual: Land Treatment of Municipal Wastewater and the following assumptions:
    - Mean precipitation data from Grapeview Weather Station = 52.21 inches/year (7 miles SE of Belfair – close to NB/CI site) increased to match DNR data for the area = 61 inches/year, then increased an additional 15% to estimate a 10-year return period = 70.0 inches/year
    - Percolation rate of 4% (conservative)
    - Operating sprinklers for 12 hours per day max
- Limiting nitrogen loading rate to be 55.29 inches/month based on the following assumptions:
    - 7.83 mg/L designed N concentration from WRF
    - Potential for Evapotranspiration from Irrigation Requirements for Washington – Estimates and Methodology Agricultural Research Center Washington State University, Research Bulletin XB 0925 1982
    - Nitrogen uptake estimates for Douglas Fir Forest – EPA recommendations
    - Operating sprinklers for 12 hours per day, maximum.

- Land area requirements will include a factor of three (3) to allow areas to rest for two days and an additional 25% to account for irregularities at the sites.

The Facility Plan determined that the limiting factor to land application of reclaimed water in this region is based on the nitrogen uptake in the soil and vegetation. The limiting application rate was calculated to be 55.29 inches/month (1.83 inches/day) based on the EPA's water balance equations presented in the Process Design Manual: Land Treatment of Municipal Wastewater.

Table 5-1 presents the estimated land area requirements for the potential Belfair Area Sewer System based on the criteria above and the average design flow defined in Section 4. The land area required is separated into two components, land required for irrigation and land required for the reclamation facilities, which is discussed in greater detail in the following section.

**Table 5-1**
**Land Area Requirements**

| | 2015 Projected Flow (0.40 mgd) | 2025 Projected Flow (1.10 mgd) |
|---|---|---|
| Land Area Required for Irrigation | 33 acres | 84 acres |
| Land Area Required for Reclamation Facilities | 15 acres | 30 acres |
| Total Land Area Required | 48 acres | 114 acres |

## Siting Considerations

The Facility Plan evaluated potential land application sites in the Lower Hood Canal area with respect to the following criteria:

- Soils type
- Topography
- Geology/Hydrogeology
- Proximity to development and surface waters
- Land use
- Assessor maps
- Tax records reflecting parcel size and ownership

- Forest areas
- Availability of water and power

The Facility Plan concluded that two sites had potential for land application of reclaimed water, one being the expansion of the North Bay/Case Inlet Facility and the second being on property located southeast of the Belfair UGA in Section 33. This site is located on land owned by Overton & Associates.

With the increase in wastewater flow projections for the Belfair service area from what was presented in the Facility Plan, land area requirements have significantly increased (Table 5-1). Using these updated planning criteria, a preliminary evaluation of potential land application sites surrounding Belfair was conducted by Associated Earth Sciences, Inc. (AESI). The preliminary evaluation was limited to the North Shore/Belfair area of Lower Hood Canal within Mason County.

The evaluation included a review of the siting alternatives and supporting documentation presented in the Facility Plan as well as a review of current documentation and information available for the Belfair area. The evaluation considered the suitability of land for the application of wastewater based on five physical parameters; soil type, topography, geology/hydrogeology, distance to surface water and parcel size. A copy of the Technical Memorandum is presented in Appendix G. Figure 5-1 presents the sites identified as potential sites for land application of reclaimed water within close proximity to the Belfair area.

**Possible Sites for Land Application (Belfair Area)**

Four sites were identified in the Belfair area as having adequate soil type, topography, geology/hydrogeology, and distance to surface water. These potential land application sites are shown in Figure 5-1 and briefly described below.

*Washington State DNR (Areas 1 & 2)*

Two sites that appear to be suitable for land application of reclaimed water were identified on lands owned Washington State Department of Natural Resources (DNR). These sites are located west of the Belfair UGA and upland from the North Shore area of Lower Hood Canal.

One site, identified as Area 1, was also identified as a potential land application site in the Facility Plan. The Tahuya Track covers a large area that drains into Mission Creek, Little Mission Creek and Stimson Creek basins. The Tahuya Track is open to the public and offers extensive off-road vehicle trails that are maintained by DNR. The Tahuya Track was eliminated from consideration in the Facility Plan due to current uses of the track, third-party users and DNR's reluctance to commit to this use of the property as identified in the Facility Plan.

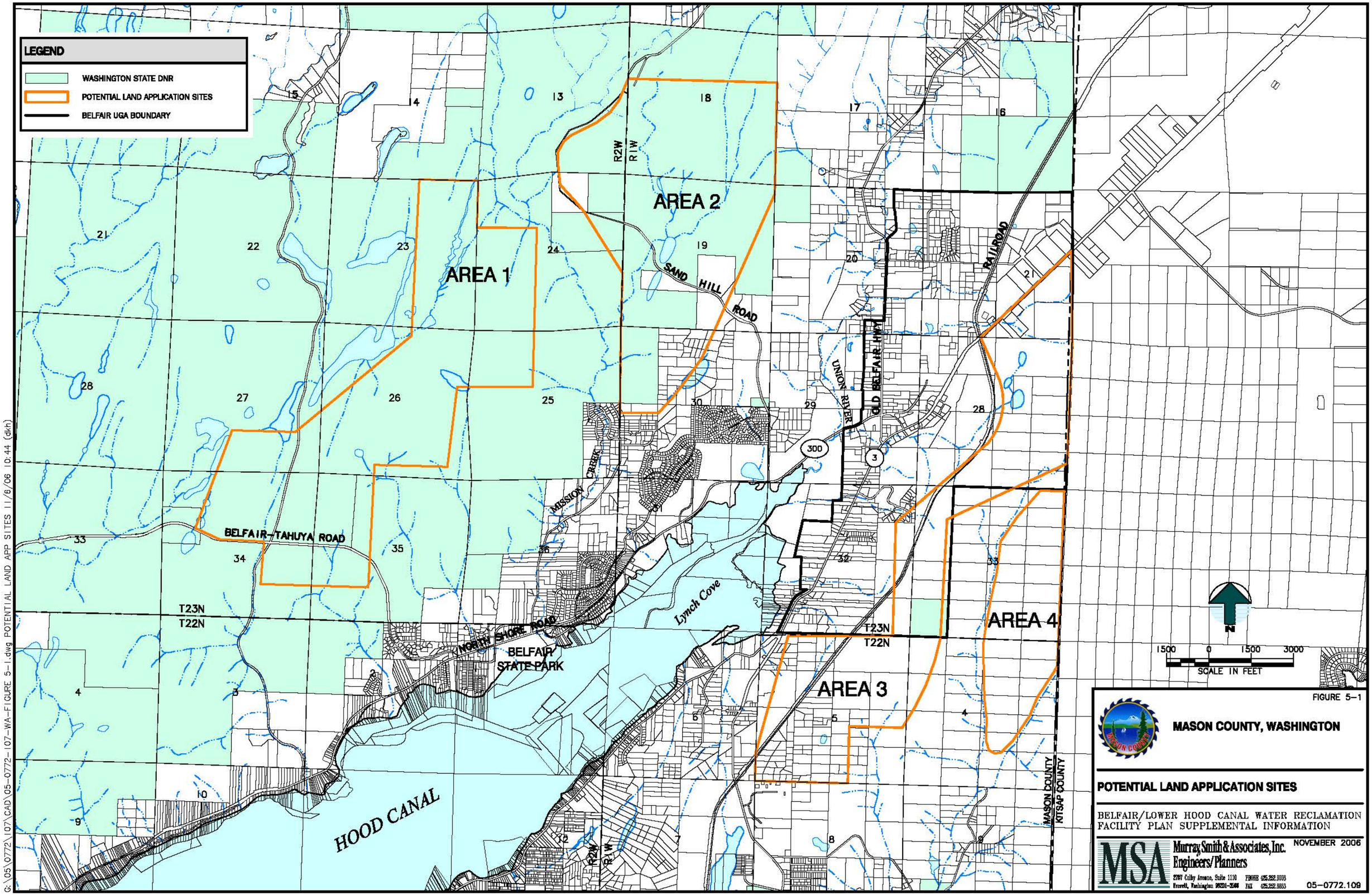


FIGURE 5-1

MASON COUNTY, WASHINGTON

POTENTIAL LAND APPLICATION SITES

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

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PHONE 425.252.9005 FAX 425.252.9055

NOVEMBER 2006

05-0772.109

G:\05\0772\07\CAD\05-0772-107-WA-FIGURE 5-1.dwg POTENTIAL LAND APP SITES 11/6/06 10:44 (dkh)

In addition to the conditions stated in the Facility Plan, Area 1, the Tahuya Track, is a significant distance from the Belfair UGA and will require a sewer force main to convey wastewater from the Belfair UGA to the site. The force main will pass through the rural North Shore area of the Lower Hood Canal, a practice that is not desirable from a Growth Management perspective.

Area 2, also located on DNR property, is northwest of the Sand Hill Elementary School. This site lies between the Mission Creek and Union River basins. Although this location was not identified in the Facility Plan, it is similar to the Tahuya Track with respect to land use and proximity to the Belfair UGA. Like the Tahuya Track, this location will also require a sizable force main located through rural North Shore.

*Belfair/South Belfair (Area 3)*

An area located within the Belfair UGA and south was also identified as having favorable site conditions for land application of reclaimed water. This area is located upland, east of SR 3 and the railroad. The majority of this area drains into the Lower Hood Canal watershed; however the southern portion of Area 3 drains south into the North Bay watershed.

The portion of Area 3 that lies within the Belfair UGA is not compatible with the practice of land application of reclaimed water because it is zoned for urban development. The portion of Area 3 that is directly south of the Belfair UGA has multiple land owners and a significant number of residents. There are also a number of water supply wells in the area. Given the extent of land required for the water reclamation facility, this location does not have sufficient area to accommodate the proposed facilities due to the density of existing development.

*Overton & Associates - Section 33 (Area 4)*

An area located adjacent to the Belfair UGA, to the southeast was identified as having favorable conditions for land application of reclaimed water. This area was also identified in the Facility Plan as the Overton & Associates site and is located in Section 33, outside the Belfair UGA. This area is a managed commercial forest owned by Overton and Associates and is restricted from general public access.

The Facility Plan identified this area as being approximately 50% second growth with portions of the area replanted within the past ten years. No groundwater wells are located in this Section. Defining features in Area 4 are the BPA power lines and Cascade Natural Gas easements running diagonal across the site. The area sits between Coulter Creek, to the east, and a tributary to Coulter Creek to the west. Coulter Creek flows through the eastern third of Section 33 which flows into North Bay 2 ½ miles to the south. The State operates a fish hatchery at the mouth of this stream.

Previous discussions with Overton & Associates have indicated a favorable response to the use of this area for a water reclamation site, as identified in the Facility Plan. Recent discussions with Overton and Associates continue to show similar response and a desire to work with the County to determine the best use of reclaimed water with forest management.

**Recommended Alternative**

A review of potential land application sites for reclaimed water was conducted by County staff and Commissioners. A working direction was established based on the review of alternatives and the recommendation of the Consultant. The preferred land application site in the Belfair area is the Overton & Associates site (Area 4). The preference of the Overton & Associates site is based on the following:

- Suitability – Based on the preliminary evaluation conducted by AESI, the Overton & Associates site appears to have favorable conditions for the land application of reclaimed water. This was also the conclusion of the Facility Plan for application sites near the Belfair UGA.

- Proximity – The Overton & Associates site is adjacent to the Belfair UGA, in close proximity to current and future development. The initial installation of sewers, as well as future phases, will be limited to areas within the Belfair UGA. Conveying wastewater outside the UGA through rural areas to reach the reclamation facility will not be required.

- Land Use – The preferred land application site is a managed commercial forest, compatible with the application of reclaimed water. The owner is willing to work with the County and forest managers to maximize the beneficial use of the reclaimed water.

**Expanded North Bay - Case Inlet Water Reclamation Facility**

The expansion of the North Bay/Case Inlet (NB/CI) Water Reclamation Facility site was discussed in detail in the Facility Plan and was the second site carried forth for further evaluation. The Facility Plan identified that 34 acres are available for the expansion of the Water Reclamation Facility, primarily for raw and reclaimed water storage. In addition, 120 acres are available for the expansion of the sprayfield on adjacent properties owned by Cascade Natural Gas.

The Facility Plan identified sufficient area at the NB/CI facility to accommodate expansion to serve the Belfair service area. Therefore, no additional evaluation of the NB/CI site was conducted as part of this supplemental information.

## Summary

The review of potential siting alternates for the land application of reclaimed water in the Belfair area was primarily triggered by the increased wastewater flow projections from the Belfair service area. The evaluation concluded with a working direction from the Mason County Board of Commissioners that preferred the Overton & Associates site, Area 4, adjacent to the Belfair UGA. As discussed, the Facility Plan concluded that sufficient area is available at the NB/CI site to accommodate expansion and no additional evaluation of that site was conducted.

The alternatives evaluated in this section were based on the most accurate existing information available. As noted in the Facility Plan, as the project proceeds into the design phase detailed site investigations and studies must be conducted in order to fully evaluate the feasibility of the Overton & Associates site. A significant amount of work has already been completed at the existing NB/CI facility. If the site is to be expanded, additional studies and site specific evaluation will also need to be conducted.

Both the Overton & Associates site and the expansion of the NB/CI site appear to be adequate for the siting of water reclamation and effluent utilization facilities based on the preliminary evaluations herein and in the Facility Plan. However, the determination of the most feasible and effective location for such facilities is not just limited to the adequacy of the sites, conveyance and treatment requirements and alternatives will also play a significant role in the determination of the location and type of water reclamation and effluent utilization facilities, as discussed in the following section.

# SECTION 6

# SECTION 6
# SUPPLEMENT TO CHAPTER 10
# TREATMENT ALTERNATIVES

Chapter 10 of the Facility Plan identified and evaluated different management options for wastewater treatment in the Belfair/Lower Hood Canal study area. The Facility Plan considered centralized treatment alternatives for the entire Lower Hood Canal service area as well as the Belfair area that included producing Class A reclaimed water for land application.

For the immediate Belfair area the Facility Plan evaluated alternatives that included an activated sludge treatment facility near Belfair or the expansion of the existing North Bay/Case Inlet (NB/CI) Water Reclamation Facilities. The original Facility Plan recommended a Sequencing Batch Reactor (SBR) and land application of reclaimed water on the Overton and Associates site east of Belfair. The Facility Plan was amended in 2003 and concluded that wastewater should be conveyed to an expanded NB/CI facility.

Since the approval of the amended Facility Plan, population growth figures have changed and the sewer service area has been refined as defined in Section 2. Wastewater flow and loading projections have been updated to reflect current population growth projections and potential service area. This section will reevaluate treatment alternatives for the Belfair area based on updated design criteria and will focus exclusively on the alternatives that apply to the Belfair Service Area. Alternatives that included wastewater management for the entire Lower Hood Canal service area were not considered in this supplement.

## Design Criteria

In the Facility Plan the design criteria to size treatment components was based on projected 2005 wastewater flows for the Belfair area plus 20 percent reserve capacity to accommodate growth. Reserve capacity was limited to 20 percent to minimize the size and cost of proposed treatment facility improvements. The result was a design flow of 156,000 gallons per day (gpd) and 204,000 gpd with service to the Belfair State Park and surrounding area.

As discussed in Section 3, the average annual projected growth in the Belfair UGA is 9.7% based on recent 2025 population projects provided by Mason County Department of Community Development. Using current population growth values, wastewater flow projections were developed in Section 4 and are summarized in Table 6-1.

**Table 6-1**
**Wastewater Treatment Facility Average Daily Flow Projections**
**(gallons per day – gpd)**

| | 2005 | 2010 | 2015 | 2025 |
|---|---|---|---|---|
| **Service Area** | | | | |
| Belfair UGA | 104,000 | 183,000 | 321,000 | 993,000 |
| Lynch Cove/North Shore | 76,000 | 76,000 | 76,000 | 76,000 |
| **Total Flow Projections** | **180,000** | **259,000** | **397,000** | **1,060,000** |

Due to the high projected growth rate in Belfair (9.7%), wastewater flow projections are significantly greater than the design flows in the Facility Plan (156,000 gpm and 204,000 gpm). Normally a 20-year planning period is used to develop a Facility Plan, however, with a projected growth rate of 9.7%, planning and constructing facilities with capacity equal to the 20-year flow projections would require significant capital investment, placing an unrealistic financial burden on the initial project and customer base. In addition, sizing system components for the 20-year flow projections would create operational difficulties during start-up and initial years of service. For the initial phase of the sewer improvements, the design criteria to size treatment system alternatives as presented in this supplement will be based on the 10-year flow and loading projections.

In the evaluation and planning of alternatives, the need for future phases to accommodate flows beyond the 10-year planning period will be taking into consideration. Siting and the layout of system components will need to provide adequate area and clearances to allow for future expansion of processes and systems. The use of a 10-year planning horizon will require careful consideration in the development of funding strategies for the utility and continuous attention to system growth and the need to plan for future improvements.

The effluent fate has not changed from what was presented in the Facility Plan. No surface water discharges are considered within the Hood Canal or Case Inlet watersheds. The treatment criteria presented in the Facility Plan also applies; effluent shall meet Class A reclaimed water standards as summarized in Table 6-2.

**Table 6-2**
**Secondary Effluent Design Criteria**

| Parameter | Monthly Average | Daily Limit |
|---|---|---|
| BOD5 | 30 mg/L | n/a |
| TSS | 30 mg/L | n/a |
| Turbidity | 2 NTU | 5 NTU |
| Total Nitrogen | n/a | 10 mg/L |

## Treatment Alternatives

The review of treatment alternatives within this supplemental information is limited to centralized wastewater treatment alternatives that have been identified in previous planning efforts and alternatives brought to the County's attention since the conclusion of the Facility Plan. As discussed, the original Facility Plan (2001) recommended a Sequencing Batch Reactor facility near Belfair. The Facility Plan was amended in 2003 and concluded that wastewater should be conveyed to an expanded North Bay/Case Inlet facility.

The following treatment alternatives were reviewed as part of this supplemental information:

Alternative 1 – Sequencing Batch Reactor facility located near Belfair

Alternative 2 – Membrane Biological Reactor facility located near Belfair

Alternative 3 – Expansion of the North Bay/Case Inlet Reclamation Facility

Alternative 4 – Participation in the South Kitsap Industrial Area System

Also included in the review of treatment alternatives is the transmission component associated with each alternative. The expansion of the North Bay/Case Inlet Facility (Alternative 3) and the Participation in the South Kitsap Industrial Area system (Alternative 4) both require a significant transmission system component to deliver wastewater from the Belfair UGA. The impact of these transmission system components on the scope of the alternatives is considerable and must be accounted for in the evaluation of treatment alternatives. The scope of the transmission component for Alternatives 1 and 2 are based on a reclamation facility located on the Overton & Associates site, adjacent to the Belfair UGA, as described in the previous section.

A discussion about each of the treatment alternatives is presented below. The discussion is limited to the needs of the facility within the current planning horizon, 10 years, and includes contributions from the Belfair UGA and Lynch Cove/North Shore. Also presented for each alternative is an estimate of probable program costs. The estimates represent complete program capital costs for each alternative and include estimates for construction costs,

engineering, permitting, property acquisition/easements and contingencies. Detailed cost estimates are presented in Appendix J.

***Alternative 1 – Sequencing Batch Reactor facility located near Belfair***

This alternative represents construction of a new water reclamation facility near Belfair utilizing Sequencing Batch Reactor (SBR) technology as the secondary treatment method. This is similar to the alternative recommended in the original Facility Plan, dated 2001. The facility will be designed to accommodate 0.40 million gallons per day (mgd) average daily flow, with expansion for service beyond the 10-year flow projections. The Facility will be located in close proximity to the Belfair UGA in the Overton & Associates site (Section 5) and utilize land application of Class A reclaimed water as the method of effluent reuse.

The following is a summary of proposed elements to the new SBR facility:

- Transmission: As part of the initial phase of the project, one sewage pump station will be required to convey wastewater to the reclamation facility site from a centralized collection point in the core Belfair UGA service area. Due to the relatively high head conditions, 400 feet TDH, the duplex pump station will be a two stage pumping system capable of pumping the peak 10-year flow condition. The transmission system will consist of approximately 7,000 linear feet of 12-inch force main to reach the proposed treatment site. The majority, if not all, of the force main will be located within the Belfair UGA and its specific location and alignment will be based on the specific siting to the proposed treatment facility (see Figure 6-1).

- Headworks (screening, grit removal, metering): Provide an 1/8" rotating drum screen with a bypass bar screen, a vortex grit removal system and an influent magnetic flow meter.

- Secondary Treatment: Provide an SBR system with associated equipment to make the installation complete. This will include installation of influent distribution/sludge collection manifold and waste sludge pumps, and the installation of a process control panel that would direct operations of the SBR. The overall capacity of the secondary treatment process is 0.40 mgd, with a peak capacity of 3.22 mgd.

- Equalization: The SBR is a batch operation; flow is decanted off the SBR at a significantly greater rate then entering the treatment unit. To maintain reasonable flow rates on downstream processes, flow leaving the SBR must be attenuated in an equalization basin and released at a controlled rate.

- Filtration: From the equalization basin, secondary effluent would be directed to a flocculation chamber where a polymer is added, rapidly mixed and flocculated prior to effluent filters. Filtration utilizing cloth disk type filters, similar to the system at

the NB/CI facility, is recommended to meet the requirements of a Class A reclaimed water standard.

- Disinfection System: Provide UV disinfection consisting of a 3 bank system containing 4 modules and 8 lamps per modules for a total of 96 low pressure high output lamps. The rated capacity will be 2.17 mgd based on 60% transmittance.

- Effluent Pond: The construction of a 2.0 MG effluent pond will meet the 5-day bypass requirements of raw effluent. The pond will include an access ramp into the pond to permit access for annual removal of sediment.

- Spray Field: The irrigation spray field is required to be 33 acres based on a design application rate of 1.83 inches per day. The irrigation system will include a valve vault, force main, pumps and header system and overland HDPE laterals to permit easy removal of the system during harvesting operations.

- Class A Storage: Provide a Class A Storage pond to maintain 46 days of Class A reclaimed water storage in the event of conditions that will not permit irrigation. The storage capacity will be 18.5 MG. An access ramp into the pond will permit access for annual cleaning. The Effluent and Class A Storage ponds will be secured by a common security fence.

- Solids Handling Facilities: Two aerobic digesters will be utilized to store and further process waste activated sludge from the secondary treatment process. Air will be provided to the digesters to maintain the digestion process and provide mixing energy. The digesters will have decanting capabilities to increase solids concentrations. To accommodate the low volume of solids production during the initial start-up and operation of the facility, contracting solids processing to a private contractor that will transport, process and reuse biosolids, similar to the current practice at the NB/CI facility, is recommended. This will reduce the capital cost of the initial project and associated financial burden on the initial customer base. Planning for future phases, beyond the initial 10-years of operation, will need to consider the value of additional solids processing at the facility.

Based on the elements described, the estimate of probable program capital costs for a sequencing batch reactor located near Belfair is approximately $17,200,000, with an initial annual operation and maintenance cost of approximately $486,000.

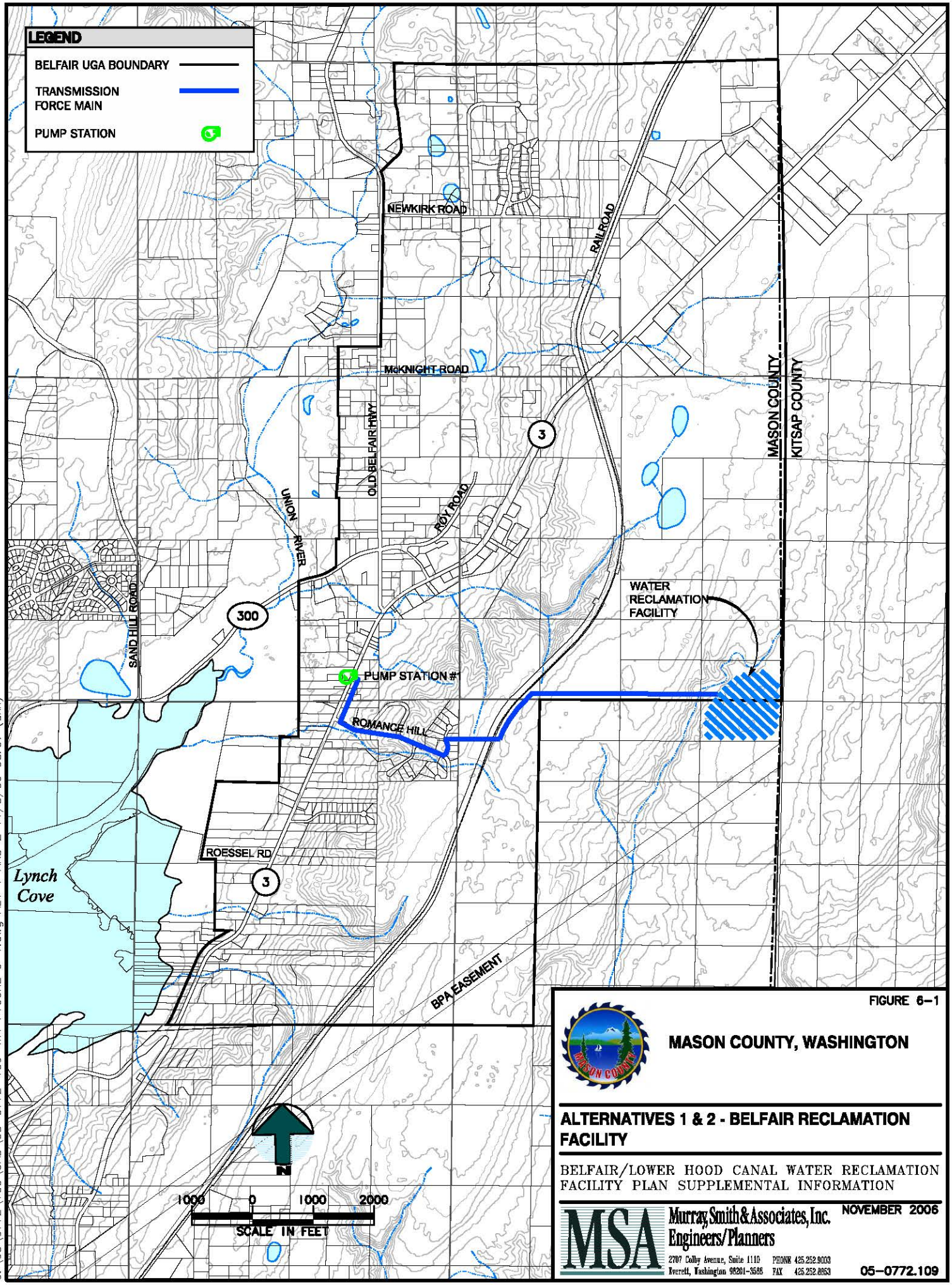


FIGURE 6-1

MASON COUNTY, WASHINGTON

ALTERNATIVES 1 & 2 - BELFAIR RECLAMATION FACILITY

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

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NOVEMBER 2006

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G:\05\0772\109\CAD\05-0772-109-WA-FIGURE 6-1.dwg ALT 1 AND 2 11/8/06 08:07 (dkh)

***Alternative 2 – Membrane Biological Reactor Facility located near Belfair***

This alternative represents construction of a new water reclamation facility near Belfair, similar in some respects to Alternative 1, except utilizing Membrane Biological Reactor (MBR) technology in lieu of the SBR system, equalization basin and effluent filters. This facility will be designed to accommodate 0.40 mgd average daily flow. The following is a summary of proposed elements to the new MBR facility:

- Transmission (pump station and force main): Transmission of wastewater from Belfair to the proposed treatment system alternative is similar to that in Alternative 1. Consisting of a duplex pump station with a two stage pumping system capable of pumping the peak 10-year flow condition. Approximately 7,000 linear feet of 12-inch force main, of which the majority, if not all, located within the Belfair UGA (see Figure 6-1).

- Headworks (screening, grit removal, metering): Provide an 1/8" rotating drum screen with a bypass bar screen, a vortex grit removal system and an influent magnetic flow meter.

- Secondary Treatment: Membrane Biological Reactor technology will be used as the secondary treatment process and to achieve Class A reclaimed water. This alternative provides an MBR system consisting of a concrete tank with basins that will house the membrane units and provide anoxic and pre-aeration zones. The system will consist of influent and effluent piping, waste pumps, blowers and associated controls to make the installation complete. No equalization basin or effluent filtration is required with this technology.

- Disinfection System: Provide UV disinfection consisting of a 3 bank system containing 4 modules and 8 lamps per modules for a total of 96 low pressure high output lamps. The rated capacity will be 2.17 mgd based on 60% transmittance.

- Effluent Pond: The construction of a 2.0 MG effluent pond will meet the 5-day bypass requirements of raw effluent. The pond will include an access ramp into the pond to permit access for annual removal of sediment.

- Spray Field: The irrigation spray field is required to be 33 acres based on a design application rate of 1.83 inches per day. The irrigation system will include a valve vault, force main, pumps and header system and overland HDPE laterals to permit easy removal of the system in case harvesting operations are required.

- Class A Storage: Provide a Class A Storage pond to maintain 46 days of Class A reclaimed water storage in the event of conditions that will not permit irrigation. The storage capacity will be 18.5 MG. An access ramp into the pond will permit access

for annual cleaning. The Effluent and Class A Storage ponds will be secured by a common security fence.

- Solids Handling Facilities: Similar to Alternative 1, aerobic digesters, with decanting capabilities and a private contract for the transporting, processing and reuse of the biosolids.

Probable program capital costs for a membrane biological reactor facility near Belfair is estimated to be approximately $17,400,000 with an initial annual operation and maintenance cost of approximately $402,000.

***Alternative 3 – Expansion of North Bay/Case Inlet Water Reclamation Facility***

This alternative represents the expansion of the existing North Bay/Case Inlet (NB/CI) Water Reclamation Facility similar to what is currently recommended in the Facility Plan. The NB/CI facility is a Sequencing Batch Reactor (SBR) system with effluent filtration, UV disinfection and Class A land application facilities. A compete description of the NB/CI facility is presented in Chapter 7 of the Facility Plan.

As noted previously, flow projections determined in Section 3 are significantly higher than originally projected in the Facility Plan. These larger flow rates are attributed to updated growth projections for the Belfair UGA and a larger service area in the Lynch Cove/North Shore area than previously identified. The result is the need for more extensive upgrades at the existing reclamation facility to accommodate the proposed flow projections from what was identified in the Facility Plan.

In addition to the increase in flow from Belfair, flow projections for the area currently served by the NB/CI will need to be considered. In the Belfair Urban Improvements Project Feasibility Report, March 2005 (Perteet/MSA) population projections and wastewater flows were estimated for the NB/CI service area. These projections were based on the number of new services installed annually since the start-up of the sewer utility and the number of vacant, buildable properties. Based on this information, annual growth within the NB/CI service area has been 6 to 7 % per year. At a growth rate of 7 %, the current service area could support growth for the next seven years with planned new development. After seven years, growth would be limited to infill within the UGA and was assumed to be comparable to the County-wide growth rate of 3.15%.

Table 6-3 presents the estimated flow projections for NB/CI service area, as defined in the Belfair Urban Improvements Project Feasibility Report, combined with the Belfair Sewer Service Area flow projections.

**Table 6-3**
**North Bay/Case Inlet Reclamation Facility Expansion Alternative**
**Average Daily Flow Projections (gallons per day – gpd)**

| | 2005 | 2010 | 2015 | 2025 |
|---|---|---|---|---|
| **Existing NB/CI Service Area** | **171,000** | **240,000** | **302,000** | **412,000** |
| **Belfair Service Areas** | | | | |
| Belfair UGA | 104,000 | 183,000 | 321,000 | 993,000 |
| Lynch Cove/North Shore | 76,000 | 76,000 | 76,000 | 76,000 |
| **Total Belfair Service Area** | **180,000** | **259,000** | **397,000** | **1,060,000** |
| **Total Flow Projections** | **351,000** | **499,000** | **699,000** | **1,472,000** |

The Facility Plan identified the capacity of the NB/CI facility as 304,000 gpd with the ability to add a third SBR unit to increase capacity to 460,000 gpd. The capacity of the NB/CI facility, with the addition of a third SBR unit, appears to be appropriate to accommodate projected flows from the existing service area over the next 20 years with limited excess capacity available.

Total flow projections from Belfair and the NB/CI service area will exceed the design capacity of the NB/CI facility in less than five years, even with the addition of a third SBR unit. Flow projections will also exceed the design capacity of the headworks and UV system, as noted below. The alternative to convey wastewater from Belfair to the existing NB/CI site will require the installation of a new, parallel secondary treatment process at the plant. The economies of conveying wastewater flows from Belfair to NB/CI will be limited to facilities and expenses that support solids handling and the operation and maintenance of the treatment processes.

With the need for a complete secondary treatment process at the NB/CI site to accommodate flows from the Belfair service area, the type of treatment process is not constrained by the existing SBR process. This alternative considers expanding the NB/CI facility with the installation of Membrane Biological Reactor (MBR) technology, similar to alternative 2, in lieu of additional SBR units, equalization basins and effluent filters.

This alternative involves providing the following modifications to the facility:

- Transmission (pump stations and force mains): The transmission of wastewater to the NB/CI facility will require a series of pump stations and force mains due to the distance and elevation difference between Belfair and the NB/CI site. The initial pump station located in Belfair will be similar to the pump station and force main identified in alternatives 1 and 2. This pump station will convey wastewater out of the core area of Belfair to a second pump station upland, southeast of the UGA,

possibility near the railroad tracks. The specific location would be determined during the design phase. The second pump station would pump wastewater to the NB/CI facility. A total force main length of approximately 30,000 linear feet would be required to convey wastewater from the two pump stations to NB/CI (see Figure 6-2).

- Headworks (screening, grit removal, metering): Provide a new headworks facility for the MBR process to operate in parallel with the existing. Headworks would be similar to alternatives 1 and 2 and include an 1/8" screen with bypass, a vortex grit removal system and an influent magnetic flow meter.

- Secondary Treatment: Provide an MBR system, similar to Alternative 2, consisting of a concrete tank with basins that will house the membrane units and provide anoxic and pre-aeration zones, influent and effluent piping, waste pumps, blowers and associated controls to make the installation complete. The two SBR units will not be modified. The MBR and existing SBR units will be run in parallel; a distribution box prior to the headworks will allow operations of both systems, or diversion to one system or the other to accommodate low flows, system repairs and maintenance.

- Disinfection System: The UV disinfection system was designed to accommodate future expansion. Channel baffles can be removed and 20 additional UV modules installed. At 8 lamps per UV module, this will add 160 lamps to the UV system. Based on the current rated capacity of the system, the modifications will increase the system capacity to a peak flow of 1.7 mgd. It should be noted that the current rated capacity of the UV system is based on a transmittance of 60%. With the MBR, the transmittance of the effluent should be significantly greater, thus increasing the rated capacity of the existing system and potentially deferring the need for system improvements. During the initial design phase of the reclamation facility upgrades, the capacity of the UV system should be evaluated using measured and estimated transmittance values.

- Bypass Storage: Modifications to the bypass storage pond system will be necessary to accommodate the 5-day bypass requirement. The addition of a new 2.0 MG bypass storage pond will increase the existing storage capacity to 3.8 MG in order to meet the bypass requirements.

- Spray Field: The addition of spray fields to accommodate flow from the Belfair system would increase the existing 20-acre spray field by 31 acres to a total of 51 acres. An additional valve vault, force mains, pumps and header system would also be required. At the design application rate of 1.83 inches per day, this will equate to an ultimate capacity in the spray field of 0.71 mgd.

- Class A Storage: The addition of a new Class A Storage pond will increase the existing Class A storage capacity by 18.5 MG to a total of 32.6 MG in order to maintain 46 days of storage for the combined system.

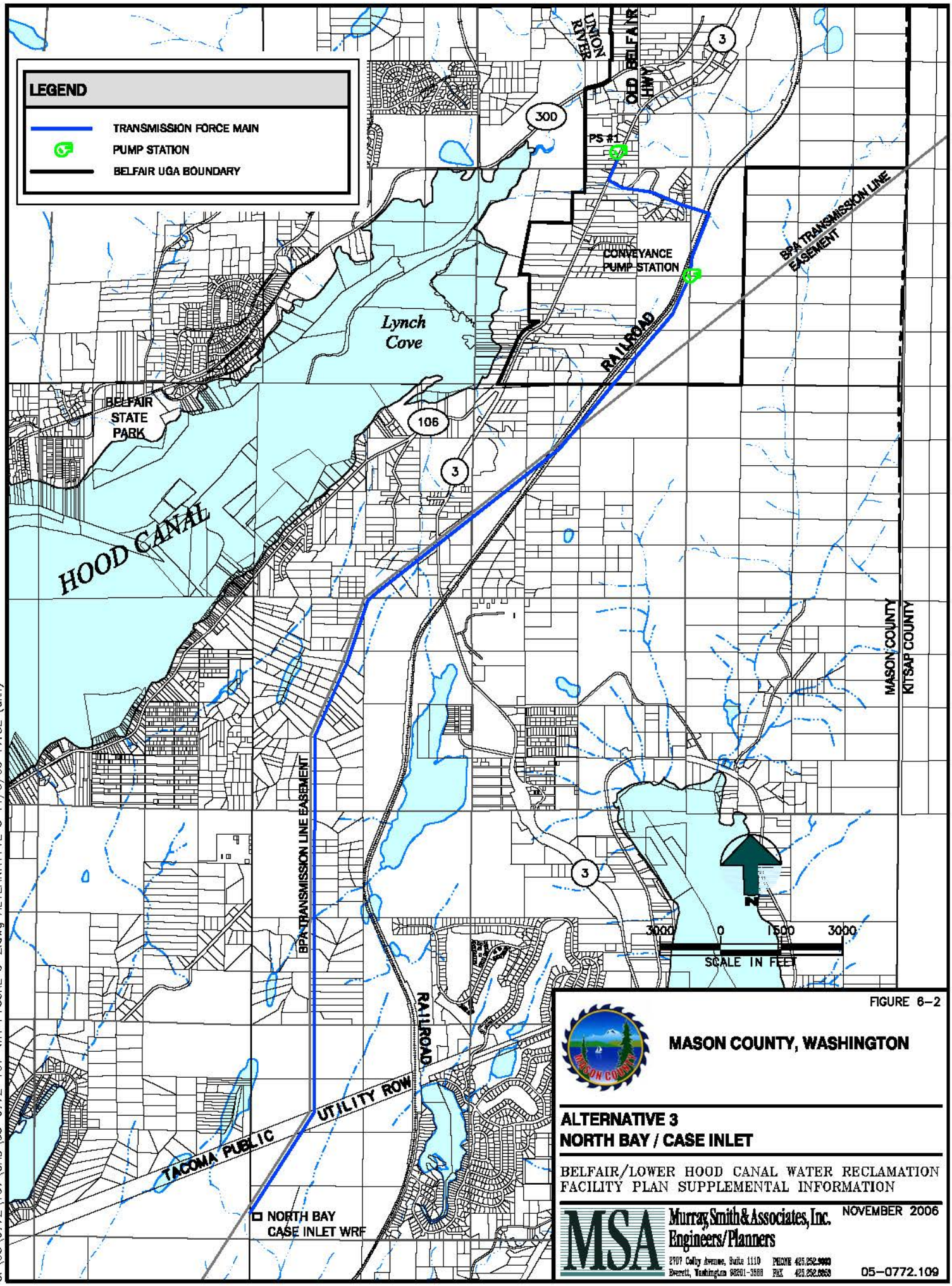


FIGURE 6-2

**MASON COUNTY, WASHINGTON**

**ALTERNATIVE 3**
**NORTH BAY / CASE INLET**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

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NOVEMBER 2006

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G:\05\0772\07\CAD\05-0772-107-WA-FIGURE 6-2.dwg ALTERNATIVE 3 11/6/06 17:52 (dkh)

- General Site Improvements: To accommodate these improvements, additional site, piping and electrical modifications will be necessary at the facility.

- Solids Handling Facilities: One additional aerobic digester will be installed on site with associated piping. Additional operation and maintenance will be required to process the additional solids associated with the increase in plant flows.

The proposed addition of an MBR unit will increase the total capacity of the North Bay-Case Inlet facility to accommodate the 10-year flows for the existing service area and the proposed Belfair UGA and North Shore service areas.

Based on the elements described, the estimate of probable program capital costs for expansion of the North Bay/Case Inlet facility with an MBR system is approximately $19,000,000, with an initial annual operation and maintenance cost of approximately $371,000. With this treatment alternative the Belfair system will benefit from the utilization of existing facilities at the NB/CI site. Costs for existing NB/CI facilities that will benefit both Belfair and the existing NB/CI service area will need to be shared proportionally. A portion of the estimated capital cost represents Belfair's allocation of these costs for existing facilities that were not paid for by grant moneys.

***Alternative 4 – South Kitsap Industrial Area (SKIA)***

This alternative represents the transmission of flows generated from the Belfair area to a proposed collection and conveyance system within the South Kitsap Industrial Area (SKIA) and eventual conveyance to the Port Orchard Sewer District's system and the Karcher Creek wastewater treatment facility.

SKIA represents an urban growth area (UGA) within Kitsap County that encompasses the Port of Bremerton airport and surrounding area. The SKIA Sub-Area Plan, December 8, 2003, identifies a preferred wastewater management alternative that collects and conveys wastewater to the City of Port Orchard with eventual discharge to the Port Orchard/Karcher Creek Sewer District treatment facility. An Interlocal Agreement between the City of Port Orchard and the Port of Bremerton was executed to support this preferred wastewater management scenario.

During the development of the Belfair Urban Improvements Project Feasibility Report, the Project Advisory Committee recommended Mason County explore the alternative of conveying wastewater to the SKIA system. This same request was also echoed during a public meeting at the conclusion of the project. In late 2005, a meeting was facilitated by the Port of Bremerton and including SKIA stakeholders; City of Port Orchard, Karcher Creek Sewer District, the Port of Bremerton representing SKIA and Mason County. The purpose of the meeting was to gauge the interest of stakeholders and discuss how such an arrangement would be structured. A memorandum was prepared to document issues discussed during the

meeting and identify key issues and understanding in the development of the SKIA alternative (Appendix H).

*Wastewater Design Flows*

From Appendix G of the SKIA Sub-Area Plan, May 31, 2003, SKIA's projected average daily flow by 2021 is 1.2 mgd and with a peaking factor of 3.5, the peak flow is estimated at 4.2 mgd. To be consistent with the previous alternatives, the 10-year flow projections will be used to size Belfair system components due to the large projected growth rate over the next 20-years. This equates to an average daily flow of 0.40 mgd and a peak flow of 1.40 mgd (3.5 peaking factor) from the Belfair system. Total design flows from the combined Belfair/SKIA systems would be 1.6 mgd for average daily flows and 5.61 mgd for peak flows.

*Transmission*

The transmission of wastewater from the Belfair service area to the SKIA system and eventually to the existing Port Orchard collection system, at ULID #6 collection system, is based on a conceptual layout of the SKIA system presented in Appendix G of the SKIA Sub-Area Plan (Appendix H). Wastewater flows from the Belfair area will be conveyed to the proposed SKIA Pump Station #4 (PS #4) located near the intersection of SR-3 and Lake Flora Road in the southern portion of SKIA (see Figure 6-3). A pump station located in Belfair will convey wastewater within the SR-3 corridor to a conveyance pump station located near the intersection of SR-3 and the railway right-of-way in the northern portion of the Belfair UGA. The conveyance pump station will then convey wastewater to SKIA PS #4. All costs for the transmission of wastewater from Belfair to SKIA's PS #4 will be the sole responsibility of the Belfair system.

Between SKIA's PS #4 and the connection to Port Orchard system, conveyance system components will be upsized from the current SKIA plan to accommodate the design flows from Belfair. Costs for these shared facilities will be based on a percentage of volumetric capacity of all shared conveyance components; gravity sewers, pump stations and force mains.

Insufficient information is available to assess downstream impacts on the City of Port Orchard's system. Discussions with the City and the former Public Works Director indicate that improvements have been made to accommodate flow from the SKIA area and there is capacity to accommodate the initial flows from the Belfair/SKIA service areas. As identified in the SKIA plan, downstream impacts, starting at the connection to ULID #6, are not distinguished as a separate capital cost, but are included in the connection charge.

*Treatment*

From discussions with City of Port Orchard and Karcher Creek Sewer District their jointly owned wastewater treatment facility has the capacity to accommodate flows from Belfair and

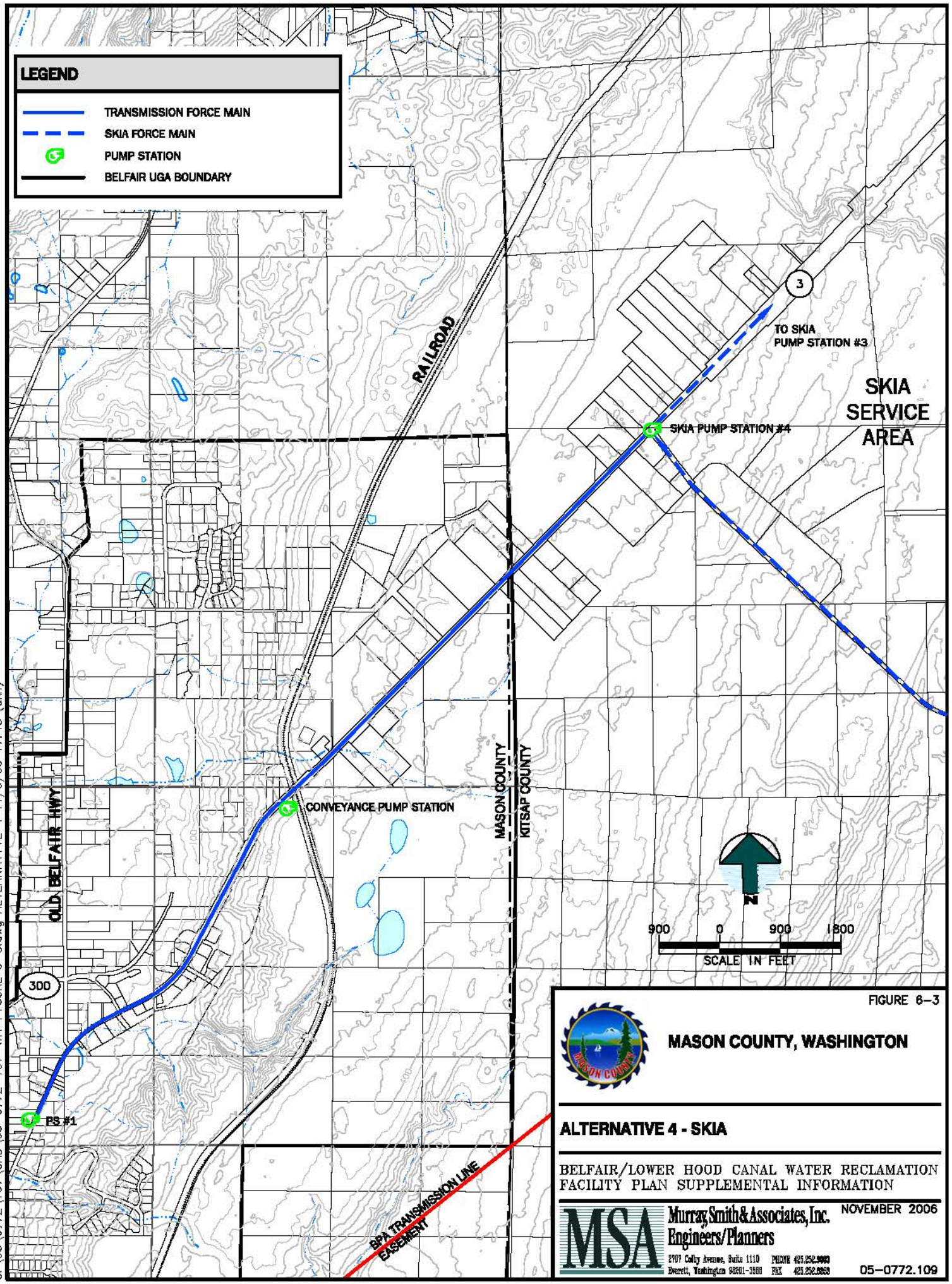


FIGURE 6-3

**MASON COUNTY, WASHINGTON**

**ALTERNATIVE 4 - SKIA**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

NOVEMBER 2006

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05-0772.109

G:\05\0772\07\CAD\05-0772-107-WA-FIGURE 6-3.dwg ALTERNATIVE 4 11/6/06 17:45 (dkh)

SKIA. Impacts to the treatment facility are not distinguished as separate capital costs, but are included as a connection charge.

*Operation and Maintenance*

Belfair's collection and transmission systems will be owned, operated and maintained by Mason County up to the connection with the SKIA system at SKIA's PS #4. Based on the SKIA plan and the Interlocal Agreement between the City of Port Orchard and the Port of Bremerton, the SKIA system will be operated and maintained by the City of Port Orchard, this will include conveyance system components used by Belfair and SKIA.

*Connection Charges and Rates*

For connection to the City of Port Orchard collection system at ULID #6, late-comer charges of $720 per equivalent residential connection are identified in the SKIA plan. Currently, Port orchard's connection fees for an equivalent connection are $6,000; approximately $2,750 towards sewer collection/conveyance and $3,250 towards treatment. Therefore a total connection charge to the SKIA system of $6,720 will be used in the evaluation of this alternative. For the purpose of developing cost estimates for this alternative, connection charges will be considered a capital cost.

The City currently has a monthly sewer rate of $36.00 per ERU. A surcharge of 50% is applied to customers outside the City limits. City records have identified that approximately $21.00 of the monthly rate is for treatment expenses. This rate was recently increased by $9.00 per month to accommodate debt service on treatment facility improvements. The rate increase was based on a 3% growth factor. The initial 900 ERU's, and the projected 2,000 ERU's in ten years, from the Belfair system will substantially impact the City's rate base, reducing the need for the recent rate increase. In addition, a portion of the rate component for the operation and maintenance of the collection system will not be necessary since Mason County will be responsible for those duties up to the connection with SKIA. Taking into consideration these factors, it is anticipated that a rate similar to the City rate, without the 50% surcharge, will be applicable for the Belfair system. Therefore a sewer rate of $36.00 month for the operation of all system components, except for the collection and transmission systems in Mason County, will be applied to the operation and maintenance costs of the system.

*Costs*

Based on the project elements, charges and rates described, an estimate of probable program capital costs for the South Kitsap Industrial Area Alternative (SKIA) was derived. In order to compare alternatives equally, the estimate of probable cost for the SKIA alternative must represent the cost of providing transmission and treatment capacity to accommodate the 10-year planning horizon for the Belfair service area. Since a significant portion of the costs for the SKIA alternative is attributed to connection charges, charges over the 10-year planning horizon were calculated based on the annual growth rate in Belfair and included in the

estimate of probable capital cost. The estimate of probable capital cost for the SKIA alternative is approximately $29,200,000, with an initial annual operation and maintenance cost of approximately $431,000.

**Discussion**

Table 6-4 summaries the estimated probable program costs for the four alternatives.

**Table 6-4**
**Estimated Treatment Program Costs**

| | Alternative 1 - SBR near Belfair | Alternative 2 - MBR near Belfair | Alternative 3 - NB/CI Expansion | Alternative 4 - SKIA |
|---|---|---|---|---|
| **Capital Costs** | $17,200,000 | $17,400,000 | $19,000,000 | $29,200,000 |
| **Annual Operation & Maintenance Costs** | $486,000 | $402,000 | $371,000 | $431,000 |

Alternatives 1 and 2 are very similar, only separated by the method of treatment to achieve reclaimed water standards. Alternative 1 represents a traditional form of wastewater treatment, sequencing batch reactors were recommended as the preferred treatment in the original draft of the Facility Plan. Sequencing Batch Reactors are a proven technology and it is the process currently used at the NB/CI facility. Alternative 2 represents the use of membrane technology, a relatively new treatment process that has made significant advances in the past 10 years.

Membrane technology provides a level of effluent quality that is typically superior to traditional forms of wastewater treatment. Effluent quality from a membrane system will consistently meet and exceed Class A reclaimed water standards. In comparison to the SBR system, Alternative 1, the membrane system replaces the SBR system, as well as the need for equalization basins and effluent filters, simplifying the treatment process. For the consistent production of Class A reclaimed water, membrane technology represents the best available technology in the wastewater industry.

Historically, membrane systems typically require greater capital outlay. The capital cost for equipment is greater then conventional equipment, but the advantages of simplifying the process and reducing the size of the treatment facility can offset the higher costs. For Belfair, the construction of an entirely new collection system favors a membrane system. A significant factor that can influence the cost of treatment facilities is the amount of

infiltration and inflow (I&I) a system will receive during the wet season and storm events. Minimizing I&I with the construction of a new, tight collection system in the Belfair service area will minimize the size of the equipment and be reflected in the capital costs. As shown in table 6-4, the costs of alternatives 1 and 2 are basically equal. Operation and maintenance costs are slightly lower for the membrane system.

Because membrane technology represents the best available technology to consistently produce a Class A reclaimed water, with no or minimal capital cost impacts when compared to the SBR system, Alternative 1, the SBR facility near Belfair, is removed from further consideration.

The SKIA alternative, Alternative 4, is dependant on a number of variables outside the County's direct control. The alternative will convey wastewater approximately 11 miles to the Karcher Creek Treatment facility, across county lines, though at least two other jurisdictions, the SKIA UGA and the City of Port Orchard. The alternative will require the development of multiple intergovernmental agreements between Mason County, Kitsap County, SKIA, Port Orchard and possibly the Karcher Creek Sewer District. The content of such agreements will vary between entities, but will address jurisdictional responsibilities, rate and fee structures, pretreatment standards, etc.

The alternative is dependent on SKIA implementing their plan for wastewater management as identified in the SKIA Sub-Area Plan, December 8, 2003. Implementation of the SKIA plan requires significant construction and capital outlay. To date, the only documentation for the SKIA wastewater management plan is the conceptual/planning level sanitary sewer evaluation prepared to support the Sub-Area Plan. No Facility Plan or Engineering Report has been completed for SKIA.

The uncertainty and the timing of the implementation of the SKIA facilities are not compatible with the schedule to provide wastewater service to the Belfair area. Mason County has recognized the need to initiate wastewater facility improvements in the Belfair area within the next year. Current funding sources available to the Belfair Sewer project reflect this time schedule. In addition, the complexity of establishing intergovernmental agreements and policies between agencies that will ensure reliable and sustainable service to Belfair, will further delay the schedule of implementing the SKIA alternative. For these reasons the SKIA alternative is removed from further consideration as a feasible alternative to providing wastewater treatment to serve the Belfair area.

**Summary**

The reevaluation of treatment alternatives for the Belfair area based on updated design criteria has identified two viable treatment alternatives: a membrane biological reactor adjacent to the Belfair UGA (Alternative 2) and expansion of the North Bay/Case Inlet facility (Alternative 3). The development of these two alternatives is similar to the conclusion of the Facility Plan, however treatment technologies proposed for the two alternatives presented significantly differ from what was presented in the Facility Plan.

# SECTION 7

# SECTION 7
# SUPPLEMENT TO CHAPTER 11
# COLLECTION SYSTEM ALTERNATIVES

Chapter 11 of the Facility Plan evaluated wastewater collection system alternatives to serve the Belfair/Lower Hood Canal study area. Collection alternatives evaluated included conventional gravity systems, low pressure systems (both septic tank effluent pump and grinder pump systems), vacuum sewer systems and variable grade systems. The Facility Plan concluded that a system utilizing a combination of conventional gravity and low pressure sewers was the most feasible approach for serving the Belfair UGA and the extension of pressure sewers out to the North Shore service area.

Based on the potential service area defined in Section 2 and wastewater flow loading projections presented in Section 4, this section will review collection alternatives required to meet the new design criteria. This review of collection alternatives will be limited to the use of a combination of conventional gravity and low pressure sewers as recommended in the Facility Plan. Alternatives presented herein will consider the general layout of the collection and conveyance system and sizing of specific sewers, force mains and pressures sewers.

## Belfair Urban Growth Area

The primary commercial and population center of Belfair borders the SR-3 corridor, which runs north/south through the UGA. The Facility Plan identified the initial phase of the proposed sewer improvements, from the SR-106 interchange to the commercial area at the interchange with SR-300 that includes McDonalds Restaurant. Future phases of sewer improvements will extend service out into the UGA as development and local conditions require.

To implement the first phase of sewers within the Belfair core area, consideration must be given to the ultimate configuration of sewers that will be required to serve the entire UGA. Sewers and system components must be sized to account for future service extensions and the associated flows. To evaluate the impact of future development on the proposed sewers within the Belfair core area, an overall assessment and layout of sewer service for the entire UGA was conducted.

To accommodate future growth, gravity sewers and low pressure sewers are sized in accordance with Ecology guidelines, for full build-out conditions. Pump stations and force mains will be sized to accommodate the 10-year growth projects, similar to the reclamation facilities, to minimize the initial cost of the project and facilitate the proper operation of the facilities during the initial years of operation.

### *Development of Basins and Basin Flows*

As a part of the Belfair Urban Improvements Project Feasibility Report (Perteet/MSA, 2005), service areas and basins were developed to appropriately plan and design for service to the entire Belfair UGA and are presented herein. Inspection of the current development and topography revealed that the UGA can be divided into three main service areas; the core Belfair commercial area, North Belfair (west of the railroad tracks) and the area east of the railroad tracks, East Belfair. Refer to Figure 7-1 for identification of the three main service areas.

The service areas were further broken down into basins that were developed based on topography and by identifying potential routes for installation of the sewers. Basins outside of the commercial corridor were kept relatively large as the majority of these basins have yet to be significantly developed and generally have large areas with the same zoning designation.

Wastewater flows for each basin were then developed for build-out conditions utilizing zoning maps provided by Mason County. The area of each land use zone within the basin was calculated and then reduced by the acreage of unsuitable land. Unsuitable lands are areas with slope greater than 15%, wetlands, and buffer areas type 1 through 5, as defined in the Draft Supplemental Environmental Impact Statement for the Proposed Belfair Urban Growth Area Plan and Development Regulations (SEIS), 2004 completed by Mason County. Average daily flows were then calculated based on the following additional criteria;

- 2.56 persons per household per the Facilities Plan.
- 80 gallons per day per capita per the Facilities Plan.
- 10, 5, 3, and 0.1 residences per acre for R-10, R-5, R-3 and LTA zoning, respectively, per densities published in Belfair Urban Growth Area Zoning and Development Regulations.
- 1,800 gpd/acre for Festival Retail (FR) and Mixed Use (MU) zoning designations, 2,000 gpd/acre for General Commercial (GC) and General Commercial-Business Industrial (GC-BI) zoning designations, and 3,000 gpd/acre for Business Industrial (BI) zoning designations.
- A 20% reduction of usable acres required for road constructions per the SEIS.
- A 25% reduction of usable land for market factor per the SEIS.

The peaking factor of 3.5 developed in the Facilities Plan was also used for the purposes of this study to determine peak hourly build-out flows within each basin. Appendix I presents the basin flow projections in detail for the UGA.

### *Alternatives for UGA Sewer Service*

As discussed, the Belfair UGA can be divided into three general service area; Belfair Commercial, North Belfair and East Belfair. Sewer service to all three areas was evaluated

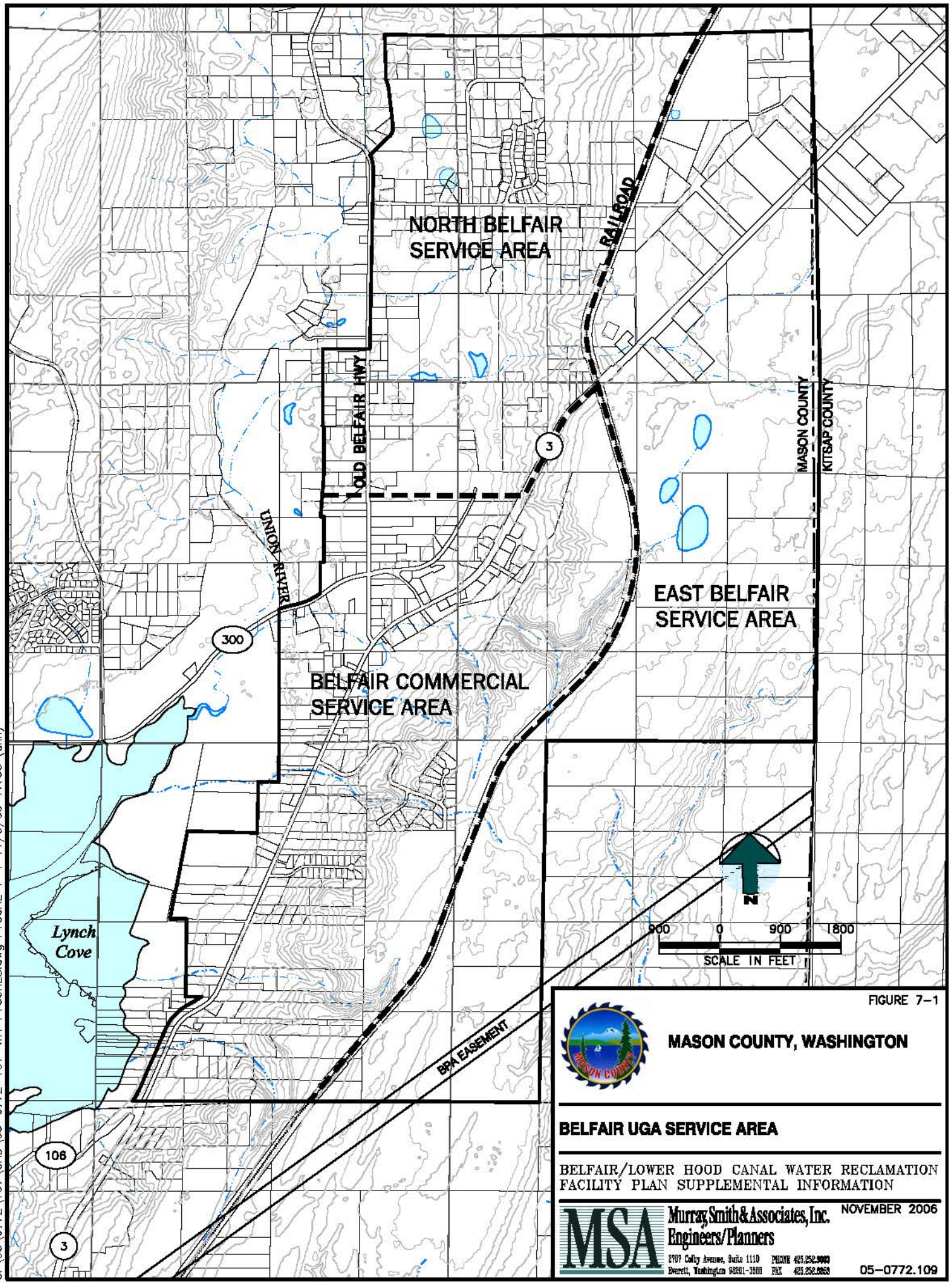


FIGURE 7-1

**MASON COUNTY, WASHINGTON**

**BELFAIR UGA SERVICE AREA**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

NOVEMBER 2006

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G:\05\0772\07\CAD\05-0772-107-WA-FIGURES.dwg FIGURE 7-1 11/6/06 17:33 (dkh)

with respect to developing the most economical and feasible route to collect and convey wastewater to the water reclamation facility.

*North Belfair Service Area*

To collect and convey wastewater from the North Belfair Service Area, the natural topography of the basin dictates conveyance of the wastewater south, through the Belfair commercial area. As a result, the Belfair Commercial area collection and conveyance system components must be sized to accommodate future flows from the North Belfair Service Area.

*East Belfair Service Area*

Alternatives to serve the area located east of the railroad tracks included routing all flows down through the Belfair commercial area or construction of a separate trunk sewer system parallel to the railroad tracks in the east Belfair service area.

The majority of the easterly service area is zoned as residential and industrial resulting in large flows at build-out. The natural topography of this area suggests that the majority of wastewater could gravity feed down into the commercial area and be collected by a trunk sewer located along SR-3. However, directing flow to the Belfair commercial area would significantly increase the required size of the commercial area collection system and any necessary pump stations. This increase of pipe sizes would result in a significant impact on construction costs of the Belfair commercial area collection and conveyance system planned to be constructed as the initial phase of the sewer project.

In addition, by dropping down into the commercial area, the wastewater will lose a significant amount of elevation, which will only need to be recovered when the wastewater is pumped to the reclamation facility. The location of the proposed water reclamation facility on the Overton & Associates site or a North Bay/Case Inlet conveyance pump station is within close proximity to this future service area. Direct conveyance to the reclamation facility or the North Bay/Case Inlet conveyance pump station from the majority of this area will be more economical from a sewer development perspective.

As development has yet to occur in this easterly service area, utilizing a separate trunk sewer system, parallel to the railroad tracks would allow construction of this sewer at a later date, if and when development occurs. This will reduce the size of the commercial area sewer components, thus lessen the financial burden of the initial project. In the long term, utilizing a separate trunk sewer will reduce pump station operation and maintenance costs.

***Alternatives for Belfair Commercial Area Sewer Service***

*Sewer Type*

Different types of collection systems can be utilized to serve the UGA depending on the topography, available space and other variables within the desired service area. The Facility

Plan identifies gravity and low pressure collection systems as feasible alternatives to serve the commercial area.

The general topography of the Belfair commercial area with its varying terrain allows sanitary sewer service to the majority of the area through the use of a gravity system. The advantages of gravity sewers include low operation and maintenance costs and high reliability. In addition, a gravity system is very compatible with projected flows and sewer extensions as build out of the UGA occurs. As a result of the numerous wetland areas, occasional creek crossings, and adverse grades, portions of the Belfair commercial area will need to be served through alternative methods. These areas, which cannot be served by gravity sewers, will have pressure sewer systems using grinder pumps similar to those currently being used in the Allyn and Victor service areas.

*SR-3 Corridor Considerations*

Improvements to State Route 3 (SR-3) through Belfair have been identified in the Belfair Urban Growth Area Plan to showcase the area and address a worsening traffic situation. In 2004, the County initiated the Belfair Urban Improvements Project Feasibility Report (Perteet/MSA, 2005) to evaluate the desired road improvements, as well as the implementation of wastewater collection system improvements in the core commercial area of Belfair, as defined in the Facility Plan. The feasibility report evaluated the potential benefits of implementing road and sewer projects at the same time and the costs of those improvements.

The Feasibility Report also evaluated existing utilities that use the SR-3 corridor in order to determine the costs associated with utility conflicts for the road and sewer improvements. A significant amount of buried and overhead utilities share the SR-3 corridor. Resolution of utility conflicts for the road and sewer projects has the potential to be a significant component of the overall project cost. Since the majority of utilities are within the Washington State Department of Transportation (WSDOT) right-of-way under franchise agreements, the cost of conflicts is typically the responsibility of the utility. However, with sewer improvements, the cost of resolving utility conflicts will be the responsibility of the sewer project.

The Feasibility Report concluded that there are significant advantages to implement sewer improvements and road improvements through Belfair at the same time. Of greatest benefit will be overall coordination of improvements to ensure there are no conflicts between proposed road and sewer components. Over $1 million in sewer project savings was identified in the Feasibility Report, with the majority of project savings attributed to sewer work elements that would be shared or included in the road improvements. With the SR-3 Improvements, many of the utility conflicts with the sewer will be resolved due to the need to resolve conflicts with the proposed road improvements.

The SR-3 improvements project through Belfair has received project funding under the 2005 Transportation Tax Package. Funding for the project will become available in 2011 with

project completion scheduled for 2013. Meetings with WSDOT, County staff and consultants have confirmed the timing of the road improvements project, with no ability to adjust the project schedule. With the critical need to provide sewers in the Belfair UGA and provide a viable solution to wastewater management in the North Shore, Mason County Board of Commissioners has determined that implementing both projects at the same time is no longer feasible. In addition, current available funding for the sewer project will significantly diminished in value, and may be withdrawn if the sewer project was to wait for the road improvements to commence.

*Sewer Location*

Alternatives were evaluated for routing of the Belfair Commercial Area collection system through the SR-3 corridor. The evaluation took into consideration impacts to the environmental, traffic patterns/control, businesses, utilities and project costs. Also, applicable regulations and requirements were also taken into consideration.

An assessment of the Belfair commercial area revealed that routing the collection system sewers outside the SR-3 corridor was not practical. West of the corridor, construction of sewers would have a detrimental affect on quality wetlands, impacting water quality in the area, and thus, resulting in significantly high construction costs. As a result, alternatives for routing of the collection system through the majority of the SR-3 corridor are limited to the use of the SR-3 right-of-way and/or adjacent properties.

Alternatives for routing of the gravity main through the SR-3 corridor were evaluated. Placing the sewer within the center turn lane and the future center turn lane alignment would take considerable coordination with WSDOT and require their approval of the alignment. Initial discussions with WSDOT indicate that they generally do not allow access to any utilities located within the limits of the fog lines. Routing the sewer line within the center of the existing center turn lane and the proposed center turn lane would cause the need for significant traffic control measures during construction. The limited space available within the right-of-way would also make it difficult to maintain traffic flow in each direction. However, placing the proposed sewer lines within the center turn lane would have significantly less impacts on utilities, as there are currently not any utilities located in this center lane corridor.

Locating the sewer within the right-of-way, outside the fog line on either the east or west side of SR-3 creates numerous conflicts with existing utilities. The westerly edge of the right-of-way is generally occupied by the Belfair Water District's water main. The water main is constructed of asbestos cement pipe and requires 10 feet of separation from any proposed sewer. The easterly side of the SR-3 right-of-way is congested with a number of communication and power utilities. As discussed, the cost of resolving utility conflicts with the proposed sewer alignment will be the responsibility of the sewer project. In addition, the location of the sewer within the SR-3 right-of-way will require a franchise agreement between WSDOT and the sewer utility. Any conflicts with future road improvements will be the responsibility of the sewer utility.

Placing the sewer line in a permanent utility easement along the easterly and/or westerly side of the SR-3 right-of-way would help alleviate the traffic control problems and congestion during construction and comply with WSDOT's general policy of no utility access within the roadway. The impacts to existing utilities will be minimized because they are generally located within the SR-3 right-of-way. This alternative will require purchase of easements adjacent to SR-3 and there will be an impact to businesses along the right-of-way during construction.

*Pump Stations*

Two collection system pump stations will be required to serve the area with the use of a gravity collection system. The Belfair commercial area is naturally broken up into two segments, split north and south by a high spot located 1,000 feet south of Romance Hill Road. Alternatives for the northerly pump station, Pump Station 1 (PS 1) are dictated by the topography of the area and are limited. To adequately serve this portion of the commercial area, PS 1 must be place at or near the lowest elevation along the SR-3 corridor, which occurs approximately 1,200 feet south of the SR-3/Old Belfair Highway intersection.

The location of the southerly pump station, Pump Station 2 (PS 2) was evaluated in conjunction with the type of collection system and natural barriers. Alternatives evaluated for PS 2 included placing the pump station at the westerly end of Roessel Road, or placing it adjacent to SR-3 approximately 700 feet north of the southerly end of the UGA.

The area south of Sweetwater Creek presents difficulties with respect to sewer service. Placing the PS 2 pump station at the southerly end of the project allows for the use of a gravity sewer to serve this portion of the UGA, however, the sewers would be very deep as they approach the pump station as a result of having to be routed under Sweetwater Creek, increasing construction costs. In addition, this section of the SR-3 corridor is very narrow and congested with utilities, a gravity sewer routed south of Sweetwater Creek would result in significant utility conflicts.

Placing PS 2 on Roessel Road results in the need to use a low pressure collection system for the entire area south of Sweetwater Creek. This will require additional system maintenance as a result of having pressure system, however, due to the topography of the area, the majority of the services on the west side of SR-3 south of Sweetwater will require a pump system regardless of what alternative is chosen. Additionally, a pump station on Roessel Road would allow for servicing the adjacent development by gravity.

## Lynch Cove/North Shore Area

### *Alternatives for Sewer Service*

*Sewer Type*

Serving the Lynch Cove/North Shore area near the Belfair State Park (North Shore) will require alternative forms of wastewater collection other than the exclusive use of gravity sewers. Given the need to serve shoreline homes with flat topography, stream crossings, and high groundwater conditions, installation of gravity sewers is not practical, therefore a pressure sewer system is recommended.

Alternative wastewater collection systems are available that would be capable of serving this area. Vacuum and septic tank effluent pump (STEP) systems are the most common alternatives that have been successfully used in other communities. As determined in the Facility Plan, to ensure operation and maintenance consistency with the County's existing collection system in the Allyn service area, it is recommended that areas determined to require a low-pressure collection system utilize the grinder pump system manufactured by e/one.

*Sewer Location*

As defined in Section 2, sewer service in North Shore will be limited to only the areas with the highest probability of septic effluent to degrade water quality in Lynch Cove. The area consists of approximately 293 residences along the shoreline of Hood Canal from the Cherokee Beach area to Gladwin Beach Road, primarily south of SR-300 (North Shore Road). A low-pressure sewer system is recommended to serve all homes in this proposed service area. The system would convey wastewater to a pump station centrally located at the Belfair State Park.

*Pump Station*

One collection pump station is required to serve the North Shore area. Because of the head limitations of the low-pressure system, it is recommended that Pump Station 3 (PS 3) be centrally located in this service area at the Belfair State Park. Flows from the low pressure system would discharge to the pump station as well as the collection system within the Belfair State Park.

Flow will be conveyed by force main and gravity sewers to Pump Station 1 (PS 1) located in the Belfair UGA. A force main between PS 3 and the UGA would consist of an alignment along SR-300. Due to the environmental sensitivity of the area, no other practical alignments exist for this force main. It is proposed that the force main be routed easterly along the shoulder of the east-bound travel lane of SR-300. This alignment will utilize the shoulder between PS 3 and the Belfair UGA as much as possible with some locations requiring alignment within the travel lane. The force main would cross the Union River and discharge

into the Belfair sewer collection approximately 1,000 feet west of the intersection of SR-300 and Old Belfair Highway.

The alternative is to locate the force main on the north side of SR-300, however from site evaluations this alignment could possibly result in cut slopes, potentially higher groundwater and/or rock excavation. As the project proceeds to the design phase, the force main alignment along SR-300 should be further evaluated to determine the most practical and cost effective alignment.

The force main between the proposed PS 3 and the Belfair UGA will be dedicated for the conveyance of wastewater from the North Shore service area to the Belfair gravity system and ultimately PS 1. This will be a pressurized conduit and no direct services will be allowed to connect.

## Recommended Collection Alternative

### *Belfair Urban Growth Area*

Improvements recommended for the Belfair Urban Growth Area (UGA) sanitary sewer system include the use of gravity sewers, low-pressure collection systems, and pump stations. These improvements were developed and sized to take into consideration future development of the UGA and the extension of sewers as build-out occurs within the UGA.

Installation of a gravity sewer is recommended for the majority of the Belfair Commercial Area collection system. The gravity collection system can be broken up into two distinct basins, based on topography, and serviced by using two pump stations along the SR-3 corridor to ultimately transport flow to the reclamation facility. Pump Station 1 (PS 1) will serve everything north the high spot located approximately 1,000 feet south of Romance Hill Road, and Pump Station 2 (PS 2) will serve the remaining commercial area along the SR-3 corridor.

Gravity sewer pipelines were evaluated using minimum slopes and sized to appropriately convey flow rates associated with a build-out condition within the UGA. The resulting pipeline diameters range from 8-inch at the northerly end of the system to 18-inch approaching PS 1. Gravity sewer pipelines to serve the Belfair Commercial area are recommended along SR-3 from approximately 350 feet south of Roessel Road to approximately 1,600 feet north of Clifton Road. Gravity pipelines along Belfair Road, Old Belfair Hwy, Roy Road, Roessel Road, and the driveway through Golden Bell Mobile Home Park are also recommended. See Figure 7-2 for an overall view of the pipeline locations.

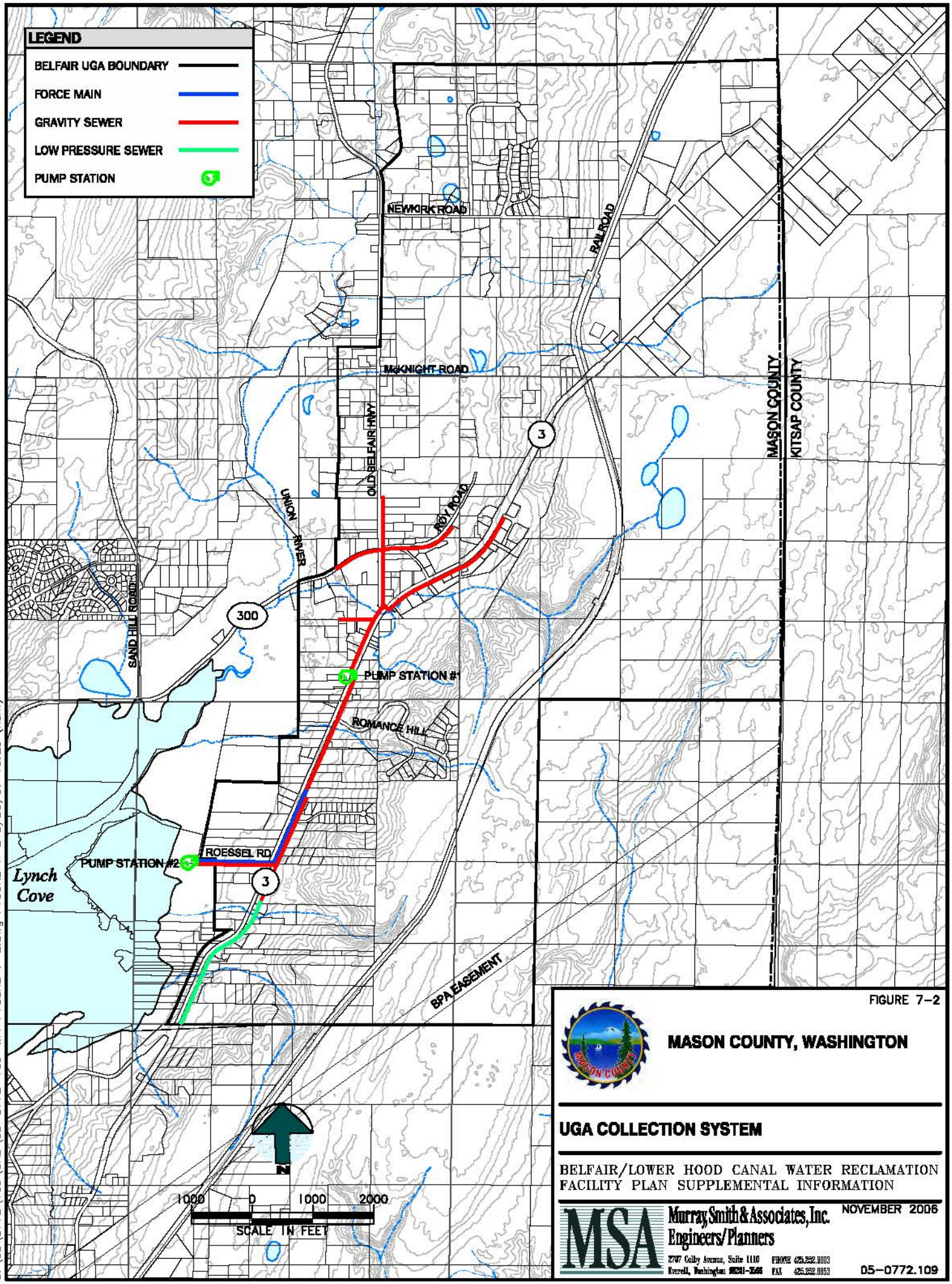


FIGURE 7-2

**MASON COUNTY, WASHINGTON**

**UGA COLLECTION SYSTEM**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

NOVEMBER 2006

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05-0772.109

G:\05\0772\109\CAD\05-0772-109-WA-FIGURE 7-2.dwg FIGURE 7-2 3/30/07 10:26 (hcm)

PS 2 will be a duplex submersible-type pump station located at the westerly end of Roessel Road. PS 2 will be capable of pumping the 10-year flow projections discussed in Section 4. Each pump would be approximately 10 horsepower, capable of pumping approximately 200 gpm with 70 feet of Total Dynamic Head (TDH). The pump station will include a stand-alone electrical/control panel with telemetry, stand-by generator, and enclosed with a chain-link fence. A 6-inch HDPE force main will convey flow to the gravity sewer system, which flows north to PS 1. The proposed force main route will be parallel to the gravity sewer along SR-3 until discharging into the gravity sewer. PS 1 is considered a part of the conveyance system and is discussed in the treatment alternatives in Section 6.

Installation of a low-pressure collection system is recommended to accommodate two conditions within the Belfair Commercial area. Existing customers located west of SR-3 from approximately the Old Belfair Highway intersection south to the Theler Center will most likely be situated below the proposed sewer grade and will require low-pressure pumping systems. Also, it is recommended that the service area south of Sweetwater Creek to the southern limits of the UGA be served by a low–pressure collection system. A low-pressure collection system using the e/one grinder pump system is recommended to maintain compatibility with the system currently used and maintained in the Allyn service area.

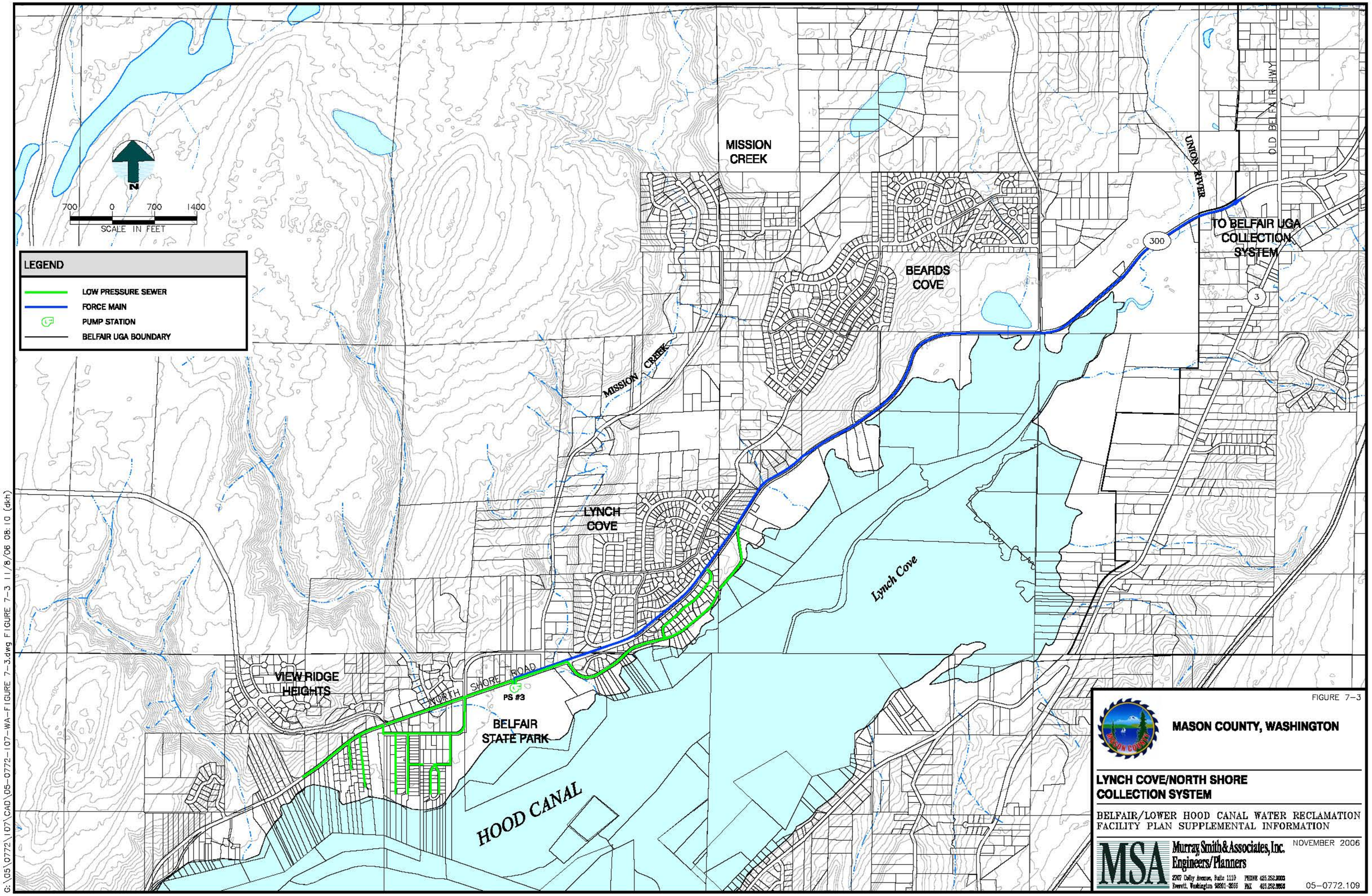
Low-pressure mains were sized assuming build-out flows. The pressure main sizes along SR-3 south of the elementary school will be 3-inch and 4-inch diameter piping. To minimize the amount of services and pipelines crossing the highway, it is recommended that individual low-pressure systems be utilized at approximately 400-foot intervals along the west side of SR-3 to coincide with the location of the manholes used for the gravity system. Each individual pressure system would collect flows along the westerly side of SR-3, then cross the highway and dump into the gravity sewer manholes located on the easterly side of the SR-3 right-of-way. Initially, it is anticipated that approximately 110 grinder pumps will be part of the Belfair sewer collection system.

Based on the elements described, the estimate of probable capital costs for the Belfair UGA Collection System components is approximately $7,900,000, with an initial annual operation and maintenance cost of approximately $37,000.

### *Lynch Cove/North Shore (Belfair State Park)*

Improvements to the Lynch Cove/North Shore area involve pressure sewers and a pump station. The improvements are sized for the area included in the service area defined in Section 2 and do not take into account future development of the North Shore area. The recommended improvements are shown in Figure 7-3.

The pressure sewers located in the North Shore area will collect wastewater from individual grinder pumps located at each service. The pressure sewers will be a combination of 2-inch through 4-inch pressure mains that discharge to Pump Station 3 (PS 3) located at Belfair State Park. Flows from the Belfair State Park's collection system will also discharge to PS 3.


N
700 0 700 1400
SCALE IN FEET
LEGEND
LOW PRESSURE SEWER
FORCE MAIN
PUMP STATION
BELFAIR UGA BOUNDARY
MISSION CREEK
BEARDS COVE
UNION RIVER
OLD BELFAIR HWY
TO BELFAIR UGA COLLECTION SYSTEM
300
3
MISSION CREEK
LYNCH COVE
Lynch Cove
VIEW RIDGE HEIGHTS
NORTH SHORE ROAD
PS #3
BELFAIR STATE PARK
HOOD CANAL
FIGURE 7-3
MASON COUNTY, WASHINGTON
LYNCH COVE/NORTH SHORE COLLECTION SYSTEM
BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION
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05-0772.109
G:\05\0772\107\CAD\05-0772-107-WA-FIGURE 7-3.dwg FIGURE 7-3 11/8/06 08:10 (dkh)

PS 3 will be a duplex submersible-type pump station capable of pumping the current flows discussed in Section 4. Each pump will be approximately 15 horsepower capable of pumping approximately 200 gpm with 125 feet of Total Dynamic Head (TDH). The pump station will be enclosed with a chain-link fence and include a stand-alone electrical/control panel with telemetry, and stand-by generator. A 6-inch HDPE force main will be located in the eastern shoulder of SR-300, bore under the Union River and discharge to the Belfair UGA gravity collection system. The length of this alignment is approximately 15,500 feet.

Discharge into the Belfair UGA gravity collection system will require upsizing of collection system components in the UGA to convey flow through the system to the transmission system and ultimately to the treatment facility.

Based on the elements described, the estimate of probable capital costs for the Lynch Cove/North Shore sewer components is approximately $8,500,000, with an initial annual operation and maintenance cost of approximately $67,000.

**Additional Sewer Service Areas**

The Mission Creek Corrections Center for Women opened recently with plans for future expansion from 200 to 400 beds. The expansion will require improvements to the facility's wastewater collection and treatment system. As part of the Facility Plan Supplemental Information scope of work, extension to the proposed Belfair sewer system was considered.

Extending sewer service to the Mission Creek Corrections Center would require a pump station and force main to connect to the Belfair collection system. The force main would run south on Sand Hill Road to the North Shore force main located in SR-300. Approximately 3.5 miles of 3-inch force main would be required to serve the Corrections Center at an average daily flow of 36,000 gpd, the design flow projections following the planned expansion of the Corrections Center between 2007 and 2009.

Connection of the Correction Center to the Belfair sewer system would require significant extension of service into rural Mason County, a practice that may be challenged from a growth management perspective. As a result, extending services to the Mission Creek Corrections Center is not considered in this Facility Planning element.

# SECTION 8

# SECTION 8
# SUPPLEMENT TO CHAPTER 13
# COST OF SYSTEM ALTERNATIVES AND FINANCING OPTIONS

The purpose of this section is to supplement Chapter 13 of the Facility Plan with a summary of the updated siting, treatment, and conveyance alternative costs that were developed within this document.

Sections 5 through 7 reviewed and evaluated alternatives for facility siting, treatment, and collection of sewage from the service area defined in Section 2. Only two treatment alternatives were carried forward for further analysis from Section 6, a membrane biological reactor facility near Belfair at the Overton & Associates site and expansion of the North Bay/Case Inlet facility.

Presented are capital cost summary, annual operation and maintenance costs, annual replacement costs and a present worth evaluation. The costs are separated into two components, the Belfair UGA and the Lynch Cove/North Shore service areas. As presented, costs for the Lynch Cove/North Shore service area are dependent on the implementation of the Belfair UGA sewer system. Transmission and treatment costs for the Lynch Cove/North Shore area are incremental costs associated with the need to increase the capacity the Belfair UGA transmission and treatment components to accommodate the increase in flow from the potential Lynch Cove/North Shore service area. These incremental costs are solely for the purpose of defining costs for the Belfair UGA sewer system with and without the Lynch Cove/North Shore service area.

## Capital Cost Summary

Three major components were included in developing cost estimates for capital improvements and are summarized below.

- Construction - These cost estimates are based upon recent experience with projects of similar work and assume improvements will be accomplished by private contractors through a public works contract. They include complete costs for the installation of improvements by a contractor and include a 20% contingency and sales tax at 8.3%.

- Property acquisition – These cost are associated with the purchase of property and the acquisition of temporary and permanent easements. The estimates are based on current property values in the Belfair area and include the administrative and consultant costs and a 20% contingency.

- Engineering, environmental and administrative – These costs area based on an estimate of services or a percentage of construction costs based on the location and complexity of the work elements. They include services starting at the predesign phase through construction and include a 10% contingency.

Cost estimates represent opinions of cost only, acknowledging that final costs of individual projects will vary depending on actual labor and material costs, market conditions for the construction, regulatory factors, final project scope, project schedule and other factors. The estimates are preliminary, and are based on the level and detail of planning presented in this plan. The estimates should be reviewed and updated as the project proceeds through the design phase.

Construction cost estimates are represented in 2006 dollars. Since construction costs change periodically, an indexing method to adjust present estimates in the future is useful. The Engineering News-Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. The ENR CCI for Seattle in November 2006 is 8,656. Table 8-1 presents a summary of the estimated capital costs of the two alternatives. Detailed cost estimates are presented in Appendix J.

**Table 8-1**
**Capital Cost Summary**

| Sewer Component | Belfair MBR | North Bay-Case Inlet Expansion |
|---|---|---|
| **Belfair UGA** | | |
| Collection | $7,900,000 | $7,900,000 |
| Transmission | $3,300,000 | $9,300,000 |
| Treatment | $13,400,000 | $8,700,000 |
| **Belfair UGA Subtotal** | **$24,600,000** | **$25,900,000** |
| **Lynch Cove/North Shore** | | |
| Collection | $8,500,000 | $8,500,000 |
| Transmission (1) | $200,000 | $600,000 |
| Treatment (1) | $500,000 | $400,000 |
| **Lynch Cove/North Shore Subtotal** | **$9,200,000** | **$9,500,000** |
| **Total Capital Cost** | **$33,800,000** | **$35,400,000** |

Note:
(1) Transmission and Treatment capital costs for the Lynch Cove/North Shore area are incremental costs based on the need to increase the capacity of the Belfair UGA transmission and treatment components to accommodate the additional flow.

The capital costs presented in Table 8-1 represents complete program costs for the installation of the sewer components as described. They account for all known costs associated with the potential Belfair Sewer project, both public and private costs. Private costs are attributed to the cost of connecting a sewer to an existing residence on private property. These costs include construction of sewer extensions on private property (side sewers) to connect the structure to the sewer in the public right-of-way or easement and

abandonment of existing septic tanks. The cost of grinder pumps, where applicable, is not considered a private cost. The grinder pumps are considered a necessary form of treatment to precondition the wastewater so that it is compatible with the pressure sewer collection system in the public right-of-way or easement. For both alternatives, the private costs are similar and represent $2,300,000 of the total capital costs shown.

### Annual Operation and Maintenance Costs

Operation and Maintenance (O&M) costs are the annual costs required to properly operate and maintain equipment, processes, facilities and the utility. These costs include power, chemical, lab and other services related to operation of the treatment process and complying with the regulatory requirements. Operation and maintenance costs also include a component for labor associated with administration and staff requirements for operation and maintenance of the utility. For the North Bay/Case Inlet Expansion, the O&M costs represent the additional O&M costs over the existing operations associated with the proposed improvements.

The O&M cost impact for the two alternatives is presented in Table 8-2. For the purpose of developing a complete forecast of operation and maintenance needs, it is anticipated that the County will maintain the individual grinder pumps in the collection system, similar to the current policy at the North Bay/Case Inlet system.

**Table 8-2**
**Annual Operation & Maintenance (O&M) Cost Summary**

| Sewer Component | Belfair MBR | North Bay-Case Inlet Expansion |
|---|---|---|
| **Belfair UGA** | | |
| Collection | $37,000 | $37,000 |
| Transmission | $60,000 | $86,000 |
| Treatment | $266,000 | $232,000 |
| **Belfair UGA Subtotal** | **$363,000** | **$355,000** |
| **Lynch Cove/North Shore** | | |
| Collection | $68,000 | $68,000 |
| Transmission (1) | $9,000 | $9,000 |
| Treatment (1) | $67,000 | $45,000 |
| **Lynch Cove/North Shore Subtotal** | **$144,000** | **$122,000** |
| **Total Annual O&M Cost** | **$507,000** | **$477,000** |

Note:
(1) Transmission and Treatment O&M costs for the Lynch Cove/North Shore area are incremental costs based on the additional operation and maintenance needs of the Belfair UGA transmission and treatment components to accommodate the additional flow.

## Annual Replacement Costs

Replacement costs represent future capital expenditures associated with the replacement of equipment, systems, structures and other facilities that are at the end of their service life and have no additional value. Typically in wastewater applications, replacement costs for equipment is 20 years, for structures, sewers and other facilities it can be up to 50 years or more. To anticipate these expenditures at the various intervals, replacement costs are equated to an annual cost. For the North Bay/Case Inlet Expansion, the replacement costs represent the additional replacement costs added to the existing operations associated with the proposed improvements.

The annual replacement cost impact for the two alternatives is presented in Table 8-3.

**Table 8-3**
**Annual Replacement Cost Summary**

| Sewer Component | Belfair MBR | North Bay-Case Inlet Expansion |
|---|---|---|
| **Belfair UGA** | | |
| Collection | $123,000 | $123,000 |
| Transmission | $76,000 | $195,000 |
| Treatment | $242,000 | $114,000 |
| **Belfair UGA Subtotal** | **$441,000** | **$432,000** |
| **Lynch Cove/North Shore** | | |
| Collection | $99,000 | $99,000 |
| Transmission (1) | $7,000 | $16,000 |
| Treatment (1) | $7,000 | $5,000 |
| **Lynch Cove/North Shore Subtotal** | **$113,000** | **$120,000** |
| **Total Annual Replacement Cost** | **$554,000** | **$552,000** |

Note:
(1) Transmission and Treatment Replacement costs for the Lynch Cove/North Shore element are incremental costs based on the increase in capacity of the Belfair UGA transmission and treatment components to accommodate the additional flow..

## Present Worth

For comparison, the 20-year present worth value of each alternative was calculated using the three costs components and is presented in Table 8-4.

**Table 8-4**
**Present Worth Summary**

| Sewer Component | Belfair MBR | North Bay-Case Inlet Expansion |
|---|---|---|
| **Belfair UGA** | | |
| Total Capital Costs | $24,600,000 | $37,500,000 |
| Annual O&M Costs | $363,000 | $356,000 |
| Annual Replacement Costs | $441,000 | $432,000 |
| **Belfair UGA 20-Yr Present Worth** | **$36,500,000** | **$37,500,000** |
| **Lynch Cove/North Shore (1)** | | |
| Total Capital Costs | $9,200,000 | $9,500,000 |
| Annual O&M Costs | $144,000 | $122,000 |
| Annual Replacement Costs | $113,000 | $120,000 |
| **Lynch Cove/North Shore 20-Yr Present Worth** | **$13,100,000** | **$13,200,000** |
| **Total 20-Year Present Worth** | **$49,600,000** | **$50,700,000** |

Note:
(1) The present worth evaluation of the Lynch Cove/North Shore presents incremental costs that are an addition to those costs of providing sewer service to the Belfair UGA.

The present worth summary slightly favors the Belfair MBR alternative, but the two alternatives are considered essentially equal since the present worth is within 2%, well within the margin of error for cost estimates at the Facility Plan level.

## Available Funding Sources

Chapter 13 of the Facility Plan contained a comprehensive listing of available funding sources available to Mason County. A discussion of available funding sources is presented in Section 11, Financial Impact Evaluation

# SECTION 9

# SECTION 9
# SUPPLEMENT TO CHAPTER 14
# PUBLIC PARTICIPATION

This section supplements Chapter 14 of the Facility Plan with information concerning public involvement in the development of this Supplemental Information for the Facility Plan.

## Public Meetings

The following is a brief summary of the three public meetings that have been conducted as part of this Facility Plan Supplemental Information project. Appendix M contains the presentation files, sign-up sheets and public comments received at each meeting.

### *November 8, 2005*

In November of 2005 the first public meeting was held at the Belfair Elementary School gymnasium to inform Belfair area residents of the purpose of updating the Facility Plan and provide opportunity for public input. The meeting covered the background of the project, defined the potential sewer service area in Belfair and Lynch Cove/North Shore, and presented the approach and design conditions that would be considered in the Facility Plan update.

### *October 11, 2006*

A second meeting was held at the Theler Center in Belfair in October 2006 to update the public on the status of the Facility Plan Supplemental Information work. Background and current project status with reviewed and proposed service areas and sewer alignments were discussed. County staff also updated the community on the status of the Limited Area of More Intense Rural Development (LAMIRD) Boundary Justification process in Lynch Cove/North Shore area and why the specific land use designation is required before providing sewer service to the rural area. The meeting also presented the public an opportunity to provide scoping comments for the programmatic Environmental Impact Statement (EIS) being developed for the Belfair Sewer Project and the proposed LAMIRD.

### *November 15, 2006*

The third public meeting was held at the North Mason School District Office in November 2006 to inform Belfair area residents of the status of the project and to present the results of the preliminary financial analysis. Also presented was a review of the LAMIRD Boundary Justification process and the EIS process.

### *Programmatic Environmental Impact Statement (EIS)*

A programmatic EIS was developed alongside the completion of the draft Facility Plan Supplemental Information. The programmatic EIS was developed for the Belfair/Lower Hood Canal Water Reclamation Facilities Plan Supplemental Information and the LAMIRD Boundary Justification. The draft EIS was open for public comment beginning at the October 11, 2006 public information meeting. The comment period extended through December 18, 2006. The public comments that were received were addressed in the final EIS that was issued on January 29, 2007.

# SECTION 10
# SUPPLEMENT TO CHAPTER 15
# PLAN SUMMARY

The purpose of this section is to supplement Chapter 15 of the Facility Plan with an updated plan summary based on the recommended collection, conveyance, siting, and treatment alternatives that were developed in this supplemental information to the Facility Plan.

## Recommended Plan

Section 6 reevaluated treatment alternatives for the Belfair service area based on updated design criteria and identified two viable treatment alternatives; a membrane biological reactor facility adjacent to the Belfair UGA and expansion of the North Bay/Case Inlet (NB/CI) facility. The development of these two alternatives is similar to the conclusion of the Facility Plan, however the proposed treatment systems are significantly larger to accommodate the service area flow projections and the treatment technology proposed represents best available technology for producing a Class A reclaimed water.

Project cost estimates derived in Section 8 show that the estimates of probable capital costs are slightly greater for the NB/CI alternative. This is attributed to the additional cost of conveyance to the NB/CI reclamation facility near Allyn compared to conveyance to a reclamation facility near Belfair. Operation and maintenance costs are slightly lower for the NB/CI alternative, which is a reflection of the efficiencies of consolidating the treatment facilities. The difference in estimated capital and operating costs for the two alternatives is offset by the estimated 20-year present worth values of the treatment alternatives which are essentially equal, within 2%.

The Belfair Water Reclamation Facility alternative represents a scenario that maintains local wastewater treatment and reclamation, within close proximity to the service area and future service areas in the Belfair UGA. Flows beyond the 10-year planning horizon will require expansion of the proposed facility. The recommended location of the Belfair reclamation facility, in Section 33, permits future access to the wastewater facility from areas that will experience a significant amount of development based on current zoning. In addition, the location of the reclamation facility near the UGA will allow access to and promote reuse opportunities for reclaimed water, including future industrial, recreational and environmental mitigation purposes.

The remote location of the NB/CI facility to the Belfair UGA will make further expansions of the facility to accommodate flows beyond the 10-year planning horizon difficult, requiring expansion of the treatment facility as well as the conveyance system. Future utilization of reclaimed water in the Belfair UGA would be inhibited by the significant capital investment, requiring conveyance of reclaimed water back to the UGA from the NB/CI facility. Also, the NB/CI expansion alternative requires the conveyance of raw wastewater through rural

Mason County, a practice that may be interpreted as providing service or access to the utility outside the Belfair UGA, against the policies of growth management.

Based on the evaluation of the viable alternatives, the Mason County Board of Commissioners provided a working direction to staff to site the reclamation facility near Belfair on the Overton & Associates property, Section 33 (Appendix G). From the discussions herein and the directive by the Board of Commissioners, it is recommended that a reclamation facility, utilizing membrane technology and land application, be located on the Overton & Associates property, adjacent to the south east corner of the Belfair UGA.

Based on direction from the Board of Commissioners, the initial sewer service area will be limited to the Belfair UGA. Service to the Lynch Cove/North Shore area, which includes the Belfair State Park, will not be provided at this time, but may be considered as a future project phase.

The following are key elements of the recommended Facility Plan:

- As the initial phase of sewer service within the Belfair UGA, provide a combined gravity and low-pressure sewer system to serve the core commercial area, along SR-3, and provide facilities that can accommodate future phases as development occurs in the UGA.

- Convey collected wastewater via a transmission force main to the Belfair Water Reclamation Facility located adjacent to the Belfair UGA.

- Treat wastewater to Class A standards and provide effluent reuse by land application at the Belfair Water Reclamation Facility, located on Overton & Associates property in Section 33.

Figure 10-1 presents the location of key elements of the recommended plan. The process flow schematic for the water reclamation facility is shown in Figure 10-2.

**Plan Highlights**

***Collection -*** Combination of gravity and low pressure sewers and pump stations to include:

| | |
|---|---|
| Belfair Commercial Area | 21,000 linear feet, one pump station |

***Transmission -*** One pump station located in the Belfair UGA with capacity of 780 gpm and 7,000 lf of 10-inch transmission main.

***Treatment -*** Water reclamation facility utilizing membrane bioreactor (MBR) technology to treat an average daily flow of 0.32 mgd sited in Section 33.

***Effluent Utilization -*** Slow rate application of Class A Reclaimed Water on 24 acres of land at the Overton & Associates site, located south and east of the BPA easement in Section 33. A Class A storage pond will be located at the water reclamation facility site.

***Biosolids management*** - Aerobic digesters, sludge disposal by contract operator.

**Design Summary**

The design flows and loading presented in Table 10-1 are based on the 10-year flow projections for the Belfair UGA sewer service area. The design flows will be recalculated during the predesign phase based on the most current information to ensure their accuracy. Table 10-2 presents the secondary effluent design criteria.

**Table 10-1**
**Design Summary: Projected Flows and Loadings**

| Design Criteria | Flow |
|---|---|
| Average Daily Flow | 0.32 mgd |
| Maximum Month | 0.38 mgd |
| Maximum Daily | 0.64 mgd |
| Peak Hourly | 1.12 mgd |
| Average Daily BOD5 | 399 lbs/day |
| Average Daily TSS | 399 lbs/day |
| Average Daily Nitrogen, TKN | 106 lbs/day |

**Table 10-2**
**Secondary Effluent Design Criteria**

| Parameter | Monthly Average | Weekly Average | Daily Limit |
|---|---|---|---|
| $BOD_5$ | 30 mg/L | n/a | n/a |
| TSS | 30 mg/L | n/a | n/a |
| Turbidity | 2 NTU | n/a | 5 NTU |
| Total Nitrogen | n/a | n/a | 10 mg/L |
| Total Coliform | n/a | <2.2/100 mL | <23/100 mL |

Tables 10-3 through 10-5 present a detailed preliminary design summary of all required components for the collection, transmission, and treatment sections of the recommended plan.

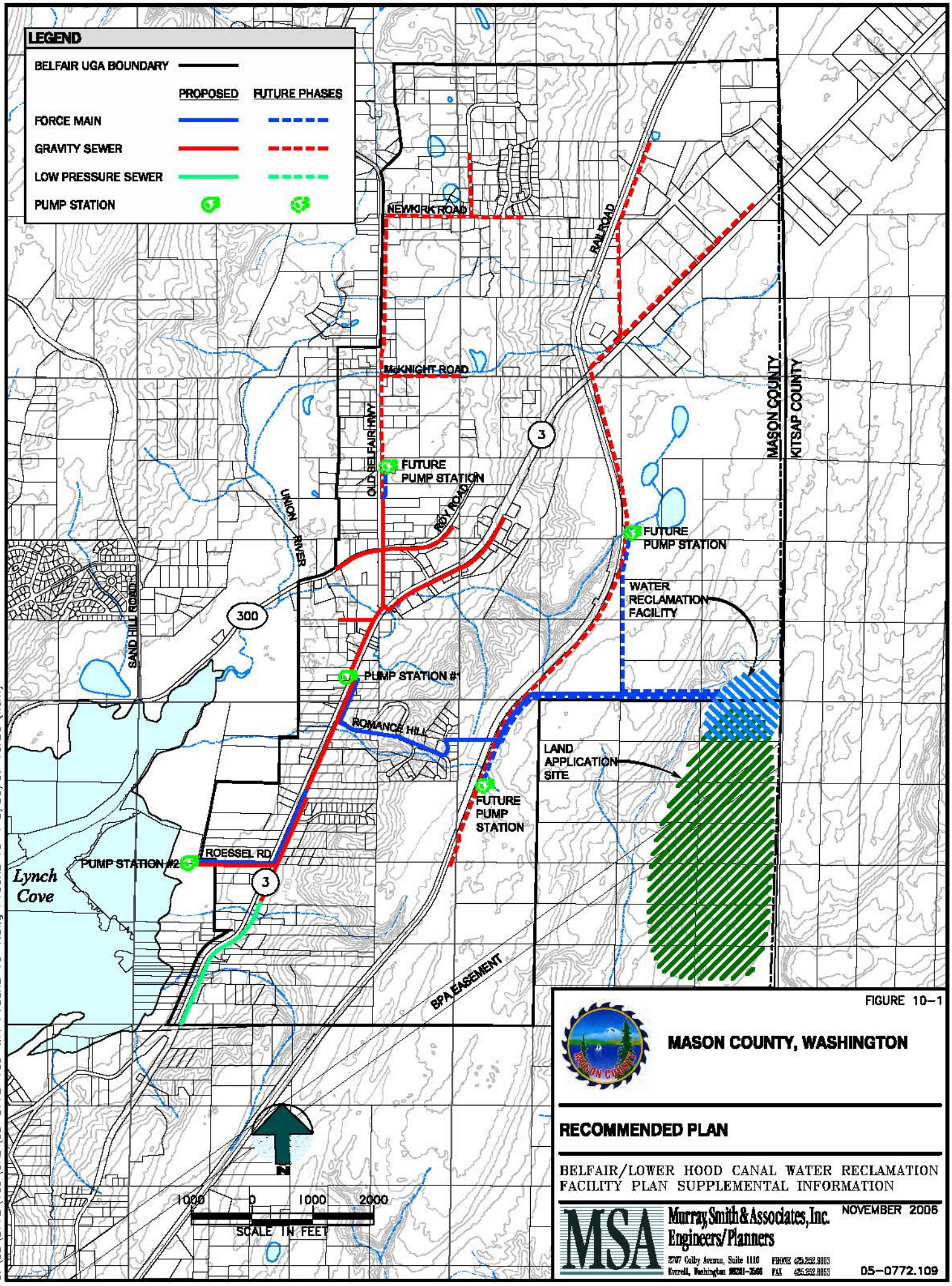


FIGURE 10–1

**MASON COUNTY, WASHINGTON**

**RECOMMENDED PLAN**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

NOVEMBER 2006

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**Table 10-3**
**Design Summary: Collection System**

| Collection Component | Description |
|---|---|
| **Belfair UGA** | |
| Gravity Sewer | |
| 18-inch | 1,100 lf |
| 15-inch | 1,250 lf |
| 10-inch | 950 lf |
| 8-inch | 10,350 lf |
| Low Pressure Sewer | |
| 3-inch | 5,200 lf |
| 4-inch | 1,950 lf |
| Pump Station No. 2 | |
| Type | Submersible |
| Capacity | 200 gpm @ 70' TDH |
| Motor | 10 HP |
| Force Main | |
| Length | 2,900 lf |
| Material | 6" HDPE, DR 13.5 |
| Velocity | 2.3 fps |

**Table 10-4**
**Design Summary: Transmission System**

| Transmission Component | Description |
|---|---|
| Pump Station No. 1 | |
| Type | Submersible / Dry-Pit (2 Stage) |
| Capacity | 780 gpm @ 375' TDH |
| Motor | 125 HP w/VFD |
| Force Main | |
| Length | 7,000 lf |
| Material | 10" Cl 52 Ductile Iron |
| Velocity | 2.8 fps |

**Table 10-5**
**Design Summary: Belfair MBR**

| Treatment Component | Description |
|---|---|
| **Headworks** | |
| Flow Meter | Magnetic |
| Mechanical Bar Screen | 1/8-inch Spacing |
| Grit Removal | Vortex Type |
| **Secondary Treatment – MBR** | |
| **Anoxic Basin (one basin)** | |
| Volume | 115,000 gal |
| Mixer | 3 hp |
| Recycle Pumps (2) | 15 hp |
| Recycle Flow Meter | Magnetic |
| **Pre-Aeration Basin (one basin)** | |
| Volume | 25,000 gal |
| Pre-Aeration Blowers (2) | 7.5 HP |
| **MBR Basin (two basins)** | |
| Volume Each | 41,000 gal |
| Qty Membrane Modules | 12 |
| MBR Process Blowers (2) | 20 HP |
| Waste Sludge Pump (2) | 5 HP |
| **UV Disinfection** | |
| Type | Low Pressure / Medium Intensity |
| Quantity of Banks | 3 |
| Total Lamps | 96 |
| **Spray Irrigation System** | |
| Irrigation Pumps (2) | 30 HP |
| No. of Zones | 3 |
| No. Spray Heads/ Zone | 102 |
| Capacity of Spray Head | 6.5 gpm |
| Class A Storage Pond | 14.7 MG |
| **Bypass System** | |
| Storage Pond | Lined |
| Volume | 1.6 MG |
| Pond/Utility Pumps (2) | 5 HP |
| **Sludge Handling** | |
| Aerobic Digester (two basins) | |
| Volume Each | 140,000 gal |
| Digester Blowers (2) | 20 HP |
| **Standby Power** | |
| Type | Diesel Generator |
| Capacity | 12 hours |
| **Samplers (Influent/Effluent)** | |
| Type | Composite |

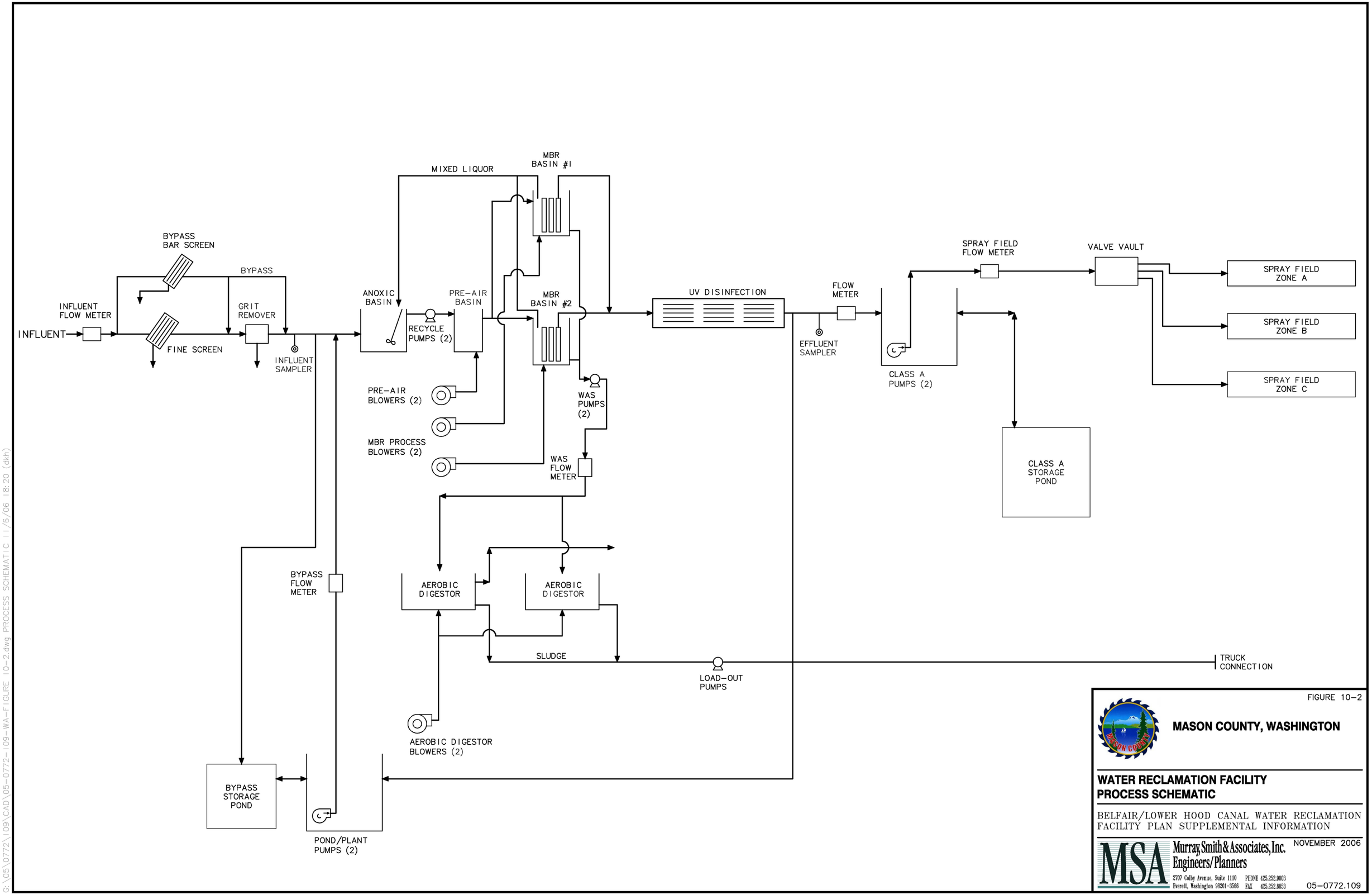


FIGURE 10-2

**MASON COUNTY, WASHINGTON**

**WATER RECLAMATION FACILITY PROCESS SCHEMATIC**

BELFAIR/LOWER HOOD CANAL WATER RECLAMATION FACILITY PLAN SUPPLEMENTAL INFORMATION

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NOVEMBER 2006

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## Cost Summary

Based on the preliminary design criteria, costs were developed for each component of the recommended plan. Detailed cost estimates were prepared and included in Appendix J. Table 10-6 presents the summary of capital costs for the recommended plan.

**Table 10-6**
**Recommended Plan Cost Summary**
**Belfair UGA**

| Sewer Component | Cost |
|---|---|
| **Collection System** | $7,900,000 |
| **Transmission** | $3,300,000 |
| **Treatment** | $13,400,000 |
| **Total Cost** | **$24,600,000** |

## Project Schedule

It is expected that three years will be required to implement this plan. Key elements of the plan are shown below:

*Design Phase*

| | |
|---|---|
| Preliminary Design/Surveys/Site Investigations | 6 months |
| Final Design/Bid Services | 12 months |
| Permits/Easements and property acquisition | 18 months |
| Community Participation | 18 months |
| Total Project Design Phase Duration | 18 months |

*Construction Phase*

| | |
|---|---|
| Construction Activities | 15 months |
| Commissioning/Start-Up | 3 months |
| Total Construction Phase Duration | 18 months |

# SECTION 11
# FINANCIAL IMPACT EVALUATION

## Introduction

The purpose of the financial section of the Facility Plan Supplemental Information is to evaluate the financial impact of completing the capital program identified in the plan, and outlining necessary steps for the financial execution of the plan. Completing these projections for a start-up system requires relying more heavily on assumptions and estimates than for an existing system with available operating and cost history. Therefore, this chapter will list the set of assumptions that are used to project financial impacts as well as identify financial issues that may be dealt with in the utility formation process as it progresses.

This chapter includes:

- Capital Cost Data and Inflationary Projections
- ERU Data and Projections
- Available Funding Sources for Capital Projects
- Capital Financing Assumptions Used for the Financial Impact Forecast
- Cost Recovery Scenarios Evaluated
- Annual Revenue Needs Forecast (a 20-year forecast is developed; for ease of presentation, representative years are shown in this chapter with the complete long-term forecasts provided in Appendix A)
- List of Assumptions Used in the Revenue Needs Projection
- List of Utility Formation Financial Issues to Consider
- Capital Facilities Charge Calculation
- Recommended Financial Strategy

## Capital Cost and Inflationary Projections

The capital costs identified in this plan are provided in current (2006) dollars. It is anticipated that these projects will be constructed up to the projected 2010 first year of utility operation. An assumption has been made then for construction cost inflation over the years 2006 through 2009 when capital spending will occur. An annual construction cost inflation rate of 4% has been used in forecasting capital costs for financing needs. The following table shows the capital cost timing projection as well as the costs escalated to the year of anticipated spending.

**Table 11-1**
**Capital Program Summary**

| | 2006 Basis | Escalated Cost |
|---|---|---|
| **2007** | $ 1,800,000 | $ 1,872,000 |
| **2008** | 15,200,000 | 16,440,320 |
| **2009** | 7,545,000 | 8,487,099 |
| | $ 24,545,000 | $ 26,799,419 |

## Equivalent Residential Unit (ERU) Data and Projections

The Belfair UGA area is projected to grow at 9.7% annually in the near term. To be conservative, Mason County Department of Community Development recommended using a 5% annual growth rate as the basis for the ERU projection. The conservative growth assumption is used for projecting future revenues. Other calculations that rely on projecting customer base use the original projection and are noted as such in this document. The following table summarizes the growth projections for the Belfair sewer utility areas.

**Table 11-2**
**ERU and Growth Summary by Area**

| ERUs | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Belfair UGA (5% annual) | 508 | 533 | 560 | 588 | 617 | 648 | 681 | 715 | 751 | 788 | 827 |
| Effective Utility Annual Growth Rate | | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% | 5.00% |
| Belfair UGA (9.7% annual) | 508 | 557 | 611 | 671 | 736 | 807 | 885 | 971 | 1,065 | 1,169 | 1,282 |
| Effective Utility Annual Growth Rate | | 9.70% | 9.70% | 9.70% | 9.70% | 9.70% | 9.70% | 9.70% | 9.70% | 9.70% | 9.70% |

The plan outlined envisions facilities capable of serving the 10 year growth horizon, or roughly 1,250 ERUs. However the benchmark of 800 ERUs, based on the 5% growth number, along with the estimate of 508 initial ERUs (2007) served, are used in the financial analysis as the basis for allocating and recovering capital costs and estimating necessary rates and charges.

## Available Funding Sources for Capital Projects

Funding capital projects for utility formation requires considering unique constraints. In the case of an existing utility there may be cash reserves available either to pay directly for capital or to provide matching funds for low cost loan programs. Existing cash also allows for short-term cash-flow management for grant programs that operate on a reimbursement basis only. An existing utility has existing revenue to pledge toward loan repayment and that may be made available for debt service that commences before project completion (and therefore utility operation and revenue collection in the case of utility formation).

Since there are no existing cash reserves, nor revenue, financing utility formation requires funding sources that provide proceeds upfront and do not require repayment until project completion or utility operation and using these options not only to fund projects but to manage project cash flow during construction. Since many grant/loan programs are reimbursement-based, meaning that they pay the agency only after agency payment for incurred costs, cash flow is a vital consideration in project financing and management.

The following is a summary of the available programs and borrowing mechanisms that are available to the County for sewer utility infrastructure funding.

## A. Government Programs

**Public Works Trust Fund.** Historically the Public Works Trust Fund (PWTF) was a commonly applied for and used, low-cost revolving-loan fund. It was established by the 1985 State Legislature to provide financial assistance to local governments for public works projects. Eligible projects have included repair, replacement, rehabilitation, reconstruction, or improvement of eligible public works systems to meet current standards for existing users. With recent revisions to the program, utility growth-related projects consistent with 20-year projected needs are now eligible. However, anticipated revisions to the PWTF program are that total funding of the program will continue to be reduced and qualifying projects will be limited to those that provide economic benefit, i.e. are growth-related. Whether PWTF will exist for sewer and water utility funding is currently in question; the Washington State Legislature is looking at the option of totally revising public works financial assistance programs. It is possible that this program might be eliminated altogether. Regardless, until that possibility becomes a reality, PWTF loans continue to be a much sought after source of capital construction financing that the Utility might pursue.

PWTF loans were available at interest rates of 0.5 percent, 1 percent, and 2 percent, with the lower interest rates given to applicants who pay a larger share of the total project costs. The loan applicant must pay a minimum of 5 percent towards the project cost to qualify for a 2 percent loan, 10 percent for a 1-percent loan, and 15 percent for a 0.5 percent loan. The useful life of the project determines the loan term up to a maximum of 20 years. Proceeds from other debt, such as the existing County SRF loans, qualify as matching funds. The lack of cash reserve does not disqualify the county from the terms awarded for matching.

The applicant must be a local government, such as a city, county, or special purpose utility district, and have an approved long-term plan for financing its public works needs. Local governments must compete for PWTF dollars since more funds are requested each year than are available. The Public Works Board evaluates each application and transmits a prioritized list of projects to the legislature. The legislature then indicates its approval by passing an appropriation from the Public Works Assistance Account to cover the cost of the approved loans. Once the Governor has signed the appropriations bill into law, the local governments receiving the loans are offered a formal loan agreement with the appropriate interest rate and term, as determined by the Public Works Board.

PWTF loans are a good option for low cost financing with the added advantage that loan disbursements largely precede project expenditures. However, loan servicing begins in the year following receipt of the loan (beginning with one year of interest only payment), which means that for a multi-year construction of a new system, project debt repayment may begin before utility operation, and thus also before utility revenues are being generated.

**Community Economic Revitalization Board.** Managed by the Department of Community Trade and Economic Development (CTED), this program provides grants and loans to fund public facilities that result in specific private-sector development. Eligible projects include water, sewer, roads, and bridges. There are current legislative efforts to increase State funding of this program, perhaps with a redesignation of PWTF funding similar to what has taken place in 2005 and 2006. In this case, grants and loans for sewer projects with defined economic development benefits might qualify for this type of financial assistance.

The County currently has $16 million in appropriated economic development grants and anticipates receiving more grants funds. The analyses are based on the current $16 million.

**Community Development Block Grant (CDBG) Program.** A federal government program administered by the State Department of Community Trade and Economic Development, the CDBG program provides grants and loans for infrastructure improvements, including utility projects, for business development that create or retain jobs for low and moderate-income residents.

**Department of Ecology.** The Department's Water Quality Financial Assistance Program sponsors 3 grant and loan programs: the Centennial Clean Water Fund (grant), Federal 319 Programs (grant), and the State Revolving Fund Loan (SRF). Most of the funding goes to wastewater programs. The Centennial Fund grants are available for projects serving 110% of existing capacity (limiting funding of growth) and the SRF is available to fund 20 years of growth (based on Growth Management Act-compliant comprehensive plans). SRF loans require establishment of a reserve that can be done over the first five years of loan repayment which begins within one year after the initiation of operation or project completion (maximum five years after the first dispersement). That repayment is delayed until operation or project completion is an important feature of this loan option for utility formation. Though, the timeline begins for planning and design loans once those phases are complete, not when the project construction is complete.

When applying for DOE programs, application materials are considered for all three programs. The department awards eligible grants and loans as a package. The county has been awarded an SRF loan in the amount of $2.4 million that they have indicated is being repackaged, though the total amount loaned will not change. That they have been awarded an SRF loan means that they have been considered for and not offered a grant for the same period. We would recommend that the county continue to seek grant funds (and low cost SRF loans) for the remaining project financing fiscal periods.

The financial hardship consideration for the Centennial Grant might apply to the county once the financial impact projections have been published. A common affordability factor for utility rates is a calculation of 1.5% of the area's median income. Any rates that exceed the 1.5% may qualify the rate as unaffordable. The State of Washington's Office of Financial Management (OFM) projects the median income for Mason County to 2005 off of the 1999 Census data. Projecting five years out from that data point to 2010, at 3% annual income growth, results in $51,000. The monthly equivalent at 1.5% is $64. The rates projected in these forecasts are significantly higher than $64 per month.

DOE offers another program that may be available based on the unique financing needs of the Belfair sewering project. A significant portion of the costs are listed as components on private property which include septic tank abandonment. DOE offers a program to loan funds to local governments to establish local loan funds. These loan programs should assist private citizens and small commercial enterprises by providing loans for water quality improvement projects. Examples listed in the FY 2007 Guidelines, Vol I document include lending money to rehabilitate on-site septic systems. Though it does not specifically cite septic system abandonment for sewering, the private on-site costs may qualify and the county should pursue funds from this program to alleviate the cost burden of the portion of financing borne by private citizens.

**Federal USDA Rural Utility Services Loans and Grants.** The USDA administers the Rural Utilities Services loan and grant program that includes a Water Environment Program that targets water and wastewater issues for rural communities, defined as having a population of less than 10,000 in a rural area, city or town. With under 1,000 equivalent residential units in the service area considered, the Belfair sewering project area may meet the population criteria to qualify for assistance. There is a housing program that may be able to assist individual homeowners with loans, or in the case of low-income senior citizens, grant funds to make needed on-site improvements.

**Federal EPA State and Tribal Assistance Grants.** The Environmental Protection Agency administers the STAG program with the intent that it will assist states and tribes in carrying out activities to ensure compliance with environmental laws and standards, and for project results to serve as examples to other jurisdictions. Applications and review processes are administered through regional offices of the EPA.

## B. Public Debt

There are two common forms of publicly issued debt that the County might consider for funding wastewater projects: revenue bonds and general obligation bonds
Revenue bonds are commonly used to fund utility capital improvements. The bond debt is secured by the future revenues of the issuing utility, and the debt obligation or credit lien does not extend to other County revenue sources. With this limited commitment, revenue bonds typically require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (annual bond debt service coverage). The County must agree to satisfy these requirements by ordinance as a condition of a bond sale.

Even so, revenue bonds typically bear a premium in market interest rates as compared to general obligation backed bond debt.

Revenue bonds can be issued in Washington without a public vote. There is no bonding limit, except perhaps the practical limit of a utility's ability to generate sufficient "net revenue" to repay the debt and meet the annual minimum debt service coverage test.

General obligation (G.O.) bonds are secured by the full faith and credit of the County e.g., taxes. The County is authorized to issue general obligation debt to a limited degree without a public vote through the use of its "councilmatic" bonding capacity, with additional bonding capacity allowable subject to public vote. Included in the voted bonding capacity is an explicit provision for water and wastewater purposes.

Secured by the full financial strength of the County, G.O. debt typically does not require the additional stringent security conditions common for revenue bonds. In addition, the broader financial backing of all financial resources of the County makes G.O. bonds a more secure investment, a feature that is rewarded through a lower interest rate and an annual debt service coverage ratio of 1.0. Nonetheless, unless the County has sufficient non-voted G.O. bonding capacity to commit, the matter of getting an affirmative vote to sell the bonds remains problematic for most municipalities.

To the degree that the County relies on publicly issued debt, it is assumed that revenue bond debt would be used. Typically, competing uses for limited G.O. authority, especially for that which doesn't require a public vote, limit its accessibility to utilities. Further, the limitations on G.O. bonded indebtedness tend to inhibit the use for utilities, even when no current plans compete, simply due to the loss of flexibility which would occur. Therefore, as a conservative assumption for this financial plan, we have assumed that all future public debt financing will be via revenue bonds, with the commensurate security requirements and higher interest costs. However, the County may wish to consider the use of "councilmatic" G.O. debt as a source of project cash flow, to be repaid from the utility upon completion of project funding and receipt of all material capital resources. The issuance of relatively short-term debt (e.g. 3-5 years) would provide a low cost source of cash during construction whiling assuring recovery of available debt capacity within a relatively short period.

One benefit offered by public debt for a utility formation is that revenue bond debt can be structured to delay debt service payments until revenues commence, through features such as deferred principal maturities and capitalized interest. Thus, debt service could be delayed until the utility is in operation and generating revenues for debt repayment.

**Capital Financing Assumptions Used for the Financial Impact Forecast**

The county has already secured a grant and an SRF loan toward financing the project costs. A summary is provided in the following Table 11-3.

**Table 11-3**
**Summary of Current Available Funding**

| | | | |
|---|---|---|---|
| State Revolving Fund '04 | $518,940 | Planning & Design | Being Repackaged |
| State Revolving Fund '06 | $802,352 | Design | Being Repackaged |
| State Revolving Fund '07 | $1,107,814 | Design | Preliminary List |
| CTED Job/Communities | $8,000,000 | Construction | Legislative appropriation '05 |
| CTED Jobs Development | $8,000,000 | Construction | Legislative appropriation '05 |
| Committed Funding | $18,429,106 | | |

With total project costs of $26.8 million (escalated to year of projected spending), $8.4 million remains to be financed. While it is recommended that county pursue first, all grant funds, and second, all low-cost state loans, it may not be that either will be secured for the total remaining funding need. The forecast assumes that a total of $7 million of PWTF loans will be secured and in order to be conservative for financial forecasting purposes, that a revenue bond will be issued for the remaining costs. It is assumed that the county would capitalize interest until operation begins and service is being provided. The three forecast scenarios presented in the next section are thus identical in assumed resources used; they differ in the method of funding repayment of the revenue bonds, specifically whether through rate revenue or ULID assessments. The following table is a summary of annual financing used in the projections.

**Table 11-4**
**Annual Financing Assumptions for Financial Impact Projections**

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2017 | 2022 | 2027 |
|---|---|---|---|---|---|---|---|---|---|
| **Capital Financing Summary** | | | | | | | | | |
| **Costs to Finance** | $ 1,872,000 | $ 16,440,320 | $ 8,487,099 | $ - | $ - | $ - | $ - | $ - | $ - |
| **Funding Sources** | | | | | | | | | |
| Grant | $ - | $ 13,129,122 | $ 2,870,878 | $ - | $ - | $ - | $ - | $ - | $ - |
| State Loans (SRF/PWTF) | 2,429,106 | 3,000,000 | 4,000,000 | - | - | - | - | - | - |
| ULID | - | - | - | - | - | - | - | - | - |
| Revenue Bond | - | - | 1,353,600 | - | - | - | - | - | - |
| | $ 2,429,106 | $ 16,129,122 | $ 8,224,477 | $ - | $ - | $ - | $ - | $ - | $ - |

## Cost Recovery Scenarios Evaluated

The construction of a new sewer utility presents unique financial challenges as compared to major projects within an existing utility. Noted above was the cash flow challenge of financing and managing completion of a major construction project without an ongoing revenue source. In addition, a new utility directly faces all costs of the initial system with the corresponding cost recovery burden. In contrast, the initial cost of most collection systems is imposed on development as it occurs, and is not a cost borne through utility rates. As a result, the projected rates for a new system, if they include such costs, are generally

dramatically higher than comparable sewer rates in other utilities, and a potential obstacle to public acceptance and affordability.

Cost and financial assumptions used for forecasting costs are described following a summary of projected costs and rates.

This section contemplates three basic strategies for funding the initial capital costs of the system, and outlines three related scenarios: Scenario 1 contemplates monthly sewer rates as the primary means of funding operations, debt repayment and capital reinvestment; Scenario 2 contemplates using ULID assessments to fund initial construction costs, with rates paying ongoing O&M costs and capital reinvestment needs and Scenario 3 contemplates recovery of collection system costs through ULID assessments and treatment-related costs through monthly sewer rates. Each Scenario represents a worse case scenario, that is no addition grants will be available and funding will be though revenue bonds and SRF/PWTF loans. The following summaries describe the scenarios in greater detail.

***Scenario 1***

In Scenario 1, utility rates are the primary source of ongoing funding and relied on to meet operating and maintenance needs (O&M), debt repayment, and capital reinvestment needs. Capital Facilities Charges are imposed on new development and used to fund capital reserves and projects, exclusively.

This scenario has the advantage of relatively simple execution of a cost recovery strategy based on the calculation of a sewer rate sufficient to meet all projected needs based on the initial ERUs served. However, with reliance on rates to fund the initial project capital costs, this scenario results in substantial sewer rates likely to exceed comparable rates in other sewer systems.

***Scenario 2***

In Scenario 2, a Utility Local Improvement District (ULID) is established to fund the initial capital costs of the collection and treatment system. Sewer Rates are then used to fund ongoing operating and maintenance costs and a contribution toward capital reserves and reinvestment. Capital Facilities Charges are imposed only for new development not previously assessed, with those revenues used to fund capital reserves and future projects.

Formation of a ULID imposes an assessment directly on benefited properties. The authority and procedural requirements for such formation are defined in RCW 36.94.220-300. In general terms, properties are assessed based on special benefit received, subject to formation process involving notification, estimation and finalization of assessments, and also subject to protest and petition rights as provided in statute.

In forming the ULID, an engineering analysis would determine an equitable basis for allocating costs to benefited properties. Typically, this may be based on any of a number of

factors or combinations of factors, often including parcel size, front footage, anticipated demand (ERUs), and variations on these basic measurements. For this analysis, it is assumed that costs would be allocated in proportion to ERUs. In short, each property would be assigned and assessed for a given number of ERUs of capacity. For existing developed properties, the ERUs would be based on existing use. For undeveloped properties, the ERUs would be based on planning criteria for potential sewer demand. As properties develop or redevelop, demands in excess of assessed capacity would normally be charged for additional capacity using the utility Capital Facilities Charge, sometimes also referred to as an "in-lieu-of-assessment" charge.

In actual development and formation of the district, different criteria could be used for assessing costs, based on an engineering analysis. However, the average costs developed in this chapter should remain a reasonable basis for evaluating typical impacts.

The use of a ULID has the advantage of sharing costs to all benefited properties, not just those currently developed. This tends to lower the cost impact on developed properties. The assessments are also separately imposed, removing this cost burden from rates and enabling property owners to pre-pay assessments or pay over time. Up to a 20 year repayment period is provided by statute. The County can require that such assessments being paid in installments are fully paid off upon any transfer of ownership, or allow such obligations to transfer with the property. The County would establish the applicable interest rate imposed on such assessments. Typically, such rate is set at 1-2% (100 to 200 basis points) above the cost of debt. The County's source of financing is not constrained by the use of the ULID mechanism. If revenue bonds are used, the assessment structure is typically viewed as a more secure funding structure, and the coverage requirement of 1.25 is often reduced based on this enhanced security. This analysis has assumed that a coverage factor of 1.0 would apply for assessment-backed revenue bonds. An added advantage for homeowners is that the assessment amount adds to their cost basis for income tax purposes, and interest paid on the assessment is potentially tax deductible.

The formation of a ULID imposes additional costs for legal, engineering and procedural requirements. This cost can be substantial, depending on the level of opposition and protest and complexity of the district formed. Estimates ranging from 5-15% of project costs are common for the added cost of ULID formation. For this analysis, 5% of the project cost has been assumed as an added cost burden. The ULID process includes robust protection of property rights; as such, there are opportunities to oppose the formation or object to the assessment imposed which can increase such costs and potentially delay formation of the ULID and completion of the project.

### *Scenario 3*

Scenario 3 combines the two funding mechanisms of rates and ULID assessments. Utility rates are relied on to meet operating and maintenance needs (O&M), and capital reinvestment needs. The debt service repayment from rates would include only the portion of debt issued to fund treatment-related capital costs. The debt repayment resulting from

funding the collection system would be recovered through the ULID assessment with all of the process and costs outlined in scenario 2. The Capital Facilities Charge would be imposed on all new development, as in Scenario 1, except that two distinct charge components would apply: a treatment CFC applicable to all new development; and a collection system CFC applicable only to development not originally assessed through the ULID.

## Annual Revenue Needs Forecast (20-year)

The annual revenue needs forecast is comprised of the annual operating cost requirement, annual debt service, and any funds collected to establish minimum operating reserve levels. These are the items that must be included at a minimum level. There are certain policies related to the long-term financial health of operating a utility that should become a part of the annual rate revenue needs forecast, such as some reserve toward capital repair and replacement, usually some factor of annual depreciation to system assets. Recommended policies will be discussed in the recommended financial strategy section, but in order to minimize what will be a significant financial impact of funding the sewer system at formation, such policies are recommended to be phased-in. The following tables summarize the annual revenue needs projection and the cost per ERU based on the two scenarios for how the revenue would be collected from customers. Costs are summarized as monthly costs per ERU.

**Table 5**
**Annual Financial Impact Summary *(3 Scenarios)***

*Scenario 1 - Rate Revenue Net Financing*

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2017 | 2022 | 2027 |
|---|---|---|---|---|---|---|---|---|---|
| **Annual Revenue Needs Summary** | | | | | | | | | |
| **Non-Capital Costs** | | | | | | | | | |
| Administration & Overhead | $ - | $ - | $ - | $ 60,000 | $ 61,800 | $ 63,654 | $ 73,792 | $ 85,546 | $ 99,171 |
| Operations and Maintenance | - | - | - | 281,800 | 290,254 | 298,962 | 346,578 | 401,779 | 465,772 |
| Build-up of Reserves | - | - | - | 45,510 | 1,406 | - | - | - | - |
| Excise Tax | 0 | 0 | 0 | 27,340 | 28,707 | 30,143 | 38,471 | 44,699 | 57,048 |
| | $ 0 | $ 0 | $ 0 | $ 414,651 | $ 382,167 | $ 392,758 | $ 458,841 | $ 532,024 | $ 621,992 |
| **Debt Service** | *capitalized interest period* | | | | | | | | |
| State Loans | $ - | $ - | $ 15,000 | $ 567,705 | $ 563,946 | $ 560,186 | $ 541,387 | $ 522,592 | $ 503,798 |
| Revenue Bond | - | - | - | 122,143 | 122,143 | 122,143 | 122,143 | 122,143 | 122,143 |
| | $ - | $ - | $ 15,000 | $ 689,848 | $ 686,088 | $ 682,328 | $ 663,529 | $ 644,735 | $ 625,941 |
| Net Coverage Increment | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Total Annual Costs | $ 0 | $ 0 | $ 15,000 | $ 1,104,499 | $ 1,068,255 | $ 1,075,087 | $ 1,122,371 | $ 1,176,759 | $ 1,247,933 |
| **Monthly Rate** | **$ 0.00** | **$ 0.00** | **$ 0.00** | **$ 141.08** | **$ 141.08** | **$ 141.08** | **$ 141.08** | **$ 141.08** | **$ 141.08** |
| **Monthly Assessment per ERU** | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| **Financing Customer Connections** | $ - | $ - | $ - | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 |
| **Total Monthly Impact** | **$ 0.00** | **$ 0.00** | **$ 0.00** | **$ 154.61** | **$ 154.61** | **$ 154.61** | **$ 154.61** | **$ 154.61** | **$ 154.61** |
| **ERU Basis** | **508** | **533** | **560** | **588** | **617** | **648** | **827** | **1,056** | **1,348** |

## *Scenario 2 - ULID Net Financing*

| Annual Revenue Needs Summary | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2017 | 2022 | 2027 |
|---|---|---|---|---|---|---|---|---|---|
| **Non-Capital Costs** | | | | | | | | | |
| Administration & Overhead | $ - | $ - | $ - | $ 60,000 | $ 61,800 | $ 63,654 | $ 73,792 | $ 85,546 | $ 99,171 |
| Operations and Maintenance | - | - | - | 281,800 | 290,254 | 298,962 | 346,578 | 401,779 | 465,772 |
| Build-up of Reserves | - | - | - | 43,339 | 883 | - | - | - | - |
| Excise Tax | - | - | - | 9,725 | 10,211 | 10,722 | 13,684 | 17,465 | 22,290 |
| | $ - | $ - | $ - | $ 394,864 | $ 363,149 | $ 373,337 | $ 434,055 | $ 504,790 | $ 587,233 |
| **Debt Service** | *capitalized interest period* | | | | | | | | |
| State Loans | $ - | $ - | $ 15,000 | $ 567,705 | $ 563,946 | $ 560,186 | $ 541,387 | $ 522,592 | $ 503,798 |
| Revenue Bond | - | - | - | 157,609 | 157,609 | 157,609 | 157,609 | 157,609 | 157,609 |
| | $ - | $ - | $ 15,000 | $ 725,314 | $ 721,554 | $ 717,794 | $ 698,995 | $ 680,201 | $ 661,407 |
| Net Coverage Increment | $ - | $ - | $ - | $ - | $ - | $ - | $ 570,427 | $ 651,632 | $ - |
| Total Annual Costs | $ - | $ - | $ 15,000 | $ 1,120,178 | $ 1,084,703 | $ 1,091,132 | $ 1,703,477 | $ 1,836,623 | $ 1,248,640 |
| **Monthly Rate** | **$ 0.00** | **$ 0.00** | **$ 0.00** | **$ 55.12** | **$ 55.12** | **$ 55.12** | **$ 56.87** | **$ 58.86** | **$ 56.22** |
| **Monthly Assessment per ERU** | $ - | $ - | $ - | $ 80.76 | $ 80.76 | $ 80.76 | $ 80.76 | $ 80.76 | $ 80.76 |
| **Financing Customer Connections** | $ - | $ - | $ - | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 |
| **Total Monthly Impact** | **$ 0.00** | **$ 0.00** | **$ 0.00** | **$ 149.41** | **$ 149.41** | **$ 149.41** | **$ 151.16** | **$ 153.15** | **$ 150.50** |
| **ERU Basis** | **508** | **533** | **560** | **588** | **617** | **648** | **827** | **1,056** | **1,348** |

## *Scenario 3 - Combined ULID/Rate Revenue Financing*

| Annual Revenue Needs Summary | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2017 | 2022 | 2027 |
|---|---|---|---|---|---|---|---|---|---|
| **Non-Capital Costs** | | | | | | | | | |
| Administration & Overhead | $ - | $ - | $ - | $ 60,000 | $ 61,800 | $ 63,654 | $ 73,792 | $ 85,546 | $ 99,171 |
| Operations and Maintenance | - | - | - | 281,800 | 290,254 | 298,962 | 346,578 | 401,779 | 465,772 |
| Build-up of Reserves | - | - | - | 44,462 | 214 | - | - | - | - |
| Excise Tax | - | - | - | 18,838 | 19,779 | 20,768 | 29,954 | 33,829 | 43,176 |
| | $ - | $ - | $ - | $ 405,100 | $ 372,047 | $ 383,384 | $ 450,325 | $ 521,155 | $ 608,119 |
| **Debt Service** | *capitalized interest period* | | | | | | | | |
| State Loans | $ - | $ - | $ 15,000 | $ 567,705 | $ 563,946 | $ 560,186 | $ 541,387 | $ 522,592 | $ 503,798 |
| Revenue Bond | - | - | - | 157,609 | 157,609 | 157,609 | 157,609 | 157,609 | 157,609 |
| | $ - | $ - | $ 15,000 | $ 725,314 | $ 721,554 | $ 717,794 | $ 698,995 | $ 680,201 | $ 661,407 |
| Net Coverage Increment | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| Total Annual Costs | $ - | $ - | $ 15,000 | $ 1,130,414 | $ 1,093,601 | $ 1,101,178 | $ 1,149,320 | $ 1,201,356 | $ 1,269,526 |
| **Monthly Rate** | **$ 0.00** | **$ 0.00** | **$ 0.00** | **$ 106.78** | **$ 106.78** | **$ 106.78** | **$ 106.78** | **$ 106.78** | **$ 106.78** |
| **Monthly Assessment per ERU** | $ - | $ - | $ - | $ 34.80 | $ 34.80 | $ 34.80 | $ 34.80 | $ 34.80 | $ 34.80 |
| **Financing Customer Connections** | $ - | $ - | $ - | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 | $ 13.52 |
| **Total Monthly Impact** | **$ 0.00** | **$ 0.00** | **$ 0.00** | **$ 155.10** | **$ 155.10** | **$ 155.10** | **$ 155.10** | **$ 155.10** | **$ 155.10** |
| **ERU Basis** | **508** | **533** | **560** | **588** | **617** | **648** | **827** | **1,056** | **1,348** |

As this summary illustrates, the rates necessary in Scenario 1 to fund the ongoing debt burden of the utility would be substantial, at $141 per month. This reflects that all capital costs (net of assumed grants) impose a rate burden. Increased grant funding could materially reduce this estimate, with an additional $1 million in added grants providing roughly $12 per month of rate relief. Should the County receive other additional grant funding, the cumulative effect could be significant. In addition to the rate burden, existing development

would directly bear the private cost of connecting to the sewer system. This cost has been amortized and shown as an equivalent monthly cost of roughly $14 per month. While this cost would not be a part of the monthly sewer rate, it is shown as an added private cost attributable to the sewering project.

For Scenario 2, the monthly rate is much lower, at approximately $55 per month. This reflects the separation of the capital burden through use of the ULID assessment. The ULID assessment is estimated to equate to roughly $81 per month. This results in an average cost roughly $5 per month less than for Scenario 1. The factors leading to this lower typical cost include:

- With assessment backing, no rate revenue coverage requirement is assumed
- All eligible properties are assumed to pay, effectively spreading capital cost recovery over all capacity being provided (including vacant properties)

The result of the combined funding options in Scenario 3 is a projected rate of $107 and assessment of $35 monthly. This scenario may improve the potential access to assistance funds by projecting the resulting rate above hardship levels, and relate more directly to distinct sewer collection costs in the two service areas.

Besides setting the initial rate in 2010, some future increases might be expected related to two factors: inflationary pressures on expenses; and progressively increasing funding toward system repair and replacement. Current projections show growth in customer base offsetting this, though it may change with actual cost and growth experience.

It should be noted that alternative scenarios also exist, and are in fact likely as funding sources are obtained or revised.

**List of Assumptions Used in the Revenue Needs Projection**

The financial forecast is based on numerous assumptions related to costs, financing and customer base. In general, the extent and impact of those assumptions are greater than for improvements serving an existing utility, where existing costs and revenues dampen such effects. The key assumptions used in the forecast of costs and rates include:

| | |
|---|---|
| • Capital Construction Costs | As defined in Section 8 |
| • ULID Formation Costs | 5% of Capital Construction Cost |
| • Operations and Maintenance | $281,800 first year of operation |
| • Capital Reinvestment | $20,000 beginning in second year of operation, increasing $20,000 per year until reaching $300,000 per year |
| • Administration | $60,000 first year of operation |
| • State Excise Taxes | Composite 2.5% rate on all revenue |

| | |
|---|---|
| • Bond Terms | 5% interest, 2% issuance, 25 years for Scenario 1<br>5% interest, 2% issuance, 20 years for Scenario 2 |
| • Bond Coverage | 1.25 for Scenario 1<br>1.0 for Scenario 2 |
| • State Loan Terms | 1.5%, 20 years |
| • PWTF | 0.5% 20 years |
| • Assessment Terms | 5% interest, 20 years |
| • General Cost Inflation | 3% annually |
| • Construction Cost Inflation | 4% annually |
| • Growth | *See ERU section |
| • Operating Reserve | Funded to 12.3% (45 days) of annual expenses |

**Capital Facilities Charge**

A Capital Facilities Charge (CFC) is calculated to determine the pro-rata share of costs that a new connection to a utility should pay in order to buy-in to ownership of capacity in the system.

CFCs are a form of connection charge authorized in the Revised Code of Washington 36.94.140. They are imposed on new customers connecting to the system as a condition of service, in addition to any other costs incurred to connect the customer. Typically, the basis for the CFC is the capital cost the Utility will incur or has incurred to provide the system. In the case of utility formation, there are no existing costs and it is based entirely on the facility costs identified in order to construct the utility to provide sewer service. The capital costs identified in this plan and referenced in this chapter, along with the capacity provided by those improvements, provide the basis for the CFC calculation.

Capacity units for calculating the CFC are commonly expressed in equivalent residential units, or ERUs, based on the typical sewage flow generated by a single family home (1 ERU). For any other development seeking to connect to the system, estimated flow contribution is used to determine a number of ERUs being served, which is then used to determine the level of CFC attributable to the customer.

The CFC calculation is then, the total capital costs divided by the total capacity being designed, expressed on an ERU basis.

It is worth noting that though a CFC has been calculated, the unique circumstances of utility formation where the customer base already exists imposes practical limits on application of the charge. Existing development would not typically be charged a CFC, but instead bear their share of capital costs through rates or assessments in order to amortize those costs. The CFC remains potentially applicable for new development, and regardless remains a valuable benchmark for determining the level of investment being incurred to provide service.

The following table summarizes the CFC calculation. It indicates that an average cost of under $6,000 per ERU is being incurred, net of grants, to provide sewer service to the potential service area.

**Table 11-6**
**Capital Facilities Charge Calculation**

| Cost Basis | | |
|---|---|---|
| **CAPITAL PLAN** | | |
| Total Future Projects | $ | 18,519,323 |
| less: ULID/Assessment-Funded Projects | | - |
| less: Grants and Contributions | | (11,040,323) |
| **TOTAL FUTURE COST BASIS** | **$** | **7,479,000** |

| Customer Base | ERUs |
|---|---|
| Existing Residential Customer Equivalents | 508 |
| Future Residential Customer Equivalents (10-yr Incremental) | 774 |
| **TOTAL CUSTOMER BASE** | **1,282** |

| Resulting Charge | | Total |
|---|---|---|
| Total Cost Basis | $ | 7,479,000 |
| Total Customer Base | | 1,282 |
| **TOTAL CHARGE PER ERU** | **$** | **5,833** |

The cost basis for total future projects excludes half of the total collection costs, assuming that a portion of the collection system cost provides local service and does not provide system capacity for other users. This assumption would need to be refined in application. Also, we have assumed that grants are first used to fund local facilities costs, and then to the degree used to fund general facilities would be excluded from recovery in a general facilities charge such as a CFC. Applying grant funds first to collection and then to treatment costs, the resulting charges are $5,833 for treatment and $0 for collection. However, various policy and practical issues can influence how grant resources are allocated between these two components, which would in practice alter this breakdown.

### List of Utility Formation Financial Issues to Consider

The formation of a new sewer utility poses unique financial and administrative challenges that require careful planning and execution. While this plan cannot definitively address all of those issues, it is prudent to identify key issues and concerns to be addressed as a financial action plan is assembled and undertaken. Those issues include:

### *Start-up Cash Flow Management*

As a new utility, no operating revenues will be generated until after project completion and start-up. Further, typical cycles of billing and receipting are likely to require several months of operation before material revenues can support ongoing activities. This poses several challenges:

- Some assistance sources, such as the Centennial fund, provide assistance through reimbursement after expenses are incurred. The project must therefore have a source of cash flow to fund expenses until reimbursed.
- Some sources, such as PWTF, impose debt repayment schedules based on when draws occur. Thus, material debt repayment could be required before the project is completed. Few funding sources allow payment of debt service as a use of grants, loans or bonds.
- Debt repayment during the first year of operation will be according to a specific schedule, such as PWTF payments which occur annually in June. Depending on when operations commence and the total lead time until debt service payments are due, there may be inadequate time to accumulate initial payments from rates.

### *Requirement for Connection to System*

In order to ensure that the new utility can fulfill its purpose to protect the environment, and to ensure the financial capacity to fund the project and its ongoing operation, the County should require connection to the system when available. Through its authority to impose rates and charges and to regulate and manage the system, such requirement should include penalties for non-compliance. Typically, utilities impose penalties equal to the applicable rates and charges for properties in violation of this requirement. This ensures that the financial plan does not create undue hardship on those customers complying with such requirements, and reduces motivation to avoid connection.

In some cases, a funding strategy can also offer added incentives for timely connection. For example, a funding program might enable customers to use available assistance or to fund their connection costs as part of the public project to be repaid through a rate surcharge or through their assessment. This could provide access to lower cost financing or possibly partial grant funding and reduce the cost burden. This could be structured to apply only for connections occurring prior to an established deadline.

### *Customer Costs to Connect to the System*

In addition to the construction cost of the public system, developed or developing properties will incur costs to retire or decommission existing septic systems and to connect to the public sewer system. Such costs are often directly borne by the developed properties, although there may be the possibility of extending assistance or funding programs for these costs. Due to limitations on the allowed use of public funds for private purpose or benefit, any

assistance or funding program should be developed with careful attention to satisfying legal requirements.

### *Regulating Interim Development*

A related issue for a newly forming utility relates to development occurring during the construction of the utility system. The County may wish to consider interim development rules as related to wastewater that allow for temporary facilities in anticipation of the sewer system. For example, holding tanks and truckage of wastewater may be a viable short-term alternative as compared to installing a new onsite disposal system, only to be abandoned upon completion of the sewer utility. Such a transition strategy may allow ongoing development while reasonably mitigating or avoiding duplicative costs.

### *Development of Financial Administrative System*

A new utility often does not have the benefit of an existing administrative infrastructure to support its day to day financial activities. In this case, the County manages several utilities and therefore has a financial structure to address utility enterprises. It also has utility billing capability and accounting systems in place.

The primary challenges for the new utility will be the development of a customer data base, establishment of rates and charges, and application of appropriate regulatory rules and requirements related to the management, operation, and extension of the system. This will include the application or development of appropriate fiscal policies.

## Recommended Financial Strategy

At this point in the planning process, the financial plan relates to basic elements of funding, cost recovery and administration. The intent is to structure and quantify the basic financial relationships resulting from the planned project. More detailed financial programs would be developed as the project moves forward.

The recommended financial strategy focuses on two areas of activity: pursuit of project funding assistance; and development of a cost recovery system. Toward this end, it is recommended that the County:

- Pursue all available grant funds and low cost loans. This includes Centennial and State Revolving Fund grants and loans, and economic development grants as applicable. A schedule of application cycles and deadlines should be developed to guide such activities.
- Consider the use of a Utility Local Improvement District (ULID) as an equitable and secure approach to allocate and recover the capital cost of the project. If pursued, establish a timeline for establishing the district and imposing assessments.

- Consider the use of short-term G.O. debt for cash management during construction and initial operations, to be repaid from utility resources.
- Develop and undertake a utility formation process that considers and evaluates utility formation issues and options and assembles a cohesive policy package for developing the utility. Define a schedule or timeline for activities related to completion of a financial administrative and policy structure for the new utility. Continue to refine the financial forecast as cost estimates are refined become better defined, financing is secured and guiding policies are codified.
- Develop sound financial policies addressing utility reserves, capital improvement and replacement funding, debt policies, rate equity, financial administration, and rate equity objectives.
- Establish and adopt appropriate ordinances and resolutions to implement a system of rates and charges and execute the financial management of the utility.

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