3.1 INTRODUCTION

A wide range of alternatives were considered for meeting Spokane County's wastewater management requirements in the *2002 Wastewater Facilities Plan* and the *2003 Wastewater Facilities Plan Amendment.* This chapter summarizes the alternatives evaluation process used and identifies the facilities conclusions previously reached in planning. Much of the past facilities planning alternatives analysis and previous conclusions remain valid and are components of Spokane County's wastewater management program. Some revisions are needed to meet the requirements of the Washington Department of Ecology's Dissolved Oxygen Total Maximum Daily Load (TMDL) and the June 30, 2006 *Foundational Concepts for the Spokane River TMDL Managed Implementation Plan.* A detailed discussion of the revised wastewater treatment process and the biosolids management plan are presented in Chapters 6 and 7. A summary of the recommended wastewater management concept is presented in Chapter 9.

3.2 FACILITIES PLANNING ALTERNATIVES EVALUATION PROCESS

In the *2002 Wastewater Facilities Plan* alternatives were identified and evaluated through an interactive process involving County staff, consultant staff, representatives from resource and regulatory agencies, City of Spokane staff, the Spokane County Water Quality Advisory Committee (WQAC), the Spokane County Board of County Commissioners and the general public. Major elements of the evaluation process are described in Chapter 3 of the *2002 Wastewater Facilities Plan.* The following sections summarize the conclusions of the alternatives analysis.

3.2.1 Development of Representative Treatment Systems

In Chapter 6 of the *2002 Wastewater Facilities Plan* treatment system alternatives were evaluated, including upgrades and expansions of existing facilities and/or construction of new treatment plants. Consideration was given to the Riverside Park Water Reclamation Facility (RPWRF) that included maintaining the current 10 mgd allocation, increasing the capacity allocation to the County, reducing the County's capacity allocation, and sale of the County's capacity allocation.

New treatment plants with year-round effluent discharge were also considered as an alternative. The cost for new wastewater treatment facilities was explored with comparison to recent benchmarking studies of competitively-operated wastewater treatment facilities.

3.2.2 Development of Conveyance Requirements

Conveyance systems were combined with treatment system alternatives and evaluated. All of the alternatives considered involved new or expanded conveyance facilities to route projected flows to the treatment plants. In this evaluation, the analysis for conveyance facilities was limited to the following areas:

- Major interceptor and/or pumping facilities needed to convey flow from the North Valley and Spokane Valley Interceptors to new or existing treatment facilities.

- Interceptor improvements needed to convey North Spokane flow to the Riverside Park Water Reclamation Facility.
- Interceptor improvements needed to reroute North Spokane flow to a new treatment facility.

3.2.3 Treatment and Conveyance System Alternatives

During the fall of 2000, workshops were held to brainstorm and screen alternatives for providing wastewater treatment capacity for Spokane County. The following concepts survived the screening process.

- Alternative 1 – All Flow to the Riverside Park Water Reclamation Facility (RPWRF)
- Alternative 2 –New Mid-Valley Plant Combined with RPWRF and/or New North Spokane Plant
- Alternative 3 – New In-City Plant Combined with RPWRF and/or New North Spokane Plant
- Alternative 4 – Multiple Mid-Valley Plants Combined with RPWRF and/or New North Spokane Plant
- Alternative 5 – No Action

Following development of the 14 subalternatives, a workshop was held to reduce the number of final alternatives to a manageable number for detailed comparison. The final treatment location alternatives were compared relative to one another using the evaluation criteria developed for in Chapter 3 of the in the *2002 Wastewater Facilities Plan* as follows:

- Capacity
- Technical
- Conveyance
- Implementation
- County Control
- Regulatory
- Water Resource
- Environmental and Community Impact
- Economics
- Financial Risk

The alternatives analysis is documented in Chapter 6 of the *2002 Wastewater Facilities Plan*. The recommended program selected from these alternatives is presented in Chapter 9 of the *2002 Wastewater Facilities Plan*. The recommended plan for treatment and conveyance is to use the County's current 10-MGD capacity allocation in the Riverside Park Water Reclamation Facility (RPWRF) and to build a new Spokane County Regional Water

Reclamation Facility (SCRWRF) to accommodate additional wastewater flows generated in the County's service area. At the RPWRF, the County owns 10 mgd of capacity based on average dry-weather flows. This capacity will be used to treat all wastewater generated in the County's North Spokane Service Area and a portion of the wastewater generated in the Spokane Valley.

3.3 TREATMENT TECHNOLOGIES EVALUATION

Chapter 4 of the February *2003 Wastewater Facilities Plan Amendment* presents a detailed treatment technology evaluation. A total of 18 candidate treatment technologies were identified for consideration. Of the 18 candidate treatment techniques, six were determined to be fatally flawed. The remaining 12 treatment techniques were then compared using non-economic evaluation criteria (i.e., without considering cost criteria) and based on that comparison, six other treatment techniques were dropped from further consideration. The remaining six treatment techniques listed below were selected as the "treatment alternatives" that would be were subjected to detailed evaluation, including consideration of economic criteria.

- S2–Conventional Activated Sludge with Nitrification/Denitrification (NDN), Enhanced Biological Phosphorus Removal (EBPR), and Primary Clarifiers
- S6–Cyclic Aeration with NDN and EBPR
- S7– Membrane Bioreactor (MBR) with NDN and Primary Clarifiers (Chemical P Removal in Primaries)
- S8–MBR with NDN and EBPR, with Primary Clarifiers
- S9–MBR with NDN, no Primary Clarifiers (Chemical P removal within the MBR System)
- S10–MBR with NDN and EBPR, no Primary Clarifiers

For each of the six "finalist" treatment alternatives selected for detailed analysis the following information was prepared: process schematic drawing; narrative discussion of process; summary table of key process components and sizing; and a discussion of full-scale experience with the process.

3.3.1 Selected Treatment Technology

On August 9, 2002, HDR and Spokane County Utilities staff participated in a workshop in Spokane to review the findings of the treatment technology evaluation. Based on both the economic and non-economic evaluation criteria, the project team recommended the following two alternatives for final consideration and selection of the best treatment alternative.

- Alternative S2–Conventional Activated Sludge with NDN, EBPR, and Primary Clarifiers. This alternative is recommended as the best non-MBR alternative.
- Alternative S7– MBR with NDN and Chemical Primary Clarifiers. This alternative is recommended as the best MBR alternative.

On August 22, 2002, Spokane County Utilities staff made a presentation to the Board of County Commissioners regarding the recommended treatment alternatives. Following discussion, the Board stated a preference for Alternative S7. Although Alternative S7 was estimated to have a higher cost than Alternative S2, the Board cited several key reasons for selecting Treatment Alternative 7, including:

- Better protection of water quality in the Spokane River.
- More easily gain Ecology's approval of a new discharge to the River, particularly in light of the uncertainty regarding the dissolved oxygen TMDL process.
- Facilitate future implementation of groundwater recharge.
- Fulfill the County's desire to use cutting edge technology, provided that it is reliable.
- Reduce space requirements.

3.4 WATER RECLAMATION FACILITY SITING ALTERNATIVES

Chapter 3 of the *2003 Wastewater Facilities Plan Amendment* presents a detailed treatment plant siting process. An initial list of 15 candidate sites was examined systematically according to site evaluation criteria under three broad categories:

- Technical and Economic
- Environmental
- Community

The site selection process consisted of the following major steps:

- Identification of candidate sites (15 sites were initially identified)
- Fatal flaw screening of candidate sites (5 sites were eliminated)
- Ranking of the screened sites against evaluation criteria and development of a shortlist of sites for detailed evaluation (5 sites were selected for detailed evaluation)
- Detailed evaluation of the finalist sites and a second ranking of alternatives against the evaluation criteria
- Selection of a preferred site and an alternative for evaluation in a *Supplemental Environmental Impact Statement* (*SEIS*)
- Preparation of an *SEIS* that evaluates the finalist sites and a no-action alternative

The process included a number of public involvement measures: two public meetings on the siting study, one public meeting on the draft *SEIS* findings, use of an advisory Focus Group, meetings with neighborhood stakeholders, and newsletters to the public.

3.4.1 Selected Water Reclamation Facility Site

The total evaluation criteria score for the Stockyards site was substantially higher than that of any other alternative. Spokane County selected the Stockyards site as the preferred location

for the Spokane County Regional Water Reclamation Facility and purchased the site, June 2004.

3.5 CONVEYANCE SYSTEM ALTERNATIVES

Chapter 6 of the *2003 Wastewater Facilities Plan Amendment* presents the facilities needed to convey wastewater from the Spokane Valley interceptor sewers into the new Spokane County Regional Water Reclamation Facility (SCRWRF). Currently, three major interceptors transport Spokane County wastewater to the City of Spokane's conveyance system: the North Valley Interceptor (NVI), the Spokane Valley Interceptor (SVI), and the North Spokane Interceptor (NSI). Wastewater in the NVI and SVI may be routed, at least in part, to the SCRWRF while 100 percent of the wastewater in the NSI is planned to be conveyed to the City of Spokane. The Stockyards facility site is located between the NVI and SVI at a higher elevation. Therefore, two pumping stations and associated force mains will be required to convey the wastewater into the headworks of the SCRWRF.

3.5.1 North Valley Interceptor (NVI) Pumping Station

There are two potential alternative locations for the NVI pumping station.

- The eastern location is at Elizabeth Street and Marietta Avenue; this is the present location of the County's flow meter, and is where the NVI wastewater enters the City of Spokane wastewater system.
- The western location is at Rebecca Street on the south side of the Spokane River, east of the Spokane Community College.

Based on the boundaries of the service areas of the City of Spokane and Spokane County, the normal location of the NVI pumping station would be the eastern location. However, the western location might be beneficial for pumping into the Stockyards Site because it would require a much shorter force main and lower dynamic pumping head. These two factors should be evaluated during preliminary design to establish whether the western location would be less expensive to construct and to operate. In addition, the routing of the force main from the western location to the treatment plant would parallel the outfall route to the Rebecca Street discharge location, and so would require only one trenching operation for the pipe routes, rather than two.

3.5.2 North Valley Interceptor (NVI) Forcemain

Eastern Pumping Station Location

From an Eastern Pumping Station location, the force main would be routed west from Elizabeth and Marietta along the southern side of the Burlington Northern Railroad tracks to approximately Fancher Road, and then south to Trent Avenue. The pipe would follow Trent Avenue to the west to Havana, run south to Boone, and then run west to Julia and the entrance to the plant site.

Western Pumping Station Location

The force main would be routed parallel to the outfall from the treatment plant, south from the Spokane River along Rebecca to Mission, and then east to the vacated Julia alignment. An easement would be required south from Mission to Boone. At Boone, the force main would enter the Stockyards site.

3.5.3 Spokane Valley Interceptor (SVI) Pumping Station

The SVI runs in Fourth Avenue parallel to I-90 on the south side and discharges into the City of Spokane wastewater system at Havana Street. The County flow-metering station is located immediately east of Havana. The location where flows would be diverted to the SCRWRF is in this vicinity. However, within the past two years, an interim pumping station was constructed at Havana and Sprague Avenue to convey the Chronicle sewer basin into the interceptor system. It was anticipated that the location of the SVI pumping station would allow the County to eliminate the interim pumping station. Therefore, alternative pumping station sites will be considered along Fourth Avenue, along Havana Street, and along Sprague Avenue. A gravity sewer will be necessary to convey the Chronicle basin flows, and/or convey the SVI flows to the pumping station site, depending on the location selected for the pumping station.

In addition, it is known that the Washington State Department of Transportation is in the early planning stages for the expansion of the I-90 Freeway, and for the connection of the future North-South Freeway. Furthermore, the area on the south side of I-90 is tentatively identified for major widening in the vicinity of Havana. In selecting a pumping station site, the County should strive to avoid future conflicts with these potential projects.

3.5.4 Spokane Valley Interceptor (SVI) Forcemain Routes

Tentative routes for the force main from the SVI pumping station to the SCRWRF would proceed north in Havana Street. The route would continue north in Havana to Boone, west on Boone to Julia, and then into the Stockyards site.

3.6 EFFLUENT OUTFALL TO THE SPOKANE RIVER

Chapter 7 of the *2003 Wastewater Facilities Plan Amendment* presents an analysis of the recommended outfall facilities to convey treated effluent from the Spokane County Regional Water Reclamation Facility for discharge to the Spokane River. The discharge configuration is based on recommendations from the Mixing Zone Study Report for the Proposed Spokane County Discharge to the Spokane River, August 2002.

3.6.1 Recommended Effluent Outfall Location

Spokane County proposes to build the Spokane County Regional Water Reclamation Facility on the Stockyards site and discharge to the Spokane River on a year-round basis. Two outfall locations are under consideration:

- Rebecca Street (also referred to as Green Street), located at River Mile 78.5, just below the outlet from the Upriver Dam.
- Springfield Avenue (also referred to as Hamilton Street), located at River Mile 75.8.

The County prefers the Rebecca Street location based on the evaluation of technical, cost and water quality considerations as part of a *2002 Supplemental Environmental Impact Statement* (*SEIS*). The Rebecca Street outfall is the most cost effective option and will be easier to construct with fewer special crossings and less construction restoration of the City right-of-way. Although the Rebecca Street Outfall discharge location has some additional environmental issues compared to the Springfield Avenue outfall, mitigation measures to address these potential impacts have been established and will be implemented by the County. A detailed risk assessment was performed to address potential concerns associated downstream water supplies. The study concluded that public health risks would be addressed by a combination of treatment and aquifer attenuation, along with supplemental monitoring and a contingency plan for an upgrade to disinfection of City wells. Additional protection against viral contamination can be provided by the use of chlorine disinfection in the Spokane County Regional Water Reclamation Facility.

3.7 SOLIDS PROCESSING AND BIOSOLIDS MANAGEMENT

A wide range of biosolids management alternatives was identified and evaluated in Chapter 7 of the *2002 Wastewater Facilities Plan*. Those surviving the initial screening process were as listed below:

- B-1: Class B Treatment and Land Application
- B-2: Class A Treatment (Thermal Treatment) and Land Application
- B-3: Composting
- B-4: Send Sludge to RPWRF
- B-5: Privatized Biosolids Management
- B-6: Co-Incineration with Solid Waste

All of the alternatives address biosolids management systems that could be implemented at a new wastewater treatment plant, either by the County alone or by the City and County together. For the portion of the County's wastewater that continues to be sent to the RPWRF, it has been assumed that land application program for Class B biosolids will be continued.

3.7.1 Discussion of Biosolids Alternatives Relative to Evaluation Criteria

Solid processing and biosolids management alternatives were described with identification of key facility requirements and implementation issues associated with treatment and end use. The biosolids management alternatives were compared relative to one another using the evaluation criteria developed for this planning effort.

Alternative B-1, Class B Treatment and Land Application, rated the highest because it has the lowest complexity and has a long, wide-spread record of success in the region. In terms of capacity, there appears to be adequate agricultural land within a reasonable haul distance of the plant to allow expansion of the program to handle sludge generation rates in 2050. Soil quality in areas where biosolids are land applied is improved by adding both moisture and nutrients. Biosolids are applied at sustainable rates. Typically, nitrogen loading is the controlling factor on application rate, although in some watersheds, agronomic phosphorus loading rates control biosolids application and are more restrictive.

There is some risk involved in all biosolids management alternatives. Land application programs have some risk associated with conversion of farmland to other uses; however, there is a large quantity of land within a reasonable distance of Spokane that is zoned to remain agricultural long into the future. For land application programs, a significant implementation issue is the ability to negotiate cooperative agreements with farmers for the amount of land needed. If such agreements cannot be obtained, the County would have the option to purchase property, but this would increase cost and may not be politically acceptable in some circumstances.

Class B biosolids have a somewhat higher risk associated with future regulatory change than those producing Class A biosolids because some experts in the field of biosolids management are projecting that, at some future date, EPA may tighten the requirements for, or even prohibit, the application of Class B biosolids. Should this occur, the solids processing facilities at the SCRWRF could be modified to produce a Class A biosolids, either by adding high-temperature processes (such as prepasteurization), or by composting the digested sludge.

Alternative B-3 Composting fares well in terms of being able to continue a reuse program long into the future, providing that market survey results confirm that the addition of a second compost supply in the region would not saturate the market. Given the potential difficulty of siting a new compost facility, this operation may not be on-line when the new treatment plant becomes operational. This would require an interim reuse or disposal method, such as Class B land application.

3.7.2 Recommended Biosolids Management

The recommended biosolids management program is presented in Chapter 9 of the *2002 Wastewater Facilities Plan* and recommends that all biosolids produced at the SCRWRF will be stabilized through anaerobic digestion and dewatered to produce a Class B biosolids. The material will be applied to agricultural land or to reclaimed mining sites. This will beneficially recycle nutrients and organic material to the land. At the SCRWRF, a biosolids management program must be developed and implemented.

During the winter, when biosolids cannot be applied to land, storage of dewatered biosolids will be provided at the application sites. In addition, a combination of liquid and dewatered biosolids storage facilities will be provided at the treatment plants to achieve a one-week storage capacity when icy roads or other conditions prevent haul of biosolids to the application sites.

During the summer, the County's biosolids management program may include delivery of liquid Class B biosolids to some users, if this is needed to minimize soil loss associated with biosolids application practices. This will be determined on a case-by-case basis.

At the SCRWRF, flexibility will be provided to convert the facility to Class A biosolids production in the future. This conversion to Class A biosolids may be driven by changing regulatory requirements, need for greater diversity in reuse options, or public desire for a compost product. The technical options for future conversion to Class A biosolids include temperature-phased digestion, pre-pasteurization, and composting. The first options could be implemented at the SCRWRF site, whereas composting would likely require a separate remote site.

3.8 WASTEWATER MANAGEMENT OPTIONS CURRENTLY AVAILABLE TO SPOKANE COUNTY

As a result of the requirements of the Washington Department of Ecology's Dissolved Oxygen Total Maximum Daily Load (TMDL) and the June 30, 2006 *Foundational Concepts for the Spokane River TMDL Managed Implementation Plan* the wastewater management options remaining for Spokane County consideration are as follows:

- Option A: Advanced treatment for Spokane River discharge with effluent phosphorus < 10 ug/l through treatment technology and other "delta offsets" with year around river discharge.
- Option B: Secondary treatment with Spokane River discharge from November 1 to March 31 and Class C effluent to land application treatment/disposal in April through October.
- Option C: Advanced treatment for Class A reclaimed effluent for reuse, aquifer recharge, wetlands restoration, and/or Spokane River discharge when appropriate.

At present, Spokane County's preference is Option A, with advanced treatment for phosphorus removal and Class A effluent which can be incorporated into a County Water Reclamation Program, providing that an NPDES discharge permit to the Spokane River is issued.

3.9 DEVELOPMENT OF COSTS

Capital Costs

For updated economic analysis, capital costs are expressed in November 2006 dollars (ENR Cost Index 7911), and should be viewed as "planning level" estimates. Cost estimates presented in the *2002 Wastewater Facilities Plan* were based upon January 2001 dollars (ENR Cost Index 6281). Cost estimates prepared for the April 2003 *Primary Design Document for the Spokane County Regional Wastewater Treatment Plant* were based on February 2003 dollars (ENR Cost Index 6640). These estimates are approximations made without detailed engineering or site-specific data. Estimates of this type can be expected to vary from 50 percent less than to 30 percent more than actual final project costs.

Table 3-1. Redundancy Criteria for Unit Treatment Processes

Criterion	Treatment System and Criterion
	Liquid Treatment Systems
1	Handle peak instantaneous flow without overflows with all units in service
2	Pumping facilities must handle peak instantaneous flow with largest unit out of service
3	Provide full treatment to maximum-day flow with all units in service
	Solids Treatment Systems
4	Handle maximum-week solids loading with all units in service
	Liquid and Solids Treatment Systems
5	Handle maximum-month flow or loading with largest unit out of service (winter condition)
6	No extraordinary manual operation is required if largest unit is out of service

The sources of construction cost data are:

- HDR's ENVision cost-estimating program based on national cost curves that HDR developed for the U.S. EPA, adjusted to regional market conditions and adjusted to October 2006 dollars.
- Recent construction costs for other, similar facilities, adjusted to regional market conditions and adjusted to October 2006 dollars.
- Recent construction costs for the County's pipeline and pump station projects and adjusted to October 2006 dollars.
- Equipment pricing from manufacturers, including installation, structure, and housing costs.

All capital costs include allowances for site work and yard piping; contractor mark-up; contingencies; and engineering, legal and administration costs. The cost estimating procedure is presented in Table 3-2 (Illustration of Capital Cost Estimating Procedure).

Operating Costs

Operating costs were developed for projected flow and loading conditions in 2020, the mid-point of the initial 20-year operating period. The following unit factors were used:

- Labor—$31.50/hr
- Electrical power—$0.13/kW-hr
- Aluminum sulfate—$219/ton
- Ferric—$344/ton
- Sodium Hypochlorite—$0.90/gal
- Sodium Bisulfate—$1.40/gal
- Citric acid—$4.09/gal

- Sodium Hydroxide—$0.57/gal
- Polymer—$10.20/dry ton
- Biosolids hauling and disposal—$154/dry ton
- Screenings hauling and disposal—$98/ton
- Grit hauling and disposal—$98/ton

Table 3-2. Illustration of Capital Cost Estimating Procedure

Cost Item	Cost
Base Construction Cost	$1,000,000
Site work	$100,000
Electrical and Controls	$150,000
Subtotal A	***$1,250,000***
Design Contingency – Misc. Costs Not Itemized (20% of A)	$250,000
Subtotal B	***$1,500,000***
Mobilization and Bonds (5% of A)	$75,000
Contractor's Overhead and Profit (10% of B)	$150,000
Subtotal C	***$1,725,000***
Washington State Sales Tax (8.1% of C)	$138,000
Subtotal D (Construction Bid Price)	***$1,863,000***
Construction Contingency - Change Orders (5% of D)	$93,000
Subtotal E (Total Construction Cost)	***$1,956,000***
Engineering, Legal, Administration (25% of E)	$489,000
Total Capital Cost	**$2,445,000**

Land Costs

Property acquisition costs were based on the following estimated land costs:

- North County – $50,000/acre
- Spokane Valley (highly developed areas) – $130,000/acre
- City of Spokane (highly developed areas) – $175,000/acre

Present-Worth Analyses

Present-worth costs are calculated using a 6.375% discount rate. Present-worth O&M costs are based on 20 years of operation. Salvage values are based on a 50-year life for structures and pipelines, and a 20-year life for equipment and electrical systems.

(BLANK)