

# **KING COUNTY INITIAL INFILTRATION/INFLOW (I/I) REDUCTION PROJECT SEPTEMBER 3, 2008 E&P SUBCOMMITTEE BRIEFING**

## **MEETING PURPOSE**

The goals of the September 3, 2008 meeting are to brief the E&P Subcommittee on the status of I/I reduction alternatives developed during predesign and to present recommendations for moving forward to final design on two I/I reduction projects. Following endorsement of the recommendations by the E&P Subcommittee, the predesign results and recommendations will be presented for approval at the September 2008 MWPAAC meeting.

This document summarizes the following information to be presented at the September 3 meeting:

- Background information on the goals and intent of the project
- A recap of the predesign process and results of the benefit/cost analysis
- Refinements made to the criteria for the Skyway project area since the July 16, 2008 E&P briefing
- A summary of the cost-effective projects identified through the predesign process
- Recommendations for final design implementation

## **BACKGROUND**

The Initial Infiltration/Inflow (I/I) Reduction Project is the latest effort under King County's Regional I/I Control Program to explore the feasibility of I/I control. The goals of this project are to:

- Conduct an I/I reduction feasibility analysis in 2007-08 for four candidate project areas: Bellevue, Renton, Issaquah and Skyway.
- Select and implement up to three initial I/I reduction projects in 2010-12 to test the cost-effectiveness of I/I reduction on a scale large enough to potentially offset the need for larger conveyance or storage facilities.
- Analyze the results of these initial projects and make recommendations to the King County Council regarding long-term I/I reduction and control, including applicable changes to policy or code.

The feasibility analysis used criteria developed for the I/I Control Program by the E&P Subcommittee. To be considered cost-effective, an I/I reduction project must reduce, delay or eliminate a downstream regional conveyance system need; and the cost savings associated with the reduction or elimination of the conveyance system need must be greater than the cost of the I/I reduction project. A benefit/cost ratio for a range of I/I rehabilitation scenarios in the four project areas was calculated as follows:

$$\text{Benefit/Cost Ratio} = \frac{(\text{CSI Project Cost Savings After I/I Reduction})}{(\text{Cost of Proposed I/I Reduction Project})}$$

As stipulated by the E&P Subcommittee during development of the I/I Control Program, a project was considered cost-effective for a benefit/cost ratio of 1.0 or greater.

## PREDESIGN PROCESS AND RESULTS

The County and its consultant team evaluated the feasibility and cost-effectiveness of I/I reduction in the four project areas over the last 12 months. As presented at E&P Subcommittee meetings on April 16, 2008 and July 16, 2008, the analysis process and results included the following:

- SSES data—including smoke testing and CCTV of sewer mains, laterals and side sewers—were reviewed to assess the sources and degree of I/I in the project areas. The CCTV revealed a moderate number of defects in mains, laterals and side sewers in each project area. I/I appears to be fairly uniformly allocated across each basin.
- Flow monitors were installed in each project basin during the 2007/2008 wet season, and the results were compared to previous flow monitoring data. The new monitoring data was generally consistent with the previous data; and both the new and old data suggest that a large percentage of I/I in the project areas originates from private property. The only significant difference between new and previous data was in the Renton project area, where the new monitoring data did not indicate the same peak levels of I/I as previously recorded.
- Rehabilitation unit costs were developed for each project area and for individual basins in each areas. The costs considered the sewer system components to be rehabilitated and were based on actual field conditions in the basins. Each property in the project areas was assigned a rehabilitation difficulty rating (easy, medium or difficult) and associated unit cost for rehabilitation. A significant finding of the analysis was that rehabilitation costs for some of the basins will be substantially higher than estimated in the Control Program because of the degree of difficulty in accessing mains, laterals and side sewers. This was particularly true for portions of the Bellevue and Issaquah project areas.
- I/I quantities were uniformly apportioned across each basin and were equated to an average I/I per property in the basin. The I/I allocation per property provided a benchmark for areas that would be most cost-effective to rehabilitate. A general finding of the analysis was that basins with an I/I allocation of less than 3 gallons per minute (gpm) per property were not good candidates for cost-effective removal of I/I.
- Rehabilitation alternatives were developed for a number of scenarios—including rehabilitation in single project basins and multiple project basins, and scenarios that combined rehabilitation in the Issaquah and Bellevue project areas where there are mutual benefits on reduction of regional downstream conveyance needs. The alternatives considered a range of I/I reduction effectiveness from 60 to 75 percent.

At the April 16, 2008 E&P Subcommittee meeting, a decision was made to remove the Renton project area from further consideration of large-scale rehabilitation under this project. This decision was based on the results of the latest flow monitoring and the suspicion that I/I in this area primarily results from a limited number of inflow sources. The County is working with the City of Renton to implement a smaller project that will focus on limited rehabilitation in the lower portion of the basin near SR 167.

Analysis indicates that cost-effective rehabilitation is feasible in only four of the 10 basins in the Bellevue, Issaquah and Skyway project areas: Basin BEL031 in Bellevue; Basin ISS003 in Issaquah; and Basins BLS002 and BLS003 in Skyway. Cost-effective rehabilitation in the remaining basins is limited due to a low I/I allocation per property in the basins (requiring a greater number of properties to be rehabilitated) and high unit costs for rehabilitation because of difficult field conditions.

## SKYWAY PROJECT AREA REFINEMENTS

At the time of the July 16 E&P Subcommittee meeting, the analysis did not indicate the potential for cost-effective rehabilitation in the Skyway project area. County modeling indicated that a relatively high amount of I/I reduction (2.32 mgd) was required to eliminate a small downstream storage requirement of 80,000 gallons. The total project cost for the storage was estimated at \$3.35 million. It was noted at the presentation that the County would be further investigating the modeling results because the amount of I/I reduction relative to required storage seemed out of balance.

After further analysis, it was determined that the storage requirement had been underestimated in the previous modeling effort. An updated evaluation indicates the following parameters for the regional conveyance needs for the Skyway project area:

- Storage Requirement: 270,000 gallons
- I/I Reduction to Eliminate Storage: 2.32 mgd (Degraded); 1.81 mgd (Non-degraded)
- Total Project Cost for Storage: \$5.37 million

The result of this refinement brings rehabilitation in Skyway near the threshold of being cost-effective.

## COST EFFECTIVE PROJECTS

Three projects meet the cost-effectiveness requirements established for the Control Program, as summarized in Table 1 and described below.

### Combined Bellevue and Issaquah Project

This alternative includes rehabilitation of laterals and side sewers in Basin BEL031 in Bellevue and Basin ISS003 in Issaquah. Project components are shown on Figures 1 and 2 and include the following:

- 82 easy and 25 medium lateral and side sewer replacements in ISS003 out of 213 properties in the basin. 50 percent of properties in the basin are rehabilitated.
- 37 easy and 76 medium lateral and side sewer replacements in BEL031 out of 133 properties in the basin. 85 percent of properties in the basin are rehabilitated.
- The estimated range of I/I reduction is 1.04 mgd (75-percent reduction effectiveness) to 0.85 mgd (60-percent reduction effectiveness).
- Reduction in the Eastgate Storage requirement is between 320,000 gallons (75-percent reduction effectiveness) and 260,000 gallons (60-percent reduction effectiveness).
- Reduction in the Issaquah Storage requirement is between 450,000 gallons (75-percent reduction effectiveness) and 370,000 gallons (60-percent reduction effectiveness).
- Reduction in the downstream conveyance costs is between \$6.97 million (75-percent reduction effectiveness) and \$5.60 million (60-percent reduction effectiveness), resulting in a benefit/cost ratio between 1.33 and 1.07.

### Skyway Alternative 1

This alternative includes rehabilitation of laterals and side sewers in Basin BLS002 in Skyway. Project components are shown on Figure 3 and include the following:

- 292 easy and 51 medium lateral and side sewer replacements out of 386 properties in the basin. 89 percent of the properties in the basin are rehabilitated.

- The estimated range of I/I reduction is 2.24 mgd (75-percent reduction effectiveness) to 1.81 mgd (60-percent reduction effectiveness).
- The rehabilitation eliminates the need for 270,000 gallons of downstream storage, and the associated \$5.37 million total project cost for the storage facility.
- The estimated project cost for the I/I rehabilitation is \$5.63 million, requiring cost-sharing of \$260,000 by the Skyway Water and Sewer District to make the project cost-effective.

## **Skyway Alternative 2**

This alternative includes rehabilitation of laterals and side sewers in Basin BLS002 and Basin BLS003 in Skyway. Project components are shown on Figure 4 and include the following:

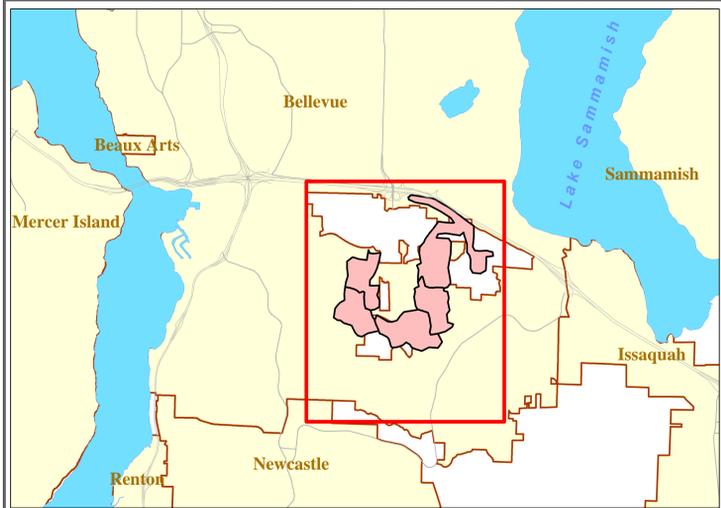
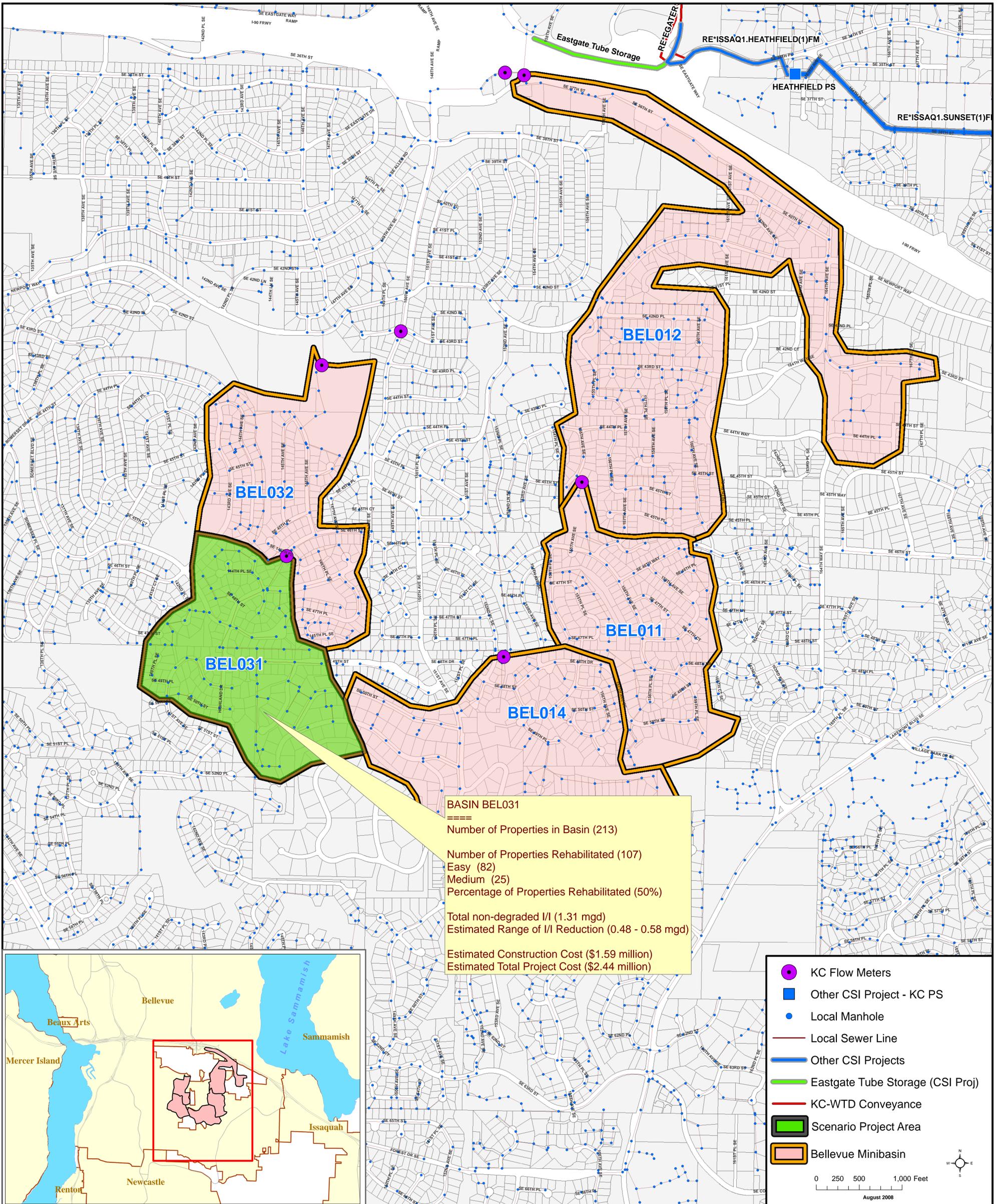
- 270 easy lateral and side sewer replacements out of 386 properties in Basin BLS002. 70 percent of the properties in the basin are rehabilitated.
- 50 easy, 13 medium and 2 difficult lateral and side sewer replacements out of 232 properties in Basin BLS003. 28 percent of the properties in the basin are rehabilitated.
- The estimated range of I/I reduction is 2.22 mgd (75-percent reduction effectiveness) to 1.81 mgd (60-percent reduction effectiveness).
- The rehabilitation eliminates the need for 270,000 gallons of downstream storage, and the associated \$5.37 million total project cost for the storage facility.
- The estimated project cost for the I/I rehabilitation is \$5.47 million, requiring cost-sharing of \$100,000 by the Skyway Water and Sewer District to make the project cost-effective.

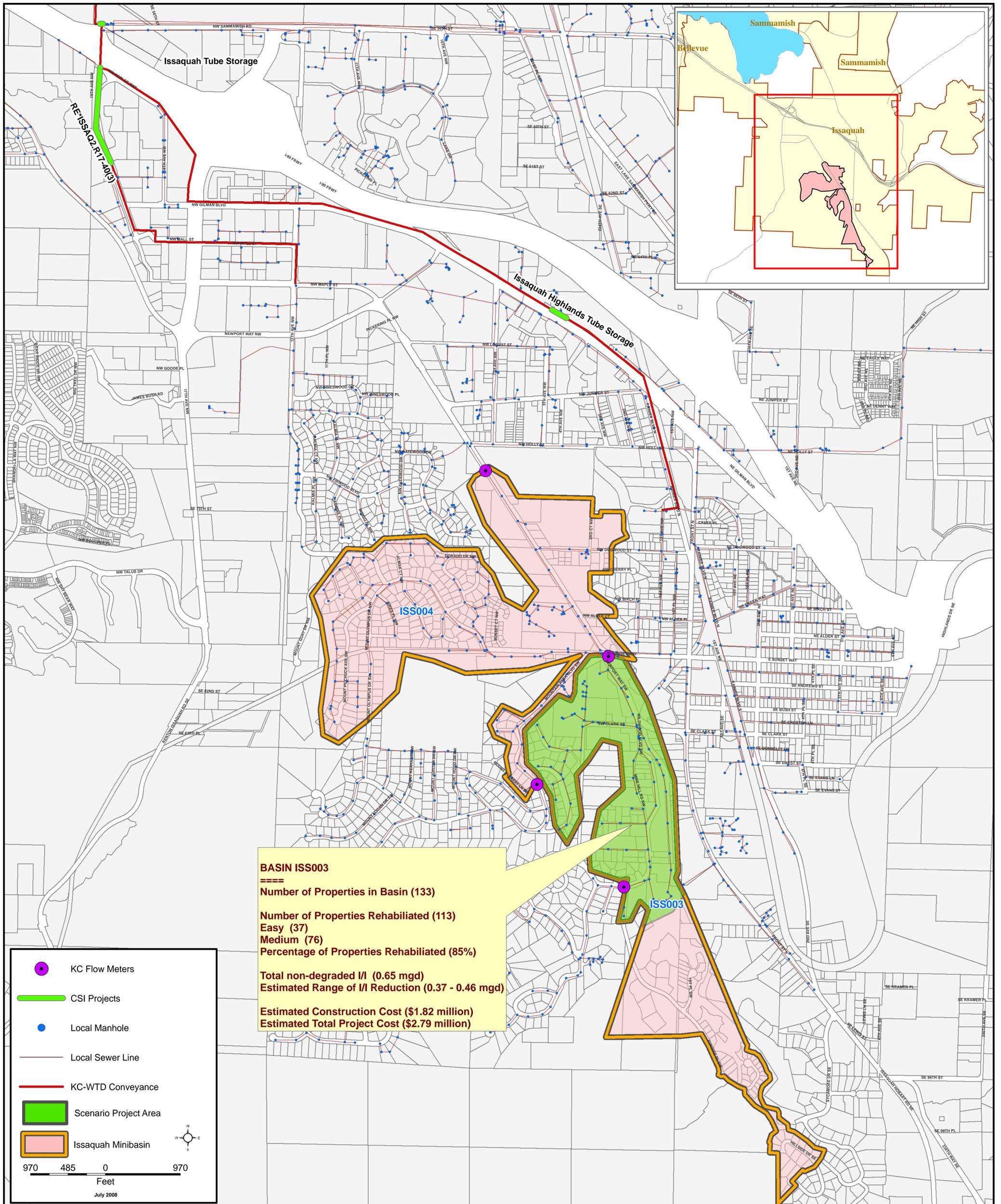
## **RECOMMENDATIONS**

The County recommends moving forward to final design and construction on the combined Bellevue/Issaquah project and on one of the two Skyway project alternatives. Implementation of the two projects will result in a construction cost of roughly \$7 million, which falls within the County's allocated budget.

**TABLE 1  
KING COUNTY I/I REDUCTION PROJECTS  
FINAL COST EFFECTIVE PROJECTS**

I/I Reduction Information								Corresponding CSI Information												
Project	Scenario	Basins	Total Non-Degraded I/I Reduction (mgd)	Total I/I Construction Cost (\$ Million)	Total I/I Project Cost (\$ Million)	I/I Reduction Assumptions	Description of Rehabilitation in Each Basin	CSI Affected Facility	Without I/I Removal		With I/I Removal		Local Agency Cost Contribution (\$ Million)	CSI Net Project Cost Savings (\$ Million)	Benefit/Cost Ratio					
									Pre Reduction Size (MG)	CSI Pre Reduction Project Cost (\$ Million)	Post Reduction Size (MG)	CSI Post-Reduction Project Cost (\$ Million)								
COMBINED BELLEVUE AND ISSAQUAH PROJECT	BEL/ISS - BH	BEL 031E	1.04	\$3.41	\$5.23	75%	82 -Easy, 25-Medium lateral and side sewer replacements out of 213 properties. 50% of properties rehabilitated.	Eastgate Storage	2.33	\$21.10	2.01	\$18.29	\$0.00	\$6.97	1.33					
		ISS 003 D(2)					37-Easy, 76-Medium lateral and side sewer replacements out of 133 properties. 85% of properties rehabilitated.	Issaquah Storage	1.77	\$14.06	1.32	\$10.61				Issaquah Interceptor	1.72	\$3.04	1.13	\$2.93
	BEL/ISS - BL	BEL 031E	0.85	\$3.41	\$5.23	60%	82 -Easy, 25-Medium lateral and side sewer replacements out of 213 properties. 50% of properties rehabilitated.	Eastgate Storage	2.33	\$21.10	2.07	\$18.81				\$0.00	\$5.60	1.07		
		ISS 003 D(2)					37-Easy, 76-Medium lateral and side sewer replacements out of 133 properties. 85% of properties rehabilitated.	Issaquah Storage	1.77	\$14.06	1.4	\$11.23							Heathfiled & Sunset Pump Station	53.24
SKYWAY ALTERNATIVE 1	BLS - FH	BLS 002F	2.24	\$3.68	\$5.63	75%	292-Easy, 51-Medium lateral and side sewer replacements out of 386 properties. 89% of properties rehabilitated.	Bryn Mawr Storage	0.27	\$5.37	0.00	\$0.00	\$0.26	\$5.63	1.00					
	BLS - FL	BLS 002F	1.81	\$3.68	\$5.63	60%	292-Easy, 51-Medium lateral and side sewer replacements out of 386 properties. 89% of properties rehabilitated.	Bryn Mawr Storage	0.27	\$5.37	0.00	\$0.00	\$0.26	\$5.63	1.00					
SKYWAY ALTERNATIVE 2	BLS - EH	BLS 002E	2.22	\$3.57	\$5.47	75%	270 -Easy lateral and side sewer replacements out of 386 properties. 70% of properties rehabilitated.	Bryn Mawr Storage	0.27	\$5.37	0.00	\$0.00	\$0.10	\$5.47	1.00					
		BLS 003E					50-Easy, 13-Medium and 2-Difficult lateral and side sewer replacements out of 232 properties. 28.0% of properties rehabilitated.													
	BLS - EL	BLS 002E	1.81	\$3.57	\$5.47	60%	270 -Easy lateral and side sewer replacements out of 386 properties. 70% of properties rehabilitated.	Bryn Mawr Storage	0.27	\$5.37	0.00	\$0.00				\$0.10	\$5.47	1.00		
		BLS 003E					50-Easy, 13-Medium and 2-Difficult lateral and side sewer replacements out of 232 properties. 28.0% of properties rehabilitated.													





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**Issaquah I/I Project Area**  
 Combined Bellevue and Issaquah Project

**Figure 1**

