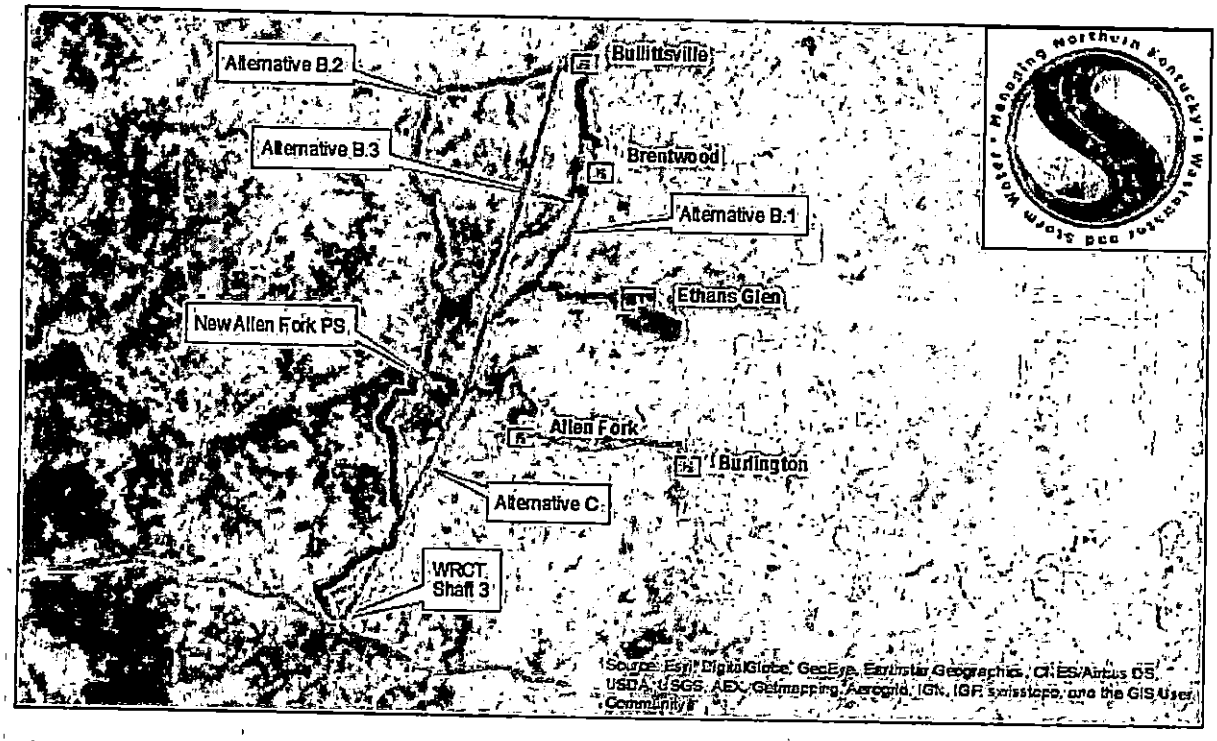
Hazen

Hazen and Sawyer
7870 E. Kemper Rd., Suite 300
Cincinnati, OH 45249 • 513.469.2700



Bullittsville Pump Station Flow Routing Business Case Evaluation

Final Report
Hazen Project No. 50031-P06-200
March 2017

Table of Contents

List of Tables

List of Figures

List of Appendices

Executive Summary

Objectives

Bullittsville Pump Station (PS), which pumps to Taylorsport PS, has inadequate capacity for current peak tributary flow, which contributes to a recurring sanitary sewer overflow (SSO) in the upstream trunk sewer. SD1's Watershed Plans call for an upgrade of Bullittsville PS, a new force main (FM) along the existing alignment, and upgrades to the receiving Tanner Road gravity sewer. However, increasing pumped flow from Bullittsville PS to Tanner Road would significantly accelerate the need for upgrades at Taylorsport PS.

Allen Fork PS also has inadequate capacity to convey projected peak tributary flow once approved development builds out. The long-term plan for Allen Fork PS in the Watershed Plans is to eliminate this pump station and redirect the flow directly to the Western Regional Conveyance Tunnel (WRCT) via a new PS and FM, thereby diverting the flow away from Burlington PS.

Due to the proximity of these facilities to each other, alternative concepts (shown in Figure ES-1) to redirect flow from Bullittsville PS to the WRCT (instead of to Taylorsport PS) and to integrate the long-term improvements for both Bullittsville PS and Allen Fork PS have been proposed.

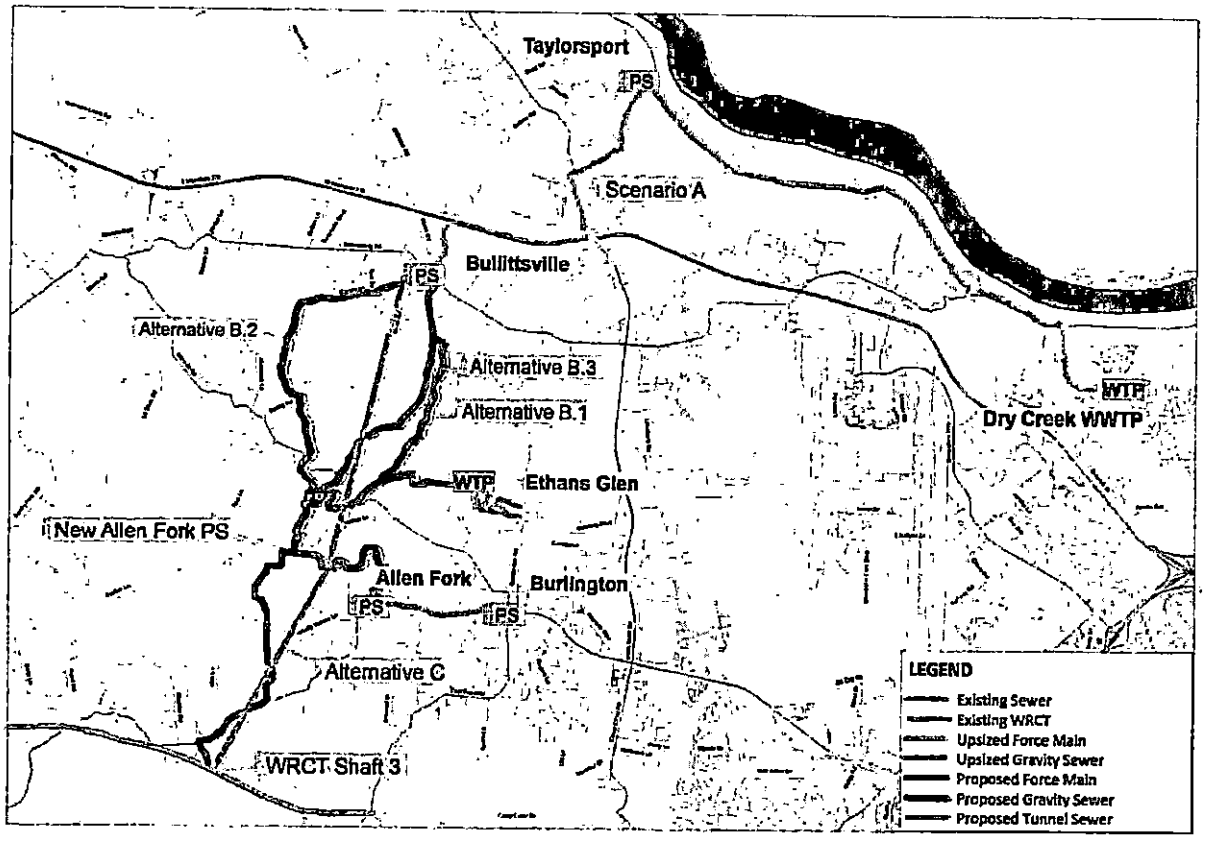


Figure ES-1: Overall Project Area (Scenarios A, B, and C)

Thus, before proceeding with design of any improvements to address capacity issues at Bullittsville and Allen Fork PSs, SD1 decided to investigate the various alternatives in order to reduce construction costs, delay expenditures to the extent practicable, reduce lift-cycle costs (LCCs), and offer other benefits.

The purposes of this business case evaluation (BCE) are to evaluate feasible alternatives to address existing SSOs and planned growth and to recommend a preferred alternative and path forward for Bullittsville and Allen Fork PSs that adequately conveys flows from the 2-year, 6-hour design storm. This BCE considers the following three scenarios and alternatives within each scenario:

Scenario A – Upgrade Bullittsville PS to continue pumping to Taylorsport PS

Under Scenario A, Bullittsville PS would continue to pump to Taylorsport PS via the Tanner Road sewer. A new Bullittsville PS with firm capacity of 7.0 mgd would be constructed, and the existing 12-inch FM would be replaced with a 20-inch FM. This would require upsizing an additional 2,830 feet of sewer along Tanner Road (in addition to the improvements currently being designed). Taylorsport PS would be upsized from its current firm capacity of 9.0 mgd to a firm capacity of 17.6 mgd. The following alternatives for Taylorsport PS were evaluated:

- **Alternative A.1**: Upsize the station to 17.6 mgd and construct a complete replacement of the existing 24-inch FM with a 30-inch FM.
- **Alternative A.2**: Upsize the station to 17.6 mgd and construct a separate, parallel 24-inch FM.
- **Alternative A.3**: Limit station capacity to 13.25 mgd and construct 550,000 gallons of equalization (EQ) storage, including an EQ pump station to dewater the storage tank.

Scenario A also includes routing of flow from the existing Allen Fork PS through a new 24-inch gravity sewer to a new, relocated, 5.23-mgd Allen Fork PS and FM that would convey the flow to Shaft 3 on the WRCT. The existing trunk sewer tributary to the existing Allen Fork PS will also need to be upsized.

Scenario B – Redirect Bullittsville PS flow to the WRCT via the proposed replacement Allen Fork PS

Scenario B would reroute all flow from Bullittsville PS to the WRCT via the new Allen Fork PS, using one of the following alternatives:

- **Alternative B.1**: This alternative was ruled out as infeasible.
- **Alternative B.2**: Eliminate Bullittsville PS with a 24-inch gravity sewer along the west branch of Woolper Creek to the site of the new Allen Fork PS.
- **Alternative B.3**: Construct a new 7.0-mgd Bullittsville PS, new 20-inch FM, and new 24-inch gravity sewer to convey flow to the new Allen Fork PS.

This would free up capacity in the Tanner Road sewer and Taylorsport PS, reducing, but not eliminating, those upgrade needs. After the improvements that are in design, only one additional span (420 feet) of sewer along Tanner Road would need to be upsized for this alternative. Only pump replacement and

minor electrical upgrades would be needed at Taylorsport PS (by approximately 2035) to achieve the required 10.8 mgd capacity.

The new Allen Fork PS would have a capacity of 12.2 mgd under Scenario B, but the tributary gravity sewer improvements would be the same as in Scenario A.

Scenario C – Redirect Bullittsville PS flow and Allen Fork flow to the WRCT via a proposed tunnel sewer

Scenario C would reroute all flow from Bullittsville PS and Allen Fork PS to the WRCT via a new tunnel sewer, which would connect into the existing WRCT at Shaft 3. Identical to Scenario B, this would free up capacity in the Tanner Road sewer and Taylorsport PS, requiring the same improvements to those facilities as Scenario B. A tunnel entrance shaft west of Bullittsville PS and a sewer redirecting the flow from Bullittsville PS would be constructed. A second entrance shaft would be included near the proposed location of the new Allen Fork PS described in Scenarios A and B to receive redirected flows from Allen Fork PS; however, the Allen Fork PS would not be needed in Scenario C. A third shaft would be required near the tunnel terminus for retrieval of the tunneling equipment.

Initial Improvements Common to All Alternatives

Regardless of which scenario is selected, initial improvements to Bullittsville PS, Allen Fork PS, and Burlington PS are needed as soon as practicable to reduce existing SSOs and provide capacity for planned development, for which reserved capacity has already been approved. These initial improvements, which would accommodate flows of 3.55 mgd to Bullittsville PS and at least 4.6 mgd to Allen Fork PS, would delay the need for more extensive improvements by approximately seven to eight (7 – 8) years. Therefore, it is recommended that SD1 begin design and commence construction of these improvements as soon as practicable. The estimated capital costs for these initial improvements are $5.0 million for Bullittsville improvements and $3.8 million for Allen Fork and Burlington improvements.

Alternatives' Costs

Table ES-1 presents estimated costs for each alternative, including the initial and other common improvements.

Table ES-1: Summary of Alternatives' Costs

	Bullittsville PS to Taylorsport PS			Bullittsville PS to WRCT			
	Alt. A.1	Alt. A.2	Alt. A.3	Alt. B.1	Alt. B.2	Alt. B.3	Alt C
35-YR Capital Cost	$97,100,000	$94,200,000	$69,600,000	$ -	$73,200,000	$75,700,000	$127,900,000
35-YR Energy Cost	$7,000,000	$6,700,000	$7,800,000	$ -	$6,000,000	$6,600,000	$4,100,000
35-YR O&M Cost	$3,500,000	$3,500,000	$3,700,000	$ -	$3,100,000	$3,500,000	$2,200,000
35-YR Odor Control Cost	$15,100,000	$15,100,000	$15,100,000	$ -	$13,800,000	$13,900,000	$11,700,000
35-YR LCC, NPV (n=2.8%)	**$87,300,000**	**$85,400,000**	**$71,500,000**	**$ -**	**$72,600,000**	**$75,000,000**	**$110,700,000**

Conclusions

The estimated capital and net present value (NPV) costs of Alternatives A.3, B.2, and B.3 are within 5% of each other. However, Alternatives A.1, A.2, and C costs are significantly higher than the other alternatives and were ruled out. Thus, although Alternatives A.1 and A.2 are most consistent with the Watershed Plans, these are not cost-effective and are not recommended; neither is Alternative C. Alternatives A.3, B.2, and B.3 are considered to be feasible, cost-effective alternatives. A comparison of various quantities and values for each of these alternatives and the favorability of each is presented in Table ES-2 to help better compare the alternatives.

Table ES-2: Comparison of Cost-effective Alternatives

Alternative	Major Creek Crossings	Minor Creek Crossings	Length Within 50' of Major Creek (lin. ft.)	Length with Depth >15' (lin. ft.)	Length Impacting Mature Trees (lin. ft.)	New Easements Required	Length within Road ROW (lin. ft.)*	Length Under Pavement (lin. ft.)	Major Road Crossings	Length within Farmland (lin. ft.)***	Water Main Crossings
A.3	12	13	11,100	2,600	16,100	10	24,100	12,600	5**	7,500	2
B.2	16	34	26,800	9,300	20,100	31	11,500	8,100	5	7,500	10
B.3	12	19	10,400	5,700	13,900	16	11,000	10,900	7	10,100	6

Notes:
Green shading = favorable; yellow shading = moderate; red shading = unfavorable.
* Installation within road right of way has pros and cons, so favorability of installation in ROW is debatable.
** Alternative A.3 major road crossings include I-275 and North Bend Road.
*** Installation within farmland has pros and cons (e.g. when compared to installation in road ROW), so favorability of shorter lengths in farmland is debatable.

Alternatives A.3 and B.2 appear to be slightly less expensive than the other cost-effective alternative. Also, Alternative B.2 offers the ability to serve additional areas in Boone County south of I-275 that currently are not expected to develop by 2050. However, the sizing and costs of improvements presented in this BCE do not provide for capacity to serve these additional areas. Alternative B.3 seems to offer the

most non-cost advantages and fewest disadvantages at a comparable cost, with the highest potential flexibility to reduce costs during design.

Wastewater treatment costs at Dry Creek WWTP and Western Regional WRF and treatment capacities at these facilities were not evaluated in this BCE, yet the cost associated with treating wastewater from Bullittsville PS could be significantly different at these facilities. Thus, treatment costs, capacities, and related considerations may be important factors in selecting between Alternative A.3 and one of the Scenarios B alternatives (i.e., B.2 or B.3). Furthermore, projected odor control costs account for approximately 20% of the NPV of each alternative; and this BCE included only a high-level estimate of these future costs based on existing odor control costs. Thus, the relative costs of the three cost-effective alternatives could change with different assumptions regarding future odor control costs.

Table ES-3 presents a summary of the total capital costs of Alternatives A.3, B.2, and B.3, including all years used in developing the LCC analysis. Preliminary schedules and cost/budgetary outlay by year are presented for each feasible alternative in the report. The final decision of which of the three feasible, cost-effective alternatives to select should be made by SD1 after fully vetting the advantages and disadvantages of each, discussing the project with Boone County and other stakeholders, considering treatment-related costs, and more-detailed evaluation of future odor control costs for the preferred alternatives.

Table ES-3: Categorical Costs of Preferred Alternatives

	Alt. A.3	Alt. B.2	Alt. B.3
Design (Preliminary and Final)	$9,051,000	$9,514,000	$9,839,000
Easement Acquisition	$357,000	$542,000	$508,000
Construction Administration & Inspection	$6,022,000	$6,313,000	$6,534,000
Construction	$54,194,000	$56,814,000	$58,802,000
TOTAL CAPITAL COST (2016 DOLLARS)	**$69,600,000**	**$73,200,000**	**$75,700,000**