

December 30, 2021

Craig Johnson, P.E.
Crist Engineers Inc.
205 Executive Ct.
Little Rock, AR 72205

Subject: Gulpha Basin Alternative Evaluation TM

Dear Mr. Johnson:

In accordance with the February 2021 Subconsultant Agreement with Crist Engineers and September 29th meeting, RJN Group, Inc. (RJN) is pleased to submit the Gulpha Basin Alternative Evaluation TM. The activities included utilizing the recalibrated Gulpha basin hydraulic model to evaluate options to eliminate “chronic” SSOs. The three alternatives evaluated are as follows:

- Option 1. Gulpha Storage Tank:** 11-million-gallon (MG) storage tank with odor control equipment at the Heller property east of Lakeside School District. Includes a five-million-gallon per day (MGD) pump station to empty the storage tank. Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the storage tank (MH 1742). Also includes 11.5-MGD pumping capacity at the Gulpha pump station and new 24-inch force main on the proposed alignment discharging into gravity main segment 947:5304.
- Option 2. Full Conveyance with Single Force Main:** Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station. The pump design should incorporate pumps with variable frequency drives with a delivery range between 2.5 to 32-MGD at a new Gulpha pump station and a 36-inch force main on the proposed alignment discharging to the Davidson Wastewater Treatment Plant’s (DWWTP) headworks.
- Option 3. Full Conveyance with Dual Force Mains:** Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station. Includes six-MGD dry-weather pumping capacity utilizing existing pumps and 26-MGD wet-weather pumping capacity at the Gulpha pump station. This option would entail rehabilitation or replacement of the existing 20-inch Gulpha force main for dry-weather flow and construction of a 36-inch force main for wet-weather flow on the proposed alignment discharging to the DWWTP headworks.

The following conclusions were based on the results of these evaluations. *RJN recommends that Hot Springs implement Option 2 – Full Conveyance with Single Force Main.* This option allows for CHS to best utilize the existing capacity of DWWTP’s EQ Basin without the addition of new storage assets that will have considerable O&M costs associated. This option allows for renewal of the Gulpha Interceptor and pump station while also being the most cost-effective option. The renewal of the Gulpha interceptor is projected to remove significant amounts of extraneous inflow and infiltration, as an unaccounted benefit. If future budgets allow, the existing Gulpha force main may be rehabilitated and utilized for dry-weather flows.

We appreciate the opportunity to work with Hot Springs and the excellent cooperation throughout the project. Should you have any questions, please do not hesitate to reach out.

Respectfully Submitted,
RJN GROUP, INC.

A handwritten signature in blue ink that reads "Mac Compton".

Mac Compton, P.E.
Senior Project Manager

Colton Bryant, E.I.
Project Engineer

MC/CB/18-3665-00
Enclosure

INTRODUCTION

In February 2021, RJN Group, Inc. (RJN) contracted with Crist Engineers was requested to install 44 flow monitors and 10 rain gauges throughout the Hot Springs, AR sewer system with the purpose of recalibrating the existing hydraulic model. Along with recalibrating the model, updates to the hydraulic model from 2015 was performed with edits made to current population, water consumption data, and sewer main additions. Additionally, RJN, with guidance from Crist Engineers, was requested to evaluate storage and conveyance alternatives within the Gulpha sewer basin to eliminate the remaining five “chronic” Sanitary Sewer Overflows (SSOs).

The purpose of this technical memorandum is to discuss alternative storage and conveyance options evaluated within the Gulpha sewer basin along with each option’s probable costs so that a comprehensive comparison can be conducted.

BACKGROUND

Since 2009, RJN has been assisting the City of Hot Springs in eliminating SSOs throughout the Hot Springs, AR sewer system. RJN performed a flow monitoring program of the entire sanitary sewer system along with subsequent Sanitary Sewer Evaluation Studies (SSES) from 2009 to 2010, after which, the 2010 SECAP report was delivered. Within this report, rehabilitation of 50,797 LF of sewer main, and improvement of the Gulpha pump station was recommended for the Gulpha sewer basin. This included construction of a 30-inch parallel force main and upgraded 30-MGD pumping capacity at the Gulpha pump station. **Figure 1.1** summarizes the recommendations for the Gulpha basin from the 2010 SECAP report. A hydraulic model update and recalibration was performed in 2015 which focused on those areas that were about to undergo capacity enhancements, such as the Stokes tributary area. In 2018, two meters were placed just upstream of the Gulpha pump station to evaluate the flows entering the station at that time.

Project ^{2/}	Length (ft)	No I-I Reduction Capital Cost ^{2/} (\$)	With I-I Reduction Capital Cost ^{2/} (\$)
PRIORITY 1 PROJECTS			
<i>Gravity Mains</i>			
E. Grand Ave	295		
Upper Gulpha Interceptor	<u>1,873</u>	<u>457,178</u>	<u>457,178</u>
<i>Gravity Subtotal</i>	2,168	508,950	508,951
<i>Force Main</i>			
Gulpha Pump Station Force Main	<u>16,016</u>	<u>5,621,686</u>	<u>5,205,265</u>
<i>Force Main Subtotal</i>	16,016	5,621,686	5,205,265
<i>Pump Station</i>			
Gulpha Pump Station		<u>8,360,300</u>	<u>6,999,980</u>
<i>Pump Station Subtotal</i>		<u>8,360,300</u>	<u>6,999,980</u>
Priority 1 Total		14,490,936	12,714,196
PRIORITY 2 PROJECTS			
<i>Gravity Mains</i>			
Gulpha Interceptor	20,192	14,321,445	12,998,981
Ridgeway St	8,159	2,170,446	2,119,174
Spring St & Festival St	247	58,858	58,858
Upper Gulpha Interceptor	<u>4,014</u>	<u>859,905</u>	<u>662,380</u>
<i>Gravity Subtotal</i>	32,613	<u>17,410,653</u>	<u>15,839,393</u>
Priority 2 Total		17,410,653	15,839,393
Gulpha Total		31,901,589	28,553,589

Figure 1.1 – 2010 Gulpha SECAP Recommendations

The City of Hot Springs rehabilitated over 4,000 manholes (MH), along with capacity improvements of multiple force mains, gravity mains, and pump station upgrades. Within the Gulpha sewer basin, there are currently seven SSOs total, five of which occurred more than five times in 2020 and are considered “chronic”. A chronic SSO is an SSO that occurs more than five times per year. **Figure 1.2** shows the locations of those seven SSOs. The SSO at MH 10578 is currently being addressed with the completion of the East Grand Ave. capacity improvement project. The remaining SSOs will be addressed by the completion of one of the alternatives discussed in chapter 2 of this technical memorandum.

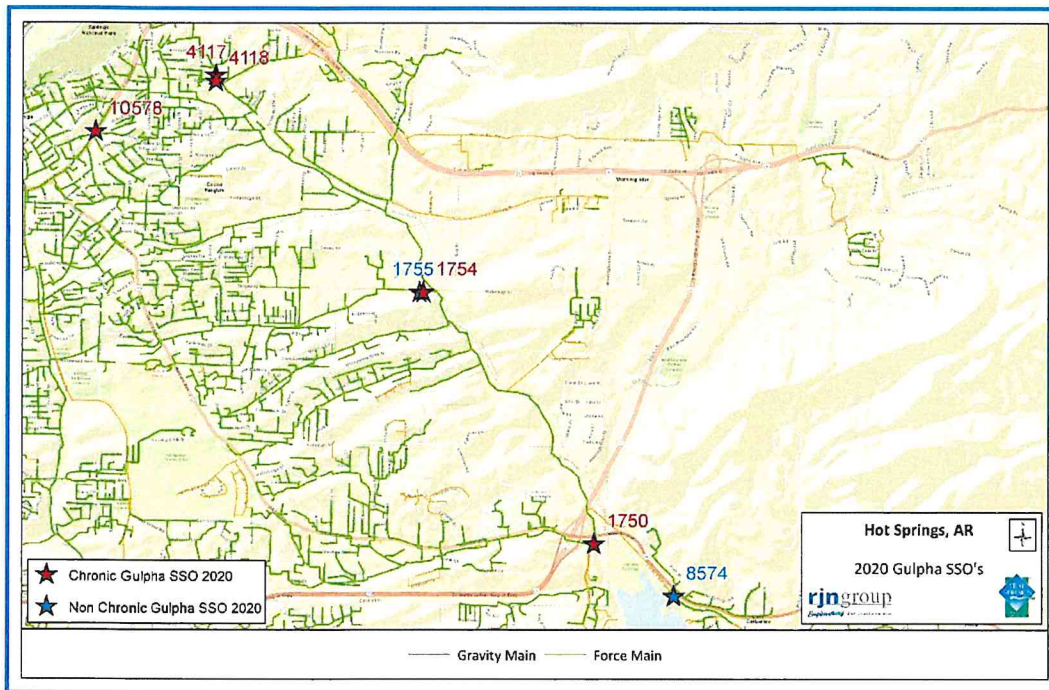


Figure 1.2 – 2020 Gulpha Basin SSOs

ALTERNATIVE EVALUATIONS

Eliminating the SSOs in the Gulpha sewer basin requires the sewer system to handle peak flows occurring during the 2-year/24-hour design storm event. The design storm is a theoretical storm event in which a total of 4.3-inches of rainfall falls over 24-hours and has a peak 1-hour intensity of 1.94-inches. Three options have been evaluated within the Gulpha basin so that the remaining recorded SSOs are eliminated. The three options are as follows:

- Option 1. Gulpha Storage Tank:** 11-million-gallon (MG) storage tank with odor control equipment at the Heller property east of Lakeside School District. Includes a five-million-gallon per day (MGD) pump station to empty the storage tank. Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the storage tank (MH 1742). Also includes 11.5-MGD pumping capacity at the Gulpha pump station and new 24-inch force main on the proposed alignment discharging into gravity main segment 947:5304.
- Option 2. Full Conveyance with Single Force Main:** Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station. The pump design should incorporate pumps with variable frequency drives with a delivery range between 2.5 to 32-MGD at a new Gulpha pump station and a 36-inch force main on the proposed alignment discharging to the Davidson Wastewater Treatment Plant's (DWWTP) headworks.
- Option 3. Full Conveyance with Dual Force Mains:** Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station. Includes six-MGD dry-weather pumping capacity utilizing existing pumps and 26-MGD wet-weather pumping capacity at the Gulpha pump station. This option would entail rehabilitation or replacement of the existing 20-inch Gulpha force main for dry-weather flow and construction of a 36-inch force main for wet-weather flow on the proposed alignment discharging to the DWWTP headworks.

For all options, MHs 1746, 1747, 1748, 1749, and 1750 need to be raised at least six feet. Doing so will prevent SSOs occurring near the Gulpha pump station during peak flow periods. These manholes are shown in **Figure 2.1**.



Figure 2.1 – Manholes to be Raised

PROPOSED FORCE MAIN ALIGNMENT

The City of Hot Springs provided RJN with a proposed force main alignment to be included in the evaluation for the Gulpha sewer basin. All options will require construction of a new force main along the proposed alignment. The force main begins at the Gulpha pump station and discharges into a new manhole on gravity main sewer segment 947:5304 with a total length of approximately 11,100 linear feet (LF). The high point of the proposed alignment is 46 feet lower (437 feet) than the existing force main's high point (483 feet). If constructed, this would cause the existing pumps at the Gulpha pump station to operate beyond their current allowable operational range. Therefore, to utilize the proposed force main, new pumps will be needed. The proposed force main alignment is shown in **Figure 2.2**.

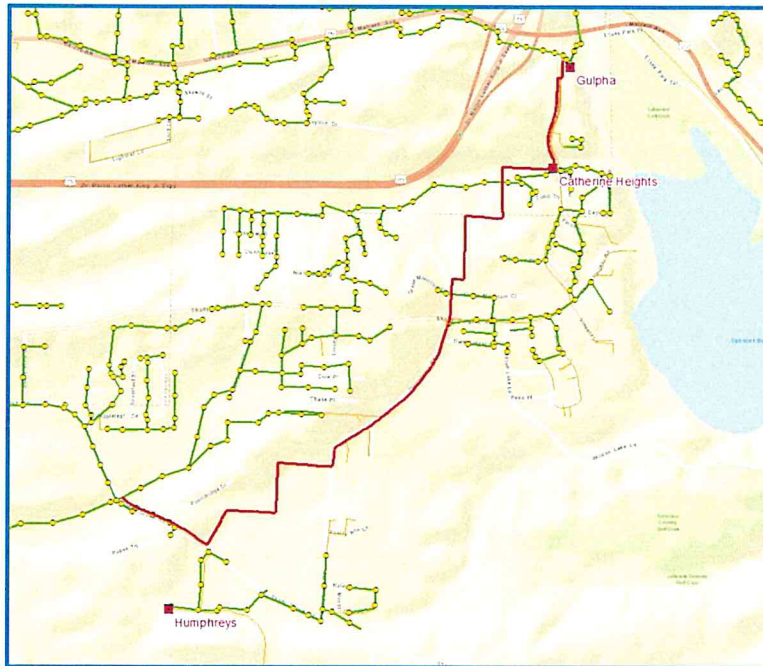


Figure 2.2 – Proposed Force Main Alignment

GULPHA STORAGE TANK

A storage tank option was evaluated with an initial goal of limiting the amount of capacity improvements needed along the Gulpha interceptor and limiting the need for increased pumping capacity at the Gulpha pump station. RJN was instructed by the City of Hot Springs to evaluate a storage tank option located at the “Heller property” east of Lakeside High School and north-west of exit nine on Highway 270 east. This location was selected due to feasibility of land acquisition and position within the Gulpha basin that allows for maximum utilization. The location of the proposed storage tank is shown in **Figure 2.3** on page 2-3.

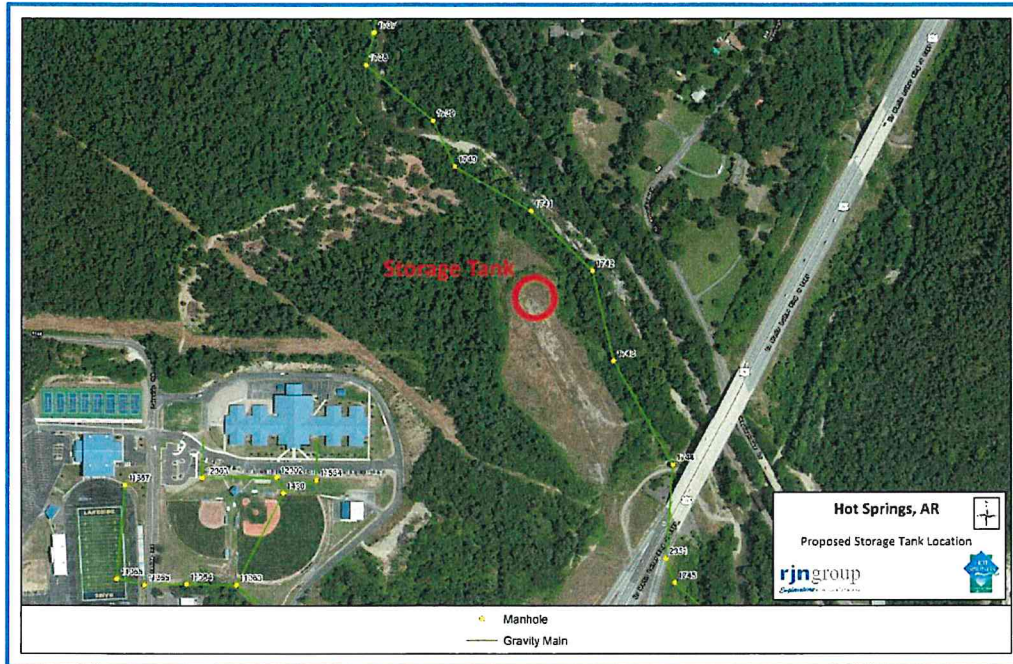


Figure 2.3 – Proposed Storage Tank Location

Initial setup was required when evaluating this option in the hydraulic model. To complete setup the following actions were completed:

- Add the force main along the proposed alignment with a 24-inch diameter
- Model the base of the storage tank to be 50-feet underground with a 36-inch influent pipe diverting off MH 1742. A storage tank with a diameter exceeding 200-feet becomes cost prohibitive, therefore, to achieve the appropriate volume, a 50-foot-deep storage tank is required.
- Add a pump to empty the storage tank after peak flow passed and sufficient capacity was available downstream

This scenario was run through the hydraulic model and upon review, multiple recorded SSOs were still predicted to occur along the Gulpha interceptor due to capacity restrictions even after storing peak flow. Therefore, upsizing of the Gulpha interceptor was completed in the hydraulic model as per recommendations in the 2010 SECAP report. This includes upsizing the gravity sewer main from MH 3314 near Gorge Rd to MH 4015 as part of the Spring Street upsizing project (7,270 LF) and upsizing gravity sewer from MH 4103 to MH 1742 as part of the Gulpha interceptor capacity improvement project (17,570 LF). Increased pipe diameters range from 15-inch at MH 3114 to 42-inch at MH 1742. With this option, capacity improvements are not required downstream of the storage tank. **Figure 2.4** on page 2-4 shows the Spring Street and Gulpha Capacity improvements for this option. After implementing the Gulpha interceptor capacity improvements in the hydraulic model, all recorded SSOs along the Gulpha interceptor were no longer predicted to overflow. In the event of back-to-back storm events, the Gulpha storage tank would likely not be able to store peak rainfall during the second storm and SSOs would likely occur along the Gulpha interceptor.

The second goal with this option is to maximize the already existing storage capacity at the DWWTP EQ basin and to prevent SSOs from occurring at the force main discharge into gravity main segment 947:5304. The pumps at Gulpha pump station were sized large enough to reduce the size of the storage tank, without creating an SSO at the discharge of the force main. For this option, two six-MGD pumps with a firm 11.5-MGD capacity is recommended at the Gulpha pump station to convey both dry and wet-weather.

Storage tank volume of 11-MG will be required with a height of 50-feet and a diameter of 193.5-feet. A five-MGD pump station was sized to drain the storage tank in approximately 51-hours, starting 87-hours after peak rainfall. Draining the storage tank at rates higher than five-MGD would result in downstream surcharging and recirculation of flow. A graph showing the time to drain the Gulpha storage tank is shown in **Figure 2.5** on page 2-5. It should be noted that additional operation and maintenance (O&M) costs will be expected during the lifetime of the Gulpha Storage tank. This would include cleaning, safety checks, repairs, routine maintenance, etc. These costs are not included in the cost estimate for this option provided within this interim technical memorandum.

Estimated costs for this option are presented in **Table 2-1** on page 2-5. Due to high variability in the current market, costs are subject to change. Additionally, more detailed costs will be provided within the SECAP update report to be submitted at the beginning of 2022.

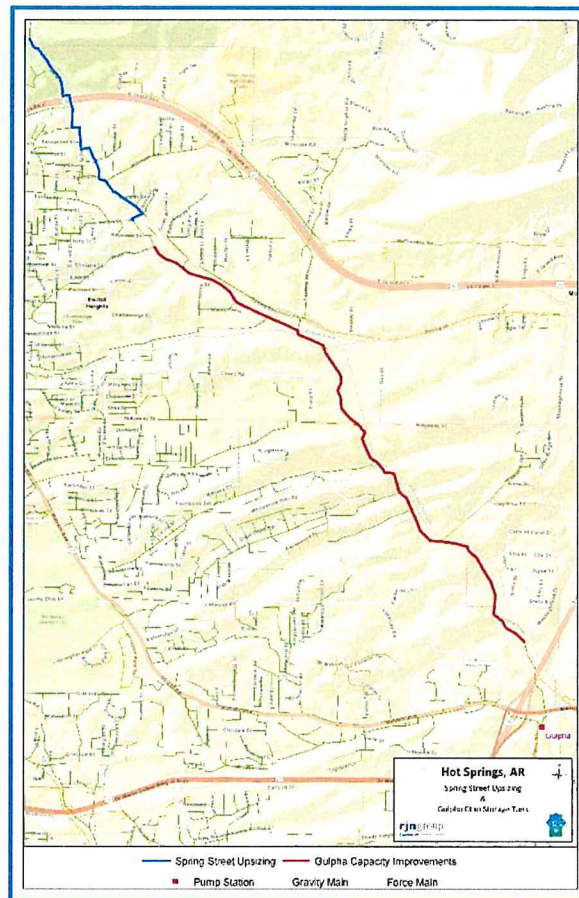


Figure 2.4 – Spring Street and Gulpha CI to Storage Tank

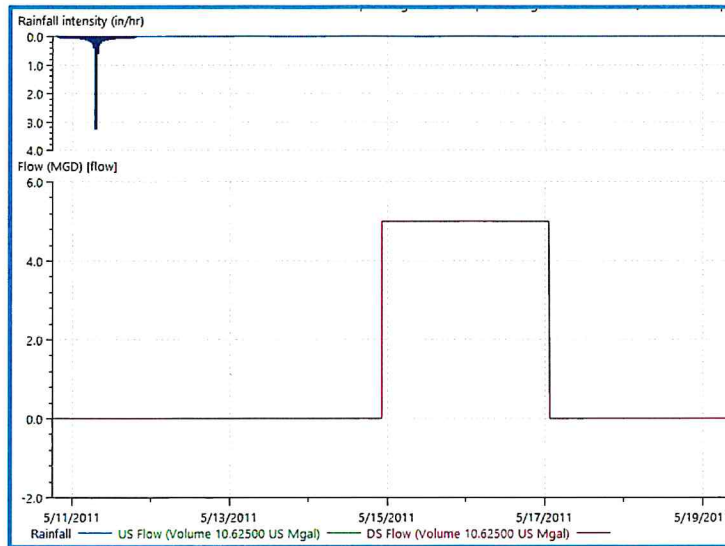


Figure 2.5 – Gulpha Storage Tank Drain Time

TABLE 2-1 COST SUMMARY OF GULPHA STORAGE TANK ALTERNATIVE			
Item	Unit Cost	Quantity	Estimated Capital Cost ^{2/} \$
Storage Tank	8,500,000 (\$)	1	8,500,000
Odor Control	750,000 (\$)	1	750,000
5 MGD Pump station ^{1/}	1,320,000 (\$)	1	1,320,000
6 MGD Pump ^{1/}	333,333 (\$)	3	1,000,000
24-inch Force main	450 (\$/LF)	11,100 LF	4,995,000
Spring St. Upsizing	470 (\$/LF)	7,270 LF	3,416,900
Gulpha Interceptor	950 (\$/LF)	17,570 LF	16,691,500
Contingency	3,600,000 (\$)	1	3,600,000
Professional Services	6,500,000 (\$)	1	6,500,000
Total			46,773,400

1/ Includes backup pump

2/ Cost in 2021 Dollars. Includes 10% contingency and 18% professional services fee.

FULL CONVEYANCE WITH SINGLE FORCE MAIN

A full conveyance option was evaluated with the purpose of conveying peak flows during the design storm to the DWWTP with a single force main and without storage in the Gulpha basin. Initial setup in the hydraulic model included: implementing the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station and utilizing the proposed force main alignment. Gulpha interceptor capacity improvements to the Gulpha pump station total 20,200 LF of replacement. Spring Street and Gulpha interceptor capacity improvements for this option are shown in **Figure 2.6** on page 2-6.

Upsizing the Gulpha interceptor allows more flow to be conveyed to the Gulpha pump station. The peak flow rate predicted to reach the Gulpha pump station under these conditions during the design storm is 32-MGD. Therefore, a firm capacity of 32-MGD is necessary at the Gulpha pump station for this option.

According to the hydraulic model, a flow rate of 32-MGD through the Gulpha force main would cause SSOs at the force main discharge into gravity main segment 947:5304. Therefore, it is recommended to extend the proposed force main alignment to the DWWTP headworks for this option. This would add approximately 5,100 LF of force main to the proposed alignment for a total of 16,200 LF. At 32-MGD of peak flow, the forcemain would need to be at least 36-inches in internal diameter to maintain sufficient velocities. An internal diameter of 36-inches at 32-MGD of flow would deliver a velocity of 7.0 feet per second (fps).

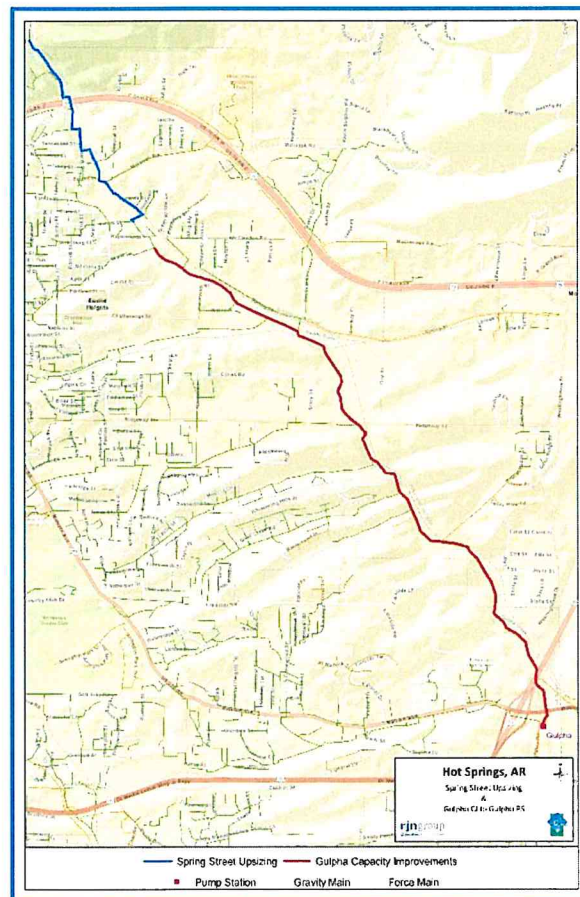


Figure 2.6 Spring Street and Gulpha CI to Gulpha PS

Average dry-weather flow in the Gulpha sewer basin is 2.5 MGD. The pump design should incorporate pumps with variable frequency drives with a delivery range between 2.5 to 32-MGD. Consequently, dry-weather velocities through the 36-inch force main would be less than one-fps which can lead to formation of hydrogen sulfide (H₂S) and deposition. The use of calcium nitrate can sequester sulfate reducing to hydrogen sulfide in anerobic conditions that can be prevalent in long force mains. Furthermore, calcium nitrate can reduce the formation of ammonium compounds in anaerobic conditions that may be prevalent where wastewater is stored in the equalization basin at DWWTP. Ammonium compounds will have detrimental treatment impacts on the biological process at DWWTP.

As a result of this anticipated sulfate and ammonium production, it is recommended that the Gulpha pump Station design incorporate a means to dose calcium nitrate. Estimated costs for this option are presented in **Table 2-2**.

TABLE 2-2 COST SUMMARY OF FULL CONVEYANCE WITH SINGLE FORCE MAIN ALTERNATIVE			
Item	Unit Cost	Quantity	Estimated Capital Cost ^{1/} \$
New Pump Station	5,100,000 (\$)	1	5,100,000
36-inch Force Main	500 (\$/LF)	16,200 LF	8,100,000
Spring St. Upsizing	470 (\$/LF)	7,270 LF	3,416,900
Gulpha Interceptor	950 (\$/LF)	20,200 LF	19,190,000
Contingency	3,500,00 (\$)	1	3,500,000
Professional Services	6,300,000 (\$)	1	6,300,000
Total			45,606,900

1/ Cost in 2021 Dollars. Includes 10% contingency and 18% professional services fee.

FULL CONVEYANCE WITH DUAL FORCE MAINS

The full conveyance with dual force mains option was evaluated to increase dry-weather velocity through the Gulpha force main and to provide easier operation of the Gulpha pump station pump/force main configuration. This option requires the same Spring Street and Gulpha interceptor capacity improvements as the single force main option but utilizes a dry-weather force main and wet-weather force main. For this option, continuing the use of the existing 20-inch Gulpha force main's alignment for dry-weather operation is evaluated. The existing pumps at the Gulpha pump station may be utilized to service the 20-inch force main during dry-weather flows. The existing Gulpha force main is reaching end-of-life and would require rehabilitation or replacement to continue use. Assuming pressure grade CIPP rehabilitation method, the internal diameter of the 20-inch Gulpha force main would decrease to approximately 17-inches. Dry-weather velocities through a 17-inch force main are approximately 3.0 fps.

A 30-inch wet-weather force main was initially attempted to convey wet-weather flows in the hydraulic model, but peak velocity through the forcemain was 8.1 fps which can lead to force main failure. Therefore, a 36-inch wet-weather force main that extends from the Gulpha pump station to the DWWTP is recommended. The existing pumps can provide six-MGD of capacity during peak flow periods, so an additional 26-MGD pumping capacity would be necessary. Dedicating dry-weather pumps to a dry-weather force main and wet-weather pumps to a wet-weather force main simplifies the configuration at the Gulpha pump station compared to both dry and wet-weather pumps servicing a single force main. This option may allow for the existing Gulpha pump station to stay in service and a new peak flow pump station be constructed if it is determined to be more practical. Estimated costs for this option are presented in **Table 2-3** on page 2-8.

**TABLE 2-3
COST SUMMARY OF FULL CONVEYANCE
WITH DUAL FORCE MAIN ALTERNATIVE**

Item	Unit Cost	Quantity	Estimated Capital Cost^{1/} \$
New Pump Station	4,100,000 (\$)	1	4,100,000
Force Main Rehab	500 (\$/LF)	7,300 LF	3,650,000
36-inch Force Main	500 (\$/LF)	16,200 LF	8,100,000
Spring St. Upsizing	470 (\$/LF)	7,270 LF	3,416,900
Gulpha Interceptor	950 (\$/LF)	20,200 LF	19,190,000
Contingency	3,800,000 (\$)	1	3,800,000
Professional Services	6,840,000 (\$)	1	6,840,000
Total			49,096,900

1/ Costs in 2021 Dollars. Includes 10% contingency and 18% professional services fee.

CONSIDERATIONS

When evaluating each option, it is imperative to consider the downstream effects at the DWWTP. Currently, several upgrades are underway at the DWWTP that will increase biological and hydraulic capacity which will reduce storage volume to the EQ basin during storm events. Each option was evaluated on the total volume stored at the EQ basin as well as the time required for DWWTP to recover from the design storm event. Stored EQ volume is returned to process via a pump station, having a pump range between 2 to 12-MGD; however, the return rate should not be detrimental to the biological process.

The biological process has a 7-Day rated capacity of 24-MGD. For the hydraulic modeling effort, the drain back is scheduled to commence once flows reduce to 20-MGD to provide an operational buffer. A hydraulic flow splitting structure post preliminary treatment diverts 24-MGD to the biological process, with up to an additional 24-MGD diverted to tertiary filters where flow is then combined with biological treatment prior to UV disinfection. When flow exceeds 48-MGD, it is diverted prior to preliminary treatment to the EQ basin, which has a storage capacity of 80-million gallons. **Figure 3.1** below shows a hydrograph of influent flows to the DWWTP during the design storm event. Flow values into DWWTP from the Gulpha sewer basin are calculated based on the 2021 flow monitoring and recalibration efforts. Flow values from the rest of the sewer system (Fairwood, Stokes, Hot Springs Creek) are calculated using the 2015 SECAP model for this interim technical memorandum. The 2015 SECAP model has implemented all capacity improvements recommended therefore, has minimal model predicted SSOs.

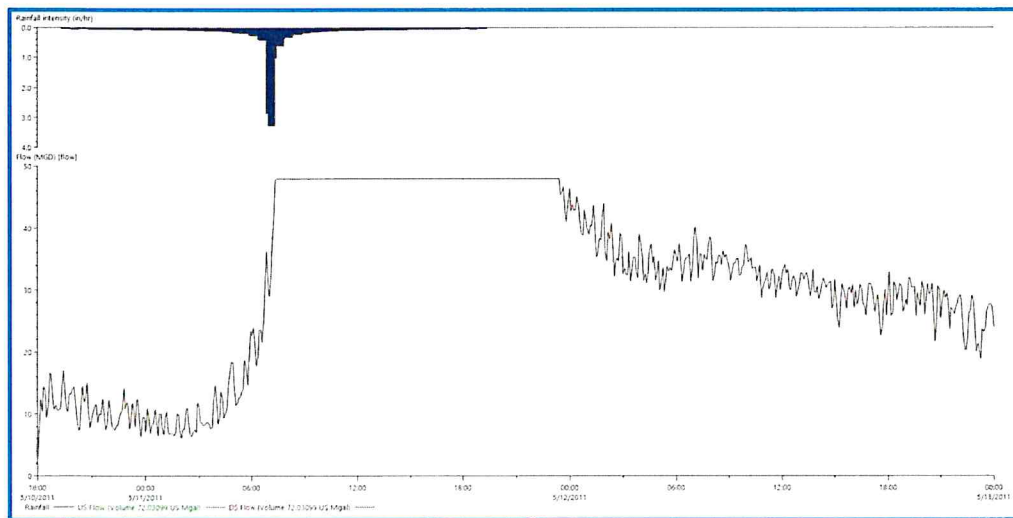


Figure 3.1 – DWWTP Influent Hydrograph

GULPHA STORAGE TANK

For the Gulpha storage tank option, the hydraulic model predicts that the EQ basin at the DWWTP will fill for approximately 15-hours during the design storm and hold a total volume of approximately 10.7 MG. **Figure 3.2** below shows EQ storage vs. time during the design storm. The EQ drain pumps were controlled to pump at 8-MGD when influent flow had dropped down to 12-MGD for a total of 20-MGD through the biological process. **Figure 3.3** shows the time required for complete recovery of the DWWTP. According to the hydraulic model, it will take approximately seven and a half days to fully recover from the design storm event for this option.

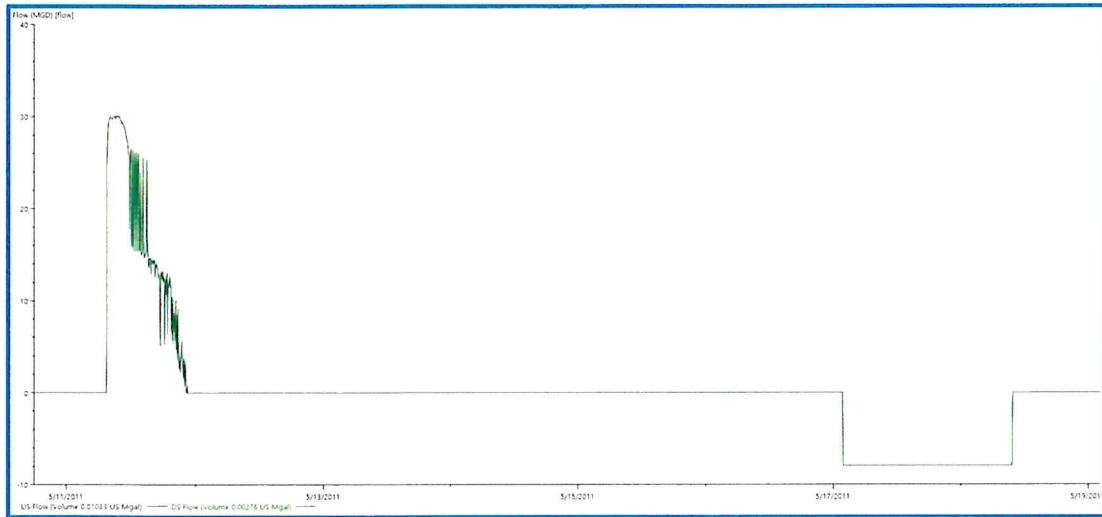


Figure 3.2 – EQ Storage Vs. Time – Gulpha Storage Tank Option

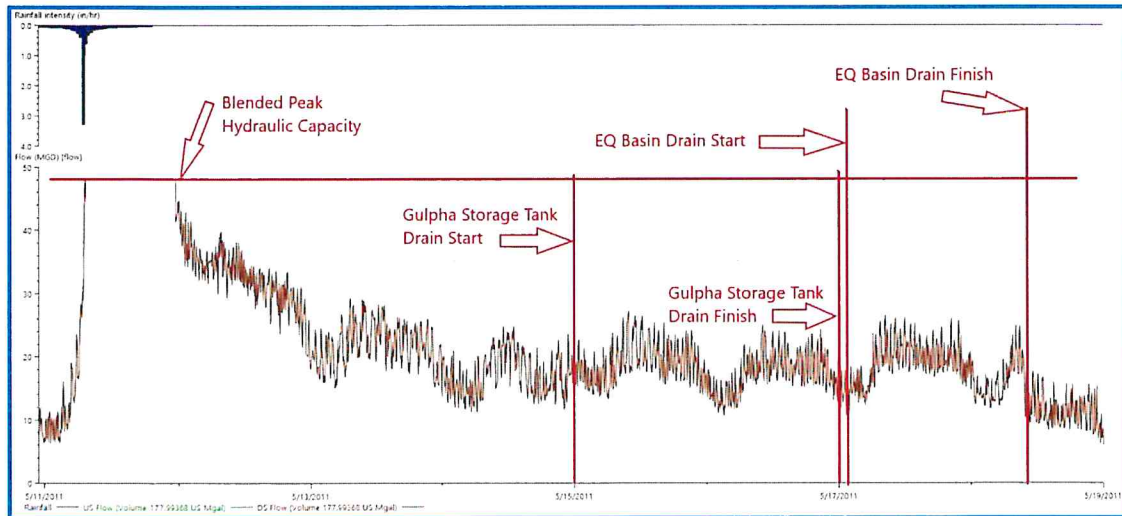


Figure 3.3 – DWWTP Recovery – Gulpha Storage Tank Option

FULL CONVEYANCE OPTIONS

The flow arriving at the DWWTP for both “Full Conveyance” options are essentially the same since the total pump rate at the Gulpha pump station is the same (32 MGD). The hydraulic model predicts that the EQ basin at the DWWTP will fill for approximately 14-hours during the design storm and hold a total volume of approximately 20 MG, of the 80 MG capacity, before draining begins.

Figure 3.4 below shows EQ storage vs. time during the design storm. **Figure 3.5** shows the time required for complete recovery of the DWWTP. According to the hydraulic model it will take approximately eight days to recover from the design storm event for the full conveyance options.

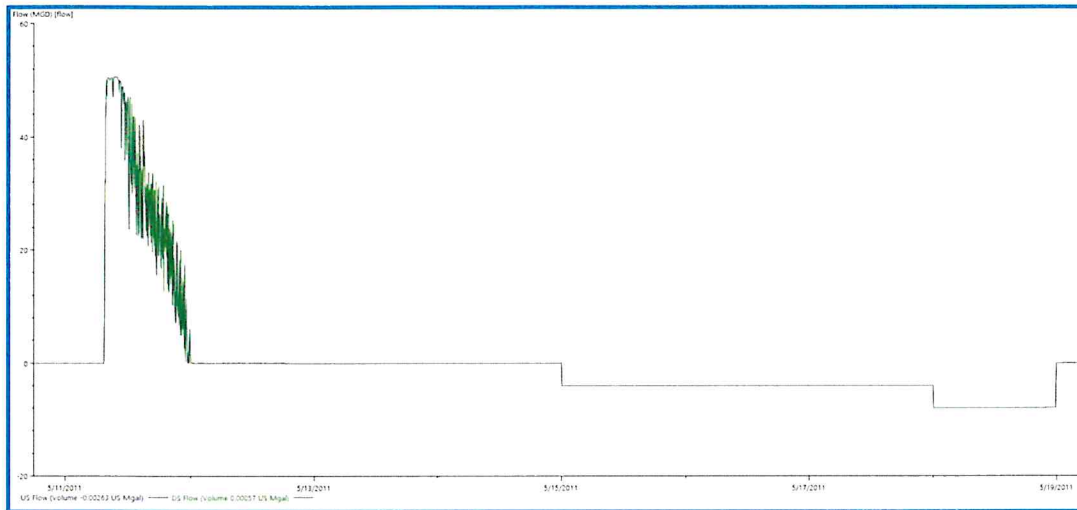


Figure 3.4 –EQ Storage Vs. Time – Full Conveyance Options

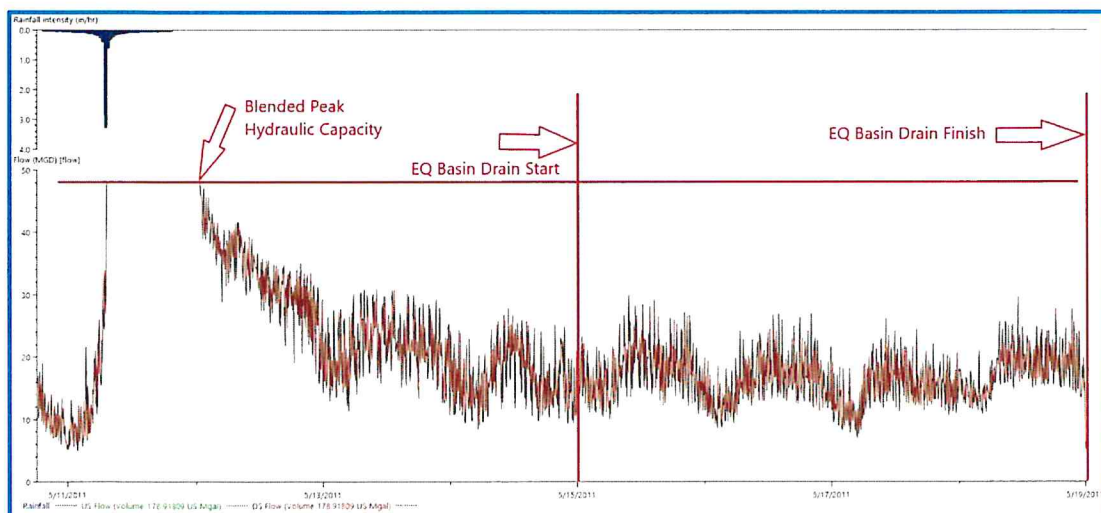


Figure 3.5 – DWWTP Recovery – Full Conveyance Options

SUMMARY

Since 2010, the City of Hot Springs has made significant efforts in reducing the number of SSOs occurring throughout the city. The city conducted city-wide flow monitoring in 2010 and 2015 and a sanitary sewer evaluation study in 2010 which led to the rehabilitation of over 4,000 manholes, upsizing of several gravity mains and force mains, and upgrades to pumping capacity at pump stations.

There are currently seven SSOs remaining in the Gulpha sewer basin, five of which occurred more than five times in 2020. **Figure 4.1** below shows the locations of the seven SSOs. The SSO at manhole (MH) 10578 is currently being addressed with completion of the East Grand Ave. capacity improvement project.

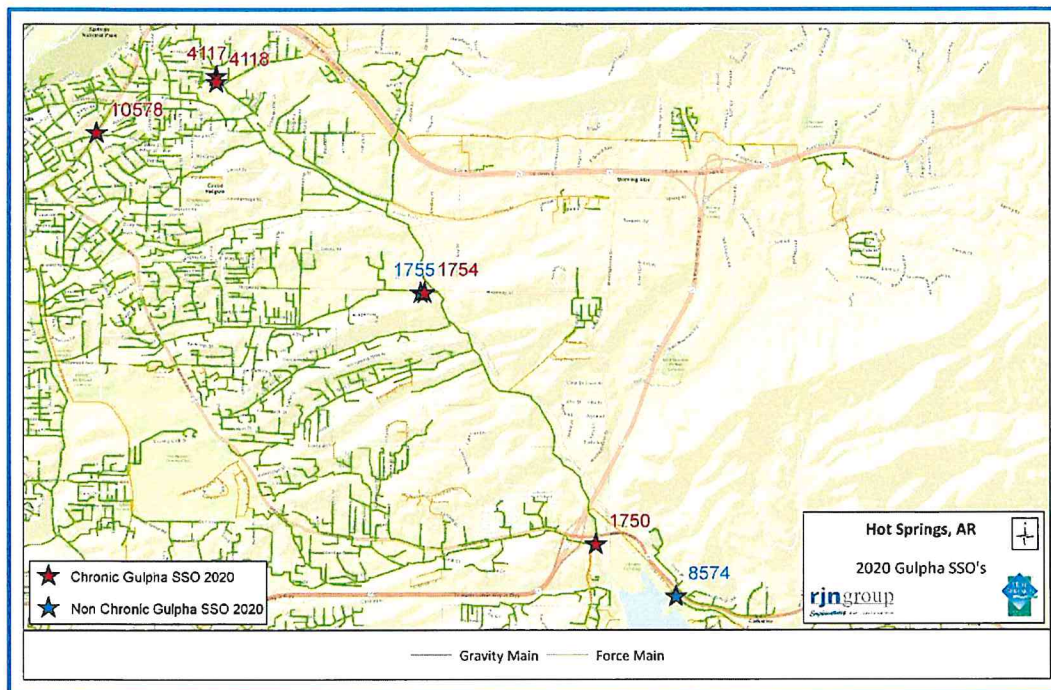


Figure 4.1 – 2020 Gulpha Basin SSOs

To eliminate the remaining SSOs, the Gulpha sewer basin needs to efficiently convey peak flows during the 2-year/24-hour design storm event. Three alternatives were evaluated with the purpose of conveying peak flows in the Gulpha sewer basin during the design storm event to the DWWTP. The three alternatives are as follows:

- Option 1. Gulpha Storage Tank:** 11-million-gallon (MG) storage tank with odor control equipment at the Heller property east of Lakeside School District. Includes a five-million-gallon per day (MGD) pump station to empty the storage tank. Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the storage tank (MH 1742). Also includes 11.5-MGD pumping capacity at the Gulpha pump station and new 24-inch force main on the proposed alignment discharging into gravity main segment 947:5304.
- Option 2. Full Conveyance with Single Force Main:** Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station. The pump design should incorporate pumps with variable frequency drives with a delivery range between 2.5 to 32-MGD at a new Gulpha pump station and a 36-inch force main on the proposed alignment discharging to the Davidson Wastewater Treatment Plant's (DWWTP) headworks.
- Option 3. Full Conveyance with Dual Force Mains:** Requires completion of the Spring Street and Gulpha interceptor capacity improvements to the Gulpha pump station. Includes six-MGD dry-weather pumping capacity utilizing existing pumps and 26-MGD wet-weather pumping capacity at the Gulpha pump station. This option would entail rehabilitation or replacement of the existing 20-inch Gulpha force main for dry-weather flow and construction of a 36-inch force main for wet-weather flow on the proposed alignment discharging to the DWWTP headworks.

Each alternative will eliminate the remaining SSOs along the Gulpha interceptor. A summary of estimated costs and alternative specifics is given in **Table 4-1** on page 4-3.

RJN recommends that Hot Springs implement Option 2 – Full Conveyance with Single Force Main. This option allows for CHS to best utilize the existing capacity of DWWTP's EQ Basin without the addition of new storage assets that will have considerable O&M costs associated. This option allows for renewal of the Gulpha Interceptor and pump station while also being the most cost-effective option. The renewal of the Gulpha interceptor is projected to remove a significant amount of extraneous inflow and infiltration, as an unaccounted benefit. If future budgets allow, the existing Gulpha force main may be rehabilitated and utilized for dry-weather flows.

**TABLE 4-1
SUMMARY OF ESTIMATED COST AND ALTERNATIVE SPECIFICS**

Option	Alternative Description	Storage (MG)	Capacity Improvements	New Pumps	Peak Pumping Capacity (MGD)	Pumping ^{1/} (MG)	Force Main	Force Main Velocity (fps)	Estimated Capital Cost ^{2/} (\$Million)	DWWTP EQ (MG)
1	Gulpha Storage Tank	11	24,850 LF	(3) 6-MGD	11.5	28.3	24-inch	5.7	46.77	10.7
2	Full Conveyance with Single Force Main	No	27,500 LF	Yes	32	39.3	36-inch	7.0	45.61	20
3	Full Conveyance with Dual Force Main	No	27,500 LF	Yes	32	39.3	17-inch & 36-inch	5.9 & 5.7	49.10	20

1/ Total volume over 72-hours from the start of the design storm event

2/ Costs are in 2021 Dollars. Includes 10% contingency and 18% professional services fee.