Wastewater Master Plan

Authorization No. 88

City of Smithville, Missouri

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1 Executive Summary

1.1 Master Plan Purpose

HDR Engineering Inc. was retained by the City of Smithville to prepare a Wastewater Master Plan. The Master Plan summarizes HDR's assessment of the City of Smithville's Wastewater Treatment Plant (WWTP) as well as the City's collection and conveyance system, including pump stations, force mains, and major gravity interceptors. The purpose of this Master Plan is to:

- Define and prioritize wastewater infrastructure improvement needs within the next ten years related to growth and capacity upgrades and regulatory requirements.
- Develop a long term, "ultimate", collection system plan that prioritizes a gravity collection system that eliminates many of the City's existing pump stations and minimizes the need for future pump stations.

HDR's findings and recommendations are summarized throughout this Master Plan.

1.2 Analysis

Information about the existing wastewater collection and conveyance system was collected from the City. Major infrastructure, including pump stations and the WWTP, were evaluated to determine condition and performance.

This information, along with the existing and future wastewater flows, was analyzed to determine the performance of the wastewater system. These conditions were modeled to derive the following recommendations.

1.3 Recommendation

A long-term goal of the City of Smithville is to more efficiently serve the community's wastewater collection needs and provide additional capacity to facilitate growth opportunities. The most efficient long-term method to convey wastewater is through the strategic implementation of gravity sewers to serve the north and south portions of the City. With this goal in the mind, the below recommendations were made.

1.3.1 Ten-year Recommendations

1. North Smithville

The recommended ten-year improvements are described in detail in Section 6.2. These improvements generally include:

ONGOING IMPROVEMENTS – The City is currently in the process of improving Wildflower and Smith's Fork pump stations.

GRAVITY SEWER – Installation of gravity sewers along Owens Branch north of the WWTP to Hillcrest Drive and connect to the existing force main tie-in. This will allow for increased capacity in the primary force main that serves north Smithville.

PUMP STATIONS – Decommissioning of Cub Cadet pump station as gravity sewer installation allows. Installation of new pump stations “Davenport Farms”, “Diamond Crest West”, and “Greyhawke 3” to facilitate growth in northern Smithville. The cost of these projects will be the responsibility of the developer, and construction costs have not been included in this Master Plan.

2. South Smithville

The recommended ten-year improvements are described in detail in Section 6.2. These improvements generally include:

ONGOING IMPROVEMENTS – The South Booster pump station and associated piping is a planned pump station that will be located along 144th Street east of Highway 169 to collect gravity flow from the surrounding area and convey it to the WWTP by way of the South Force main. The installation of this project will allow for the decommissioning of existing Hills of Shannon pump station, as well as the capacity to eliminate Diversified Metal, McDonalds, and Platte Valley pump stations in the future. The Rocky Branch Interceptor is a planned gravity interceptor to convey flow from Forest Oaks subdivision to the WWTP by way of the new South Booster pump station and South Force main.

These ongoing improvements will provide sufficient capacity in the South for the proposed ten year period due to the limited growth predicted.

1.3.2 Ultimate Recommendations

1. North Smithville

The recommended ultimate improvements are described in detail in Section 6.3. These improvements generally include:

GRAVITY SEWER – Installation of the remainder of the Owen’s Branch Interceptor and associated tributaries to provide a foundation for a gravity wastewater collection system in the northern portion of the City.

PUMP STATIONS – Decommissioning of pump stations as gravity sewer installation allows. Installation of new pump station “Davenport Farms South” as development demands. The cost of this project will be the responsibility of the developer, and construction costs have not been included in this Master Plan.

2. South Smithville

The recommended ultimate improvements are described in detail in Section 6.3. These improvements generally include:

GRAVITY SEWER – Install the First Creek Interceptor, Wilkerson Creek Interceptor, and associated tributaries to provide a foundation for a gravity wastewater collection system in the southern portion of the City.

PUMP STATIONS – Decommissioning of pump stations as gravity sewer installation allows.

1.4 Cost

1.4.1 Ten-year Cost

The cost for the proposed installation of Owens Branch Interceptor during the ten-year planning period is shown in Table 1-1 below:

Table 1-1. Owens Branch Interceptor – Phase 1 Total Cost

OWENS BRANCH INTERCEPTOR - PHASE 1 TOTAL COST	Pipe Length (Ft.)	Pipe Size (In.)	Total Cost[1,2,3]
Owens Branch - Phase 1	9,157	30	$6,517,000

Notes

1. Includes complete installation of pipes, MHs, and other ancillary structure and surface restoration.

2. Includes 20% for survey, engineering, legal, & easements and 30% contingency.

3. Estimated cost in 2020 dollars.

1.4.2 Ultimate cost

The cost for the proposed installation of the remainder of Owens Branch Interceptor, as well as the installation of the First Creek Interceptor, Wilkerson Creek Interceptor, and all associated tributaries is shown in Table 1-2 below. Note that these large interceptors are long-term solutions that should be constructed in phases as growth and development require. See Section 6.4 for a proposed phasing approach.

Table 1-2. Collection System Ultimate Interceptor Expansion

Collection System Ultimate Interceptor Expansion	Length (LF)	Size (IN)	Total Cost[1,2,3]
Owens Branch Phase 2	9,075	18	$ 3,342,700
Owens Branch Phase 3	3,478	8	$ 826,000
Owens Branch Tributary 1	1,249	8	$ 297,500
Owens Branch Tributary 2	4,950	10	$ 1,471,300
Owens Branch Tributary 3	2,884	8	$ 683,900
Owens Branch Tributary 4	5,309	10	$ 1,580,800
First Creek Phase 1	2,279	21	$ 974,200
First Creek Phase 2	6,317	18	$ 2,327,300
First Creek Phase 3	9,075	10 - 18	$ 2,167,300
Wilkerson Creek Phase 1	1,373	36	$ 1,115,400
Wilkerson Creek Phase 2	8,109	36	$ 6,542,300

Table 1-2. Collection System Ultimate Interceptor Expansion

Collection System Ultimate Interceptor Expansion	Length (LF)	Size (IN)	Total Cost[1,2,3]
Wilkerson Creek Phase 3	6,580	27 - 30	$ 4,315,700
Wilkerson Creek Phase 4	10,839	21	$ 4,628,800
Wilkerson Creek Tributary 1	1,638	8	$ 390,500
Wilkerson Creek Tributary 2	3,686	10	$ 1,092,700
Rocky Branch Segment 1	5,938	21	$ 2,539,100
TOTAL	**80,382**		**$ 34,295,500**

Notes

1. Includes complete installation of pipes, MHs, and other ancillary structure and surface restoration.

2. Includes 20% for survey, engineering, legal, & easements and 30% contingency.

3. Estimated cost in 2020 dollars.

2 Introduction

2.1 Background

The City of Smithville currently owns and operates the Smithville Wastewater Treatment Plant (WWTP) located west of State Highway 169 and north of Main Street. This plant was originally constructed in 1995 to replace an aging lagoon system. The treatment plant discharges treated wastewater to the Little Platte River, which ultimately flows to the Platte River.

The existing wastewater treatment plant is currently served by an extensive system of gravity sewers, force mains, and pump stations. There are currently two primary force mains that serve the City, the North Force Main and the South Force Main. The North Force Main conveys all flows generated north of the City's wastewater treatment plant, while the South Force Main performs the same function for the southern portion of the City.

The City recognized the need to improve the wastewater collection and conveyance system and the WWTP. HDR conducted this Master Plan for the City to analyze existing flow conditions of the current system, as well as projected future flow conditions within the City. This Master Plan contains recommended improvements to both the collection and conveyance system as well as the WWTP based on the results of the hydraulic analysis performed.

The WWTP operations are regulated by Missouri Department of Natural Resources (MDNR) and the United States Environmental Protection Agency (EPA) WWTP. The plant must meet the design and quality standards set by the MDNR and EPA. MDNR guidelines were used throughout the analysis.

2.2 Scope of Work

The City of Smithville contracted with HDR Engineering to perform the following tasks:

1. Data Collection and Evaluation
    - Determine current and estimated flow for WWTP and collection system.
    - Review available collection system mapping.
    - Review condition and capacity of each pump station with City staff.
    - GPS locate pump stations and record wetwell depths.

2. Collection System Capacity Evaluation Using Hydraulic Model
    - Summarize existing collection system.
    - Update hydraulic model based on pump station flow data.
    - Evaluate known sewer system backups.
    - Determine projected flow for ten-year and ultimate build-out conditions.
    - Evaluate model for ten-year and ultimate build-out flow.
    - Identify overloaded pipe segments.
    - Identify and prioritize system improvements and estimate costs.
    - Develop collection system maps based on existing information.

3. Wastewater Treatment Plant Evaluation
    - Conduct field visit.
    - Determine current average and peak treatment capacity for each process.
    - Develop improvement alternatives to meet current needs.
    - Develop improvement alternatives to meet future ten-year and ultimate demands.
    - Prioritize recommended improvements and provide estimates of probable costs.

4. Wastewater Master Plan Report
    - Summarize above tasks into a comprehensive Wastewater Master Plan in accordance with MDNR requirements.
    - Estimate probable costs for current ten-year and ultimate build-out improvements.

5. Meet with City and Finalize the Master Plan Report

6. Present Report to Board of Aldermen
    - This Wastewater Master Plan represents the summation of HDR’s analysis of the City of Smithville’s Collection System and Wastewater Treatment Plant.

3 Existing Conditions and Population & Wastewater Projections

3.1 Existing Conditions

The Smithville WWTP currently serves the entire City of Smithville, which currently consists of approximately 10,764 people according to the Population Projection Memorandum from the Comprehensive Plan developed by Stover & Associates, updated July 1, 2020. A map of the existing development in Smithville can be found Appendix A, Figure A-1 Existing Development – North and Figure A-2 Existing Development - South.

The WWTP is located in the center of the City. Flows from the central portion of the City are conveyed to the WWTP by gravity interceptors. The WWTP also receives flows from two primary force mains. The North Force Main conveys all flows generated north of the WWTP. The South Force Main conveys flow from the southern portion of the City into the newly constructed Second Creek Interceptor. These two force mains are fed from an extensive system of smaller gravity sewers, force mains, and pump stations. Maps of the existing infrastructure can be found in Appendix A;

- Figure A-3 Existing Infrastructure – North
- Figure A-4 Existing Infrastructure – South
- Figure A-5 Existing Development and Infrastructure – North
- Figure A-6 Existing Development and Infrastructure – South.

As the existing wastewater infrastructure ages, ongoing maintenance and repairs will be needed. A detailed review of pump stations is provided in Section 5, and an evaluation of the WWTP is provided in Section 7. Due to the existing issues and anticipated future development, the City recognized the need to plan improvements for the wastewater collection and conveyance system.

3.2 Defining Planning Periods

This Master Plan utilizes two planning periods, the ten-year condition and the ultimate build-out condition. Recommended improvements have been considered based upon their ability to meet and achieve compliance and reliability for these planning periods and beyond. As existing facilities and future phases reach design capacity, future improvements will allow the City to maintain a wastewater system that can adequately serve the City.

3.3 Land Use

Figure B-1 in Appendix B depicts the current zoning designations for all land parcels within the City limits. A meeting was held with City staff on May 20, 2020 to discuss projected developments within the City and determine an estimated timeline for anticipated development. Following the meeting, the projected development within the ten-year planning period was defined based on development predicted to occur within that timeline. All remaining projected development was assigned to the ultimate build out planning period, which assumes full build-out of undeveloped property within the City. Projected development for the ten-year and ultimate build-out planning periods is discussed in detail in Section 6.

3.4 Population Projection

Increased in wastewater flow is directly related to population growth and anticipated development. Based on historical data, the City's average population density is 2.7 persons/residence. Historical city growth can be correlated to the number of housing starts issued each year. Figure 3-1 summarizes the building permits issued for residential houses in Smithville for the last 20 years.

Figure 3-1. Housing Starts

Housing starts have fluctuated during this time period, but overall have averaged 89 per year. At an average of 2.7 persons/residence this equates to an increase of 240 persons/year. At this average, the ten-year projected residential growth rate would be 2,400 additional residents between 2020 and 2030. This growth rate was compared to recommendations from the Comprehensive Plan prepared by Stover & Associates, which projected a population growth of between 3,500 to 4,500 new residents between 2020 and 2030. For the purposes of this Master Plan, conservatively, it is assumed 4,500 new residents will be added in the ten-year wastewater analysis.

For the ultimate development planning period, it was assumed the entire City would continue to develop according to the current zoning, and areas where annexation is anticipated were included. Average single-family residential density was assumed to match closely with current conditions of 3 houses per acre. Based on these criteria, the total ultimate population is calculated to be approximately 78,000 people or nearly seven times the City's current population. This population was used to determine ultimate wastewater flow rates and size the future interceptor sewers. A breakdown of the anticipated growth is shown below in Table 3-1.

Table 3-1. Population Projections

Population Projections	Est. Population Growth	Cumulative Population
Estimated 2020 Population	-	10,764
0-10 Year Growth	4,472	15,236
Ultimate Growth (within current City Limits)	50,278	65,514
Ultimate Growth (outside current City Limits)	12,659	78,173

3.5 Wastewater Usage and Projections

The development of a hydraulic model required the current wastewater usage for the City as well as projections of the City's future wastewater usage. To date, no flow metering has been performed on the existing sanitary system. In the absence of flow metering data, flow calculation methods were used to determine the flows within the collection system. If flow metering is performed in the future, it is recommended that the hydraulic model calibrated based on this additional data.

Future flow projections were made based on expected growth within Smithville. The population and land use were projected as described in Section 3. This information was used to determine the type of development that would occur for specified land plots, as well as the time period for the expected development.

The ten-year and ultimate planning periods assume all specified land will be developed and the flows will be conveyed to the WWTP. The City of Smithville does not specify which design standards should be followed, therefore flows from these areas of future development were calculated using MDNR as well as APWA KC Metro design criteria. The MDNR flow calculation method was selected as it is more reflective of the historical development of Smithville. Flows for the two major types of development in Smithville, residential and commercial or industrial, were calculated using the methods below.

Residential Flow Projection

For residential areas, flow can be calculated based directly on population. In the absence of distinct population data, it was assumed that each residence will have an average of 2.7 people. From historical water usage, it is assumed that each person uses 100 gallons of water per day. Some residential parcels have already been preliminarily plotted with estimated lots by the City (see Appendix B). For land with estimated lots, the number of houses is known. For land where the number of residences is not specified, it is assumed that three houses per acre will be built for residential development.

The average future flow of residential areas is calculated using Equation 1 below:

(1) $$Flow\left(\frac{gal}{day}\right) = \#\ of\ Residences \times \frac{2.7\ People}{Residence} \times \frac{100\,\frac{gal}{day}}{Person}$$

Average flow describes the amount of wastewater that is generated in an area on average, but this is not typically used for design purposes. This is because wastewater flows are not generally constant throughout the day, but instead peak during specific times of the day based on usage following a diurnal pattern. This peak flow is generally the flow that should be used in a capacity analysis, as it describes the peak flow that could be generated in an area at a specific time. Peak flow is found by multiplying the average flow by a peak flow factor.

The Peak flow factor for residential areas is calculated using the MNDR calculation shown in Equation 2 below:

(2) $$Peak\ Factor = \frac{18+\sqrt{\frac{Population}{1000}}}{4+\sqrt{\frac{Population}{1000}}}$$

Commercial and/or Industrial Flow Projection

For commercial or industrial areas, flow is calculated based on amount of floor space. The MDNR flow calculation assumes 200 gallons of wastewater is generated per 1000 square feet of floor area. For parcels designated as commercial or industrial, it is assumed that the floor space will be 20% of the acreage. Therefore, this equation can be simplified as a function of acreage.

The average future flow of commercial or industrial areas is calculated using Equation 3 below:

(3) $$Flow\left(\frac{gal}{day}\right) = \#\ of\ acres * \frac{43560\ sqft}{1\ acre} * \frac{200\ gal}{1000\ sqft} * 0.20$$

The Peak flow factor for commercial or industrial areas is assumed to be 1.5.

Average and peak flows rates were projected for the ten-year and ultimate build-out conditions. Calculated peak flow rates were calculated for each pump station within the City. Table E-1 in Appendix E lists all calculated peak flows.

4 Collection and Conveyance System Capacity Evaluation

The City of Smithville is served by a combination of wastewater collection, conveyance, and a treatment system. The City owns and operates the collection system that collects wastewater from the majority of property owners. The wastewater is conveyed by a network of collection lines, pump stations, force mains, and interceptors to the City's Wastewater Treatment Plant.

4.1 Existing Collection and Conveyance System

As presented earlier, Figures A-3 and A-4 in Appendix A identify the major existing conveyance system components that currently serve the City of Smithville. Flows from the central portion of the City are conveyed to the WWTP by gravity interceptors. The WWTP also receives flows from an extensive collection and conveyance system serving the rest of the City. The majority of this system is comprised of pump stations and force mains, which will soon reach capacity with the continued addition of new connections. The North Force Main conveys all flows generated north of the City's WWTP. The South Force Main conveys flow from the southern portion of the City into the newly constructed Second Creek Interceptor. The flows from these force mains are directed to the WWTP where the water is treated and discharged to the Little Platte River.

4.2 Collection and Conveyance System Planning

In order to determine efficient solutions and improvements necessary within the existing system, collection and conveyance system planning is used. Collection and conveyance system planning is based upon projected land use and wastewater flow rates generated by these land uses. The peak flow rates, experienced during wet weather storm events, are the most critical for pipe line sizing since the major purpose of the sewer network is to collect and convey wastewater from its sources to the location of storage and/or treatment facilities without causing overflows and sewer backups.

Pressurized collection and conveyance systems are designed to convey wastewater flow with full pipes. When the velocity of the wastewater within the pipes exceeds 7.5 feet per second (fps), it is assumed the system is over capacity.

Gravity collection and conveyance systems are designed to convey wastewater by gravity flow with no more than a full pipe. When the wastewater flow rate exceeds the full-pipe capacity of the system, the system becomes surcharged and the wastewater level builds up in the manholes to a level above the top of the pipe.

Wastewater systems normally have the ability, due primarily to the pipeline's depth, to withstand low to moderate surcharging. However, at some point, excessive surcharging of wastewater collection and conveyance systems may cause the back up of wastewater into residences and/or businesses connected to the system. Also, excessive surcharging may cause the wastewater to surcharge to a level at or above the tops of manholes and overflow into adjacent drainage courses.

Hydraulic modeling of the pressurized collection system was developed to determine which portions of the system are nearing capacity or are over capacity.

4.3 System Modeling

In order to plan for future improvements, it is necessary to model the current system under present conditions as well as modeling the system with future improvements and projected flows. The existing models for the North and South Force Mains were reviewed and updated based upon available current information and pump station flow data.

4.3.1 Hydraulic Modeling

A sanitary system model was created in InfoWorks ICM (ICM). While previous sanitary system models of the City have been created in SewerCAD, ICM provides tools that more accurately depict system conditions within the pump stations and force mains. Pertinent information regarding pumps feeding directly to force main were taken from the existing SewerCAD models and input into the new ICM model. Survey information was gathered from every pump station operated by the City. This information was also incorporated into the ICM model.

This model was used to run flows under existing and ultimate build-out conditions to accomplish the following:

- Identify overloaded sections of pipe.
- Assess the impacts of growth on the existing facilities.
- Evaluate the impact of the development of currently undeveloped land on the existing infrastructure.
- Predict the size of proposed facilities that will be constructed in the future to serve the ultimate growth conditions.

1. Development of Existing System

A geographic information system (GIS) map of the existing system was created to display the current system layout.

Survey data was collected by HDR for the majority of the pump stations operated by the City. Attributes collected during the survey include: position, elevation, pipe diameters, invert elevations, structure details, etc. This survey data is included in the GIS map.

Additionally, information from construction plans of subdivision development were collected for use in the GIS map. Attributes collected from this data include: piping locations, piping diameter, piping material, manhole layout, manhole elevations, etc. This is the most accurate information available to HDR, but it should be noted that the information provided in construction plans may not always reflect changes made during construction. Alignments may shift, manholes may be added or removed, or elevations may change during construction. Additionally, some of the information was lacking elevations, was unreadable, and/or used varying elevation datums. It is recommended that the City implement a plan to inventory their existing wastewater collection system to continue to refine and update the GIS mapping.

Supplementary information regarding outdated or missing data was provided by the WWTP staff. This includes knowledge concerning piping configuration improvements, pipe diameters, pipe material, etc. This information was also included within the GIS map.

2. Modeling Assumptions

In order to representatively depict the existing system, which includes private pump stations and multiple daisy chained pump stations, while also creating a stable model, the following assumptions were made:

- Small, private pump stations were not included in the model. The impact these private pump stations have on the overall force main is minimal or negligible.
- Any pump stations feeding into gravity lines were modeled as simple manholes. The average flow and peak flow were applied to these nodes. This configuration will simulate the daisy chain effect that is occurring within the system.
- No flow metering data is available for the City of Smithville. In order to simulate flows within the model, a unit hydrograph was created for each pump. The unit hydrograph assumes peak flow is reached at one hour. The tail of the hydrograph is 12 hours from peak flow to zero flow. Unit hydrographs used in the model can be found in Appendix E.
- As is discussed in Section 3.5, peak flow is calculated using the count of houses contributing to each pump. It was assumed that there are 2.7 people per house and each person uses 100 gallons per day. The MDNR peaking factor, which is generally around 4, is applied to each pump station's calculated flow.
- Dry weather flow is assumed to be factored into each calculation of peak flow. As the model was developed to determine system capacity, models were only run with peak flow hydrographs.

4.3.2 Modeled Scenarios

Multiple scenarios were modeled in order to develop system improvement recommendations for the ten-year and ultimate build-out plans. The following scenarios were modeled in InfoWorks ICM:

- Existing system serving current development.
- Existing system with planned development of Eagle Heights and Wildflower Pump improvements.
- Existing system serving projected ten-year development.
- Proposed ten-year improvements with projected ten-year development.
- Proposed ultimate improvements with projected ultimate build-out.

4.3.3 Model Results

Each modeled scenario was analyzed to determine any areas of the system that were over capacity. Force mains are generally considered to be over capacity when the velocity within the pipe exceeds 7.5 fps. While this was the standard used in the analysis, there are also areas within the system that have steep slopes. In this model, if one segment is showing as reaching over 7.5 fps on a segment with a slope larger than 10%, it was concluded that the pipe was not over capacity, but instead seeing high velocities due to the slope of the pipe.

Flows within pumps were graphed over time to determine if the pump is sized correctly. Flow graphs that show the pump running a few times during the simulation indicate a pump or wet well might be oversized. Flow graphs that show the pump never turning off, or returning to zero flow, indicate an undersized pump or wet well.

Within the ultimate scenario, the gravity interceptor sizes were hand calculated using the projected peak flows. The model was used as a check of these hand calculations. The results of all modeled scenarios can be found in Appendix E.

As detailed in 4.4.1.2, many assumptions had to be made in order to develop a comprehensive wastewater system model. Most importantly, significant assumptions were made regarding projected flows within the system. It is important to note that the results of the modeled scenarios should be used as a guide for planning future wastewater projects, but further detailed design is required.

1. Existing System Serving Current Development

The results of the existing system model utilizing current sanitary flows is shown via profiles of the system during peak flows, pump performance tables displaying flow versus time, and an overall figure with pipes functioning overcapacity highlighted in red. All results can be found in Appendix E.

In the north, the modeled system near Harbor Lakes shows velocities over 7.5 fps. Further investigation into this area shows the implementation of the planned improvements at Wildflower pump station will alleviate these capacity issues in the northern reach of the force main.

The segments near Greyhawke 1 showing flows higher than 7.5 fps are due to high slopes. The modeled system where the flows from the Greyhawke subdivision connect into the force main is showing flows higher than 7.5 fps. Due to this modeled result and projected development in the north, it was decided that improvements need to be made to the force main downstream of Greyhawke. The solution that aligns with the City's goal to eliminate force main and install gravity would be to install a gravity line in place of the force main from the WWTP to the Greyhawke connection. Section 6.2 details these recommended improvements.

2. Existing System with Planned Eagle Heights and Wildflower Improvements

The City is currently in the process of improving the Wildflower pump station. With these improvements incorporated into the Existing System model, it was determined that the Wildflower pump station will be adequately sized to handle the projected development of the Eagle Heights subdivision while alleviating capacity issues upstream. Section 6.2.2 details the proposed ten-year improvements in North Smithville.

3. Existing System Serving Projected Ten-year Development

The existing system was modeled with the projected ten-year development. The results of this model helped to determine and underscore the recommended improvements for the ten-year planning period. The complete discussion of recommended improvements for the ten-year planning period is located in section 6.2.

4. Proposed Ten-year Improvements with Projected Ten-year Development

The projected ten-year development indicated the need for two new pump stations to serve additional development. These were titled the "Davenport Farms" pump station and the "Diamond Crest West" pump station in the model. The addition of these pump stations increases the load on the north force main.

The model results for the proposed ten-year improvements model indicate the north force main is on the cusp of reaching capacity downstream of the Wildflower pump station. The velocities seen near the Wildflower pump station are very close to 7.5 fps. While the system is not being shown in the model as vastly over capacity, it does indicate a need to begin implementing the phased approach of the ultimate build out recommendations after the projected ten-year development occurs.

5. Proposed Ultimate Improvements with Projected Ultimate Build-Out

The model developed to analyze the proposed ultimate improvements for the projected build-out is slightly different than the other analyzed models. In order to obtain the City’s goal of removing pump stations and force main and replacing these with gravity interceptors, many more of the pipes in the ultimate improvements model are gravity. The capacity of gravity pipes is determined by the amount of surcharge occurring in the system.

As is discussed in section 4.3.1.1, gravity interceptors were initially sized by hand calculations. The pipe sizes determined based upon these calculations were then analyzed within the model. There were no instances of gravity interceptors surcharging in the model results.

The transition from force main to gravity interceptor will need to occur in phases as funding becomes available. The recommended phasing is discussed in section 6.3 detailing proposed ultimate improvements. These interceptors should be used as a guide in planning future wastewater projects, but further detailed design is required.

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5 Pump Stations Evaluation

The City of Smithville currently owns and operates 29 wastewater pump stations. The majority of these stations connect to and convey wastewater flow through one of two common force mains, the north and south. The capacities of these pump stations and common force mains are frequently the limiting factors in allowing development to occur within the City of Smithville.

The existing pump stations were reviewed in order to identify improvements necessary to serve the projected future growth within the City.

5.1 Pump Station Analysis

Due to past City development patterns, the majority of subdivision flows are conveyed by pump stations. Twenty-nine (29) pump stations are currently owned and operated by the City.

Pump station capacity was analyzed as part of the hydraulic analysis for future build-out conditions. Pump stations must be able to adequately serve the projected future flows that will be required of the collection and conveyance system. This analysis includes improvements to existing pump station capacity as well as constructing new pump stations to introduce to the system as additional development requires.

The City has a goal to reduce the number of pump stations within the collection system, as well as limit the number of future pump stations needed to serve growth. The City currently has plans to update the Wildflower pump station, to allow for increased capacity to serve the Eagle Heights subdivision that will be developed directly south. The land acquisition process to acquire the property for South Booster has begun, and design is in progress. Studies have been conducted regarding sizing the proposed Greyhawke 3 pump station. Two other pump stations are proposed within the next ten years to accommodate development in north Smithville. Ultimately, it is proposed that 7 pump stations be decommissioned in the south Smithville and 2 pump stations decommissioned in north Smithville. Figures A-3 and A-4 in Appendix A depict the location of all of the City's existing pump stations. Table 5-1 below summarizes all of the City's active pump stations and their firm capacities.

Table 5-1. Active Pump Station Summary

Pump Station Name	No. of Pumps	Station Firm Capacity (GPM)
Harbor Lakes	2	390
Diamond Crest	2	340
Wildflower	2	155
Rock Creek	2	175
Rollins Landing	2	200
Greyhawke 1	2	150
Greyhawke 2	2	90
180th Street	2	*
Lakeview Drive	2	155
Bridgeport	2	66
Big Harborview	2	375
Smith's Fork	2	30
Cub Cadet	2	*
Bridge Street	2	500
Stone Creek Villas	2	30
Cedar Lakes 1	2	275
Cedar Lakes 2	2	180
Strawberry Hill	2	*
Quail Ridge	2	175
Harbortowne	2	*
Daycare	2	100
Stone Bridge	2	*
Ashmont	2	100
Diversified Metal	2	57
McDonalds	2	250
Platte Valley	2	100
Hills of Shannon	2	300
Gerber Collision	2	30
Woods Court	2	105

*Insufficient Data

An evaluation was completed of the operation of the existing pump stations. The City currently monitors the majority of the pump stations through Mission Communications SCADA system (Mission). Pump Station run data was obtained from the City from

January 2018 through July 2020. A comparison of the average daily flows and the peak daily flows is contained in Table 5-2 below.

Table 5-2. Pump Station Average to Peak Flow Comparison Summary

Pump Station Name	Pump Station Average Daily Flows (gpm)	Pump Station Peak Daily Flows (gpm)	Average Flow to Peak Flow Factor
Harbor Lakes	111	780	7.0
Diamond Crest	71	543	7.6
Wildflower	24	287	12.0
Rock Creek	1	11	11.0
Rollins Landing	55	200	3.6
Greyhawke 1	5	21	4.2
Greyhawke 2	7	19	2.7
180th Street	*	*	*
Lakeview Drive	20	459	23.0
Bridgeport	*	*	*
Big Harborview	42	711	17.0
Smith's Fork	*	*	*
Cub Cadet	*	*	*
Bridge Street	163	1000	6.1
Stone Creek Villas	1	9	9.0
Cedar Lakes 1	26	825	31.7
Cedar Lakes 2	*	*	*
Strawberry Hill	*	*	*
Quail Ridge	5	17	3.4
Harbortowne	*	*	*
Daycare	25	200	8.0
Stone Bridge	*	*	*
Ashmont	6	28	4.7
Diversified Metal	*	*	*
McDonalds	19	340	17.9
Platte Valley	6	150	25.0
Hills of Shannon	32	594	18.6
Gerber Collision	2	4	2.0
Woods Court	12	271	22.6

Note: *No data available.

5.2 Pump Station Summary

Each pump station requires frequent inspection and maintenance by City staff to ensure they are operating as intended. In addition, there are periodic operational and rehabilitation expenses required to keep them in good working order. Pump stations conditions were evaluated with City staff on May 12, 2020 to aid in projecting future improvement needs. A summary of each pump station is contained below. Additionally, HDR and City staff performed a capacity assessment using draw-down tests on five of these pump stations: Campground, Bridge Street, McDonalds, Wildflower, and Harbor Lakes. The summary of these drawdown tests can be found in Appendix F.

Harbor Lakes – Harbor Lakes is a duplex submersible pump station that was built in approximately 2005. The pump station has a firm capacity of 390 GPM and still has the original pumps. The station does not have a dedicated access road, but is located near a paved walking trail that can be used for vehicle access if needed. There is no site lighting and the fencing should be updated. The controls are difficult for City staff to work on and it is recommended they be updated. This pump station is shown in Figure 5-1 below.

Figure 5-1. Harbor Lakes Pump Station

Diamond Crest – Diamond Crest is a duplex above-ground pump station with self-priming Gorman-Rupp pumps which has a firm capacity of 340 GPM. Pump No. 1 received a new motor in the fall of 2018. This pump station is nearing its practical capacity as it serves multiple developing subdivisions including Lake Meadows North and Clay Creek. City staff cannot easily access the easement from Lake Meadows to Diamond Crest Pump Station due to a low-lying, wet area. This pump station is shown in Figure 5-2 below.

Figure 5-2. Diamond Crest Pump Station

Wildflower – Wildflower is a duplex above-ground pump station with self-priming Gorman Rupp pumps and a firm capacity of 155 GPM. Both pumps received new motors in the fall of 2015. This pump station is nearing its practical capacity as Eagle Ridge subdivision continues to develop. The current wetwell detention at this pump station is a horizontal 36 IN pipe that is approximately 50 FT long. This is inadequate volume during high rain events which causes overflows. There is no access road to the pump station for vehicle access, or fence for protection. The City is in the process of upgrading this pump station to be in accordance with the City standards. This pump station is shown in Figure 5-3 below.

Figure 5-3. Wildflower Pump Station

Rock Creek – Rock Creek is a duplex above-ground self-priming pump station. The firm capacity of the pump station is 175 GPM. It is of newer construction and still contains its original components. The area it serves is not fully built out and the pump station has not reached its capacity.There is no fence for protection. This pump station is shown in Figure 5-4 below.

Figure 5-4. Rock Creek Pump Station

Rollins Landing – Rollins Landing is a duplex above-ground pump station with self-priming Gorman-Rupp pumps and a firm capacity of 200 GPM. The motor for Pump No. 1 was replaced in the summer of 2019. This pump station accumulates grease and must be treated by City staff. The source of grease is most likely the flows that are conveyed from the golf course. This pump station is lacking a fence for protection. The dirt access road becomes problematic during rain events, and should be upgraded. This pump station is shown in Figure 5-5 below.

Figure 5-5. Rollins Landing Pump Station

Greyhawke 1 – Greyhawke 1 is a duplex above-ground pump station that was constructed in approximately 2008. The station has a firm capacity of of 150 GPM. The original Gorman-Rupp pumps have been replaced with self-priming Ebara pumps. Pump No. 1 was replaced in 2015 and Pump No. 2 was replaced in 2018. This is the only pump station with a generator, but it is repeatedly impaired. The access road is steep and has become washed out, and should be upgraded. This pump station is shown in Figure 5-6 below.

Figure 5-6. Greyhawke 1 Pump Station

Greyhawke 2 – Greyhawke 2 is a duplex submersible pump station with a firm capacity of 90 GPM. The pumps are original. The transducers that were installed caused issues with the controls and have been replaced with floats. The City has replaced the rails and piping at this pump station. This pump station is lacking an access road altogether and one should be constructed. This pump station is shown in Figure 5-7 below.

Figure 5-7. Greyhawke 2 Pump Station

180th St. (or F-Highway) – 180th Street is a duplex submersible pump station located adjacent to the Harborview Subdivision. Both pumps were replaced in late 2017. It has newer pumps, adequate controls, and suitable wetwell retention. There is no fence for protection and the access road is in need of upgrades, specifically a drain culvert. This pump station is shown in Figure 5-8 below.

Figure 5-8. 180th Street Pump Station

Lakeview Drive – Lakeview Drive is a duplex above-ground self-priming pump station with a firm capacity of 155 GPM. It has a large wetwell detention and a concrete access road. The wooden fencing has degraded and should be upgraded. This pump station is shown in Figure 5-9 below.

Figure 5-9. Lakeview Drive Pump Station

Bridgeport – Bridgeport is a duplex submersible pump station constructed in approximately 2002. The pump station has a firm capacity of 66 GPM. It still has the original pumps. This pump station could be affected by the future round-about that will be constructed at its current location. The controls are difficult for City staff to work on and should be updated. The wooden fencing has degraded and should be upgraded. There is no access road. This pump station is not currently monitored through the Mission Communications SCADA system (Mission), but the City plans to incorporate it in the near future. This pump station is shown in Figure 5-10 below.

Figure 5-10. Bridgeport Pump Station

Big Harborview – Big Harborview is a duplex above-ground self-priming pump station with a firm capacity of 375 GPM. This pump station serves the Clay County Park restrooms and the beach on the north side of Smithville Lake. There is a large detention basin with sufficient holding capacity. The fencing should be upgraded and access road has previously been rebuilt. This pump station is shown in Figure 5-11 below.

Figure 5-11. Big Harborview Pump Station

Smith's Fork – Smith's Fork is a duplex submersible pump station located at the Smith Fork Park Campground with Hydromatic pumps. Pump No. 1 was replaced in 2019 and Pump No. 2 was replaced in 2018. In addition to serving the campground, multiple subdivisions, including Strawberry Hill, Quail Ridge, and Harbortowne, drain to this pump station. The pump station runs steadily due to the influent flows and limited pump capacity. It is currently located in a flood zone and should be re-located. Additionally, the City has concerns about the condition of the 3-inch diameter force main that runs under the Little Platte as there have been at least three known breaks. The City is in the process of upgrading this pump station. This pump station is shown in Figure 5-12 below.

Figure 5-12. Smith's Fork Pump Station

<u>Cub Cadet</u> – Cub Cadet is a duplex submersible pump station. It serves a small area collecting flow from three bathrooms. The City has replaced the pumps and the controls for this pump station. This pump station is shown in Figure 5-13 below.

Figure 5-13. Cub Cadet Pump Station

<u>Bridge Street</u> – Bridge Street is a duplex submersible pump station with Pentair pumps and a firm capacity of 500 GPM. Pump No. 2 was replaced in 2017. It was recently updated to pump to a gravity system in lieu of the forcemain, and has been performing better since this change. This is the second largest centralized pump station, and should be given priority for adding a generator. The wooden fencing has degraded and should be upgraded. The electrical service power pole and panel should be upgraded. One of the hatches is broken and should be replaced. This pump station is shown in Figure 5-14 below.

Figure 5-14. Bridge Street Pump Station

Stone Creek Villas – Stone Creek Villas is a duplex submersible pump station with a firm capacity of 30 GPM. This pump station is located directly next to private property, and there is no room for a fence. The pumps are newer, but there are some electrical wiring issues including a seal pad contact that shows inaccurate readings on Mission. The access road to this pump station is not paved, and should be upgraded. This pump station is shown in Figure 5-15 below.

Figure 5-15. Stone Creek Villas Pump Station

Cedar Lakes 1 – Cedar Lakes 1 is a duplex submersible pump station with a firm capacity of 275 GPM. The pumps and control panel are newer. This pump station is located in a private park. There is no fence for protection and no direct access road. If needed, a vehicle can access the pump station by driving through the park, but this is not preferable. This pump station is shown in Figure 5-16 below.

Figure 5-16. Cedar Lakes 1 Pump Station

Cedar Lakes 2 – Cedar Lakes 2 is a duplex above-ground self-priming pump station with a firm capacity of 180 GPM. The original pumps were replaced approximately 15-20 years ago. This pump station is not currently monitored through Mission Communication SCADA system. There is no fence for protection and the access road has been washed out. A drain culvert was added to the access road, but it was washed out during a rain event. This access road is in need of repair for continued vehicle access. This pump station is shown in Figure 5-17 below.

Figure 5-17. Cedar Lakes 2 Pump Station

Strawberry Hill – Strawberry Hill is a duplex above-ground self-priming pump station built in approximately 2005. There is no fence for protection and the gravel on the access road stops short of the pump station. This pump station is shown in Figure 5-18 below.

Figure 5-18. Strawberry Hill Pump Station

Quail Ridge – Quail Ridge is a duplex above-ground self-priming pump station with a firm capacity of 175 GPM built in 2017 and in compliance with the applicable standards. The access road is usable, but should be upgraded with a culvert and additional gravel. There is corrosion at this pump station as well as the force main, most likely due to a buildup of Hydrogen Sulfide (H_2S). This could be due to the long detention time in the force main. This pump station is shown in Figure 5-19 below.

Figure 5-19. Quail Ridge Pump Station

Harbortowne – Harbortowne is a duplex submersible pump station with ½ HP pumps and a 25 FT deep wetwell. There is no fence for protection and insufficient electrical work. The access road runs through a creek crossing, and should be upgraded. The water level in the creek raises significantly during rain events, making the pump station inaccessible to City staff. This pump station is shown in Figure 5-20 below.

Figure 5-20. Harbortowne Pump Station

Daycare – Daycare is a duplex submersible pump station with a firm capacity of 100 GPM. The control panel is newer, and there is a broken private service line. This pump station is nearing capacity and should be evaluated as the facilities that it serves continue to grow. There is no permanent surrounding fence for protection. This pump station is shown in Figure 5-21 below.

Figure 5-21. Daycare Pump Station

Stone Bridge – Stone Bridge is a duplex submersible pump station. This pump station pumps to the Daycare Pump Station. The control panel has been upgraded, but the pump station is lacking a fence for protection. Grease is an ongoing issue with this pump station and requires regular maintenance from City staff. This pump station is shown in Figure 5-22 below.

Figure 5-22. Stone Bridge Pump Station

<u>Ashmont</u> – Ashmont is a duplex submersible pump station that was installed in approximately 2007. The pump station has a firm capacity of 100 GPM. Both pumps were replaced in 2018. The fence and paved access road are suitable for City staff. Grease is an ongoing issue with this pump station and requires regular maintenance from City staff. This pump station is shown in Figure 5-23 below.

Figure 5-23. Ashmont Pump Station

<u>Diversified Metal</u> – Diversified Metal is a duplex submersible pump station with a firm capacity of 57 GPM. This pump station only serves one (1) building, and City staff feels responsibility for maintenance should fall to Owner instead of City. This pump station will be decommissioned with the construction of the South Booster Pump Station and associated gravity piping. This pump station is shown in Figure 5-24 below.

Figure 5-24. Diversified Metal Pump Station

<u>McDonalds</u> – McDonalds is a duplex submersible pump station with Hydromatic pumps and a firm capacity of 250 GPM. The City replaced Pump No. 1 in 2019 and Pump No. 2 in 2017. The station is located adjacent to 169 Highway, and there is no fence for protection. The old galvanized piping in this pump station needs upgraded. This pump station will be decommissioned with the construction of the South Booster Pump Station and associated gravity piping. This pump station is shown in Figure 5-25 below.

Figure 5-25. McDonalds Pump Station

<u>Platte Valley</u> – Platte Valley is a duplex submersible pump station with a firm capacity of 100 GPM. The pumps were replaced in 2006 and the control panel was replaced in 2013. This pump station will be decommissioned with the construction of the South Booster Pump Station and associated gravity piping. This pump station is shown in Figure 5-26 below.

Figure 5-26. Platte Valley Pump Station

Hills of Shannon – Hills of Shannon is a duplex above-ground self-priming pump station with a firm capacity of 300 GPM. This pump station will be decommissioned with the construction of the South Booster Pump Station located on 144th Street. This pump station is shown in Figure 5-27 below.

Figure 5-27. Hills of Shannon Pump Station

Gerber Collision – Gerber Collision is a duplex submersible pump station with a firm capacity of 30 GPM. It serves two building and has few issues. This pump station is shown in Figure 5-28 below.

Figure 5-28. Gerber Collision Pump Station

<u>Woods Court</u> – Woods Court is a duplex submersible pump station with a firm capacity of 105 GPM. It has an upgraded control panel and a large wetwell. There are occasional issues with this pump station on the weekends, but it rarely goes high. This pump station is shown in Figure 5-29 below.

Figure 5-29. Woods Court Pump Station

The required maintenance needs for each pump station is summarized in Tables 5-3 and 5-4 below.

Table 5-3. Condition Assessment Summary - North System

Pump Station Name	Rehabilitation	Estimated Cost[5]
Harbor Lakes	Controls, Fencing, Site Lighting	$17,000
Diamond Crest	Access Road	$10,000
Wildflower	Capacity	[1]
Rock Creek	Fencing	$5,000
Rollins Landing	Access Road, Fencing	$15,000
Greyhawke 1	Access Road	$10,000
Greyhawke 2	Access Road	$10,000
180th Street	Access Road, Fencing	$15,000
Lakeview Drive	Fencing	$5,000
Bridgeport	Controls, Access Road, Fencing	$25,000
Big Harborview	Fencing	$5,000
Smith's Fork	Located in Floodplain	[1]
Cub Cadet		[2]
Bridge Street	Structural, Fencing	$10,000
Subtotal		**$127,000**
Contingency	*25%*	*$31,750*
Total		**$158,800**

Notes:
[1] Pump station will be replaced
[2] Decommissioned with Phase I improvements
[3] Decommissioned with Phase II improvements
[4] No rehabilitation identified
[5] Estimated cost in 2020 dollars.

Table 5-4. Condition Assessment Summary - South System

Pump Station Name	Rehabilitation	Estimated Cost[5]
Stone Creek Villas	Controls, Access Road	$20,000
Cedar Lakes 1	Access Road, Fencing	$15,000
Cedar Lakes 2	Pump Replacement, Access Road, Fencing	$45,000
Strawberry Hill	Access Road, Fencing	$15,000
Quail Ridge	Access Road	$10,000
Harbortowne	Access Road, Fencing	$30,000
Daycare	Fencing	$5,000
Stone Bridge	Fencing	$5,000
Ashmont		[4]
Diversified Metal		[2]
McDonalds		[2]
Platte Valley		[2]
Hills of Shannon		[2]
Gerber Collision		[4]
Woods Court	Fencing	$5,000
Subtotal		**$150,000**
`Contingency	*25%*	*$37,500*
Total		**$187,500**

Notes:
[1] Pump station will be replaced
[2] Decommissioned with Phase I improvements
[3] Decommissioned with Phase II improvements
[4] No rehabilitation identified
[5] Estimated cost in 2020 dollars.

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6 Improvement Recommendations

Utilizing the results of the hydraulic modeling of the collection system along with the results of the pump station evaluation, improvement alternatives for the ten-year and ultimate growth conditions were developed. The improvement alternatives prioritize areas within the collection system where future development is anticipated or the hydraulic model indicates significant surcharging.

6.1 Developing Recommendations

A long-term goal of the City of Smithville is to more efficiently serve the community's wastewater collection needs and provide additional capacity to facilitate growth opportunities. The most efficient method to convey wastewater is through the strategic implementation of gravity sewers to serve the north and south portions of the City. These interceptors are long term solutions that should be constructed in phases as growth and development are proposed. Three interceptor sewers are recommended for the ultimate build-out of the City based on the watersheds, shown below in Figure 6-1. These interceptors should be used as a guide in planning future wastewater projects, but further detailed design is required.

- Owens Branch Interceptor to serve the area north of the Little Platte River.
- First Creek Interceptor to serve the City south of Hwy 93 and west of Hwy 169.
- Wilkerson Branch Interceptor to serve the area south of the Little Platte River and east of Hwy 169.

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WATERSHED LIMITS
CITY OF SMITHVILLE, MISSOURI
FIGURE 6-1

6.1.1 Interceptor Sizing

The future gravity interceptors shown in Figure 6-1 were sized using ultimate peak flow conditions. The ultimate peak flow condition utilizes the peak flows calculated for all projected development and distributes flows utilizing the watershed boundaries (See Equations 1-3). A summary of the factors used to determine the ultimate peak flow for each interceptor segment can be found in Appendix D.

Once the design flow through the pipe was determined, the approximate slope of the segment was estimated using terrain elevations from Google Earth. It was assumed that the interceptor will be buried uniformly approximately 10-15 feet below the surface, with exceptions for river or highway crossings. Manning's equation was evaluated with these slopes to determine the flow capacity of a variety of pipe sizes, and the appropriate size was selected to convey the ultimate peak flow.

6.2 Proposed Ten-year Planning Period Improvements

6.2.1 North Smithville

1. Recent and Ongoing Improvements

The Smith's Fork pump station located at Smith's Fork Campground is nearing the design capacity and is located in a low-lying area prone to flooding. The City is in the process of upgrading this pump station to improve its performance and bring it up to City standards. Construction of a new pump station is scheduled for 2021 pending approval from the Corps of Engineers.

2. Additional Improvements

The North Force Main is the portion of the wastewater conveyance system with the least available capacity. The system has the capacity to convey flows from the current residential developments as well as a limited amount of anticipated future growth. Updates and improvements to the system will need to be made if the City develops as is predicted within the next ten years. Hydraulic modeling of the system indicates the remaining capacity in the existing North Force Main is as follows in Table 6-1 and shown in the attached Figure E-1.

Table 6-1. North Smithville Short Term Development Capacity

NORTH SMITHVILLE SHORT TERM DEVELOPMENT CAPACITY	Single Family Houses	Estimated Additional Population
Additional Development Capacity (no system improvements)	265	716
Additional Development Capacity with Wildflower Pump Station improvements (Eagle Heights development responsibility)	320	864
Total Existing North Force Main Capacity	**585**	**1,580**

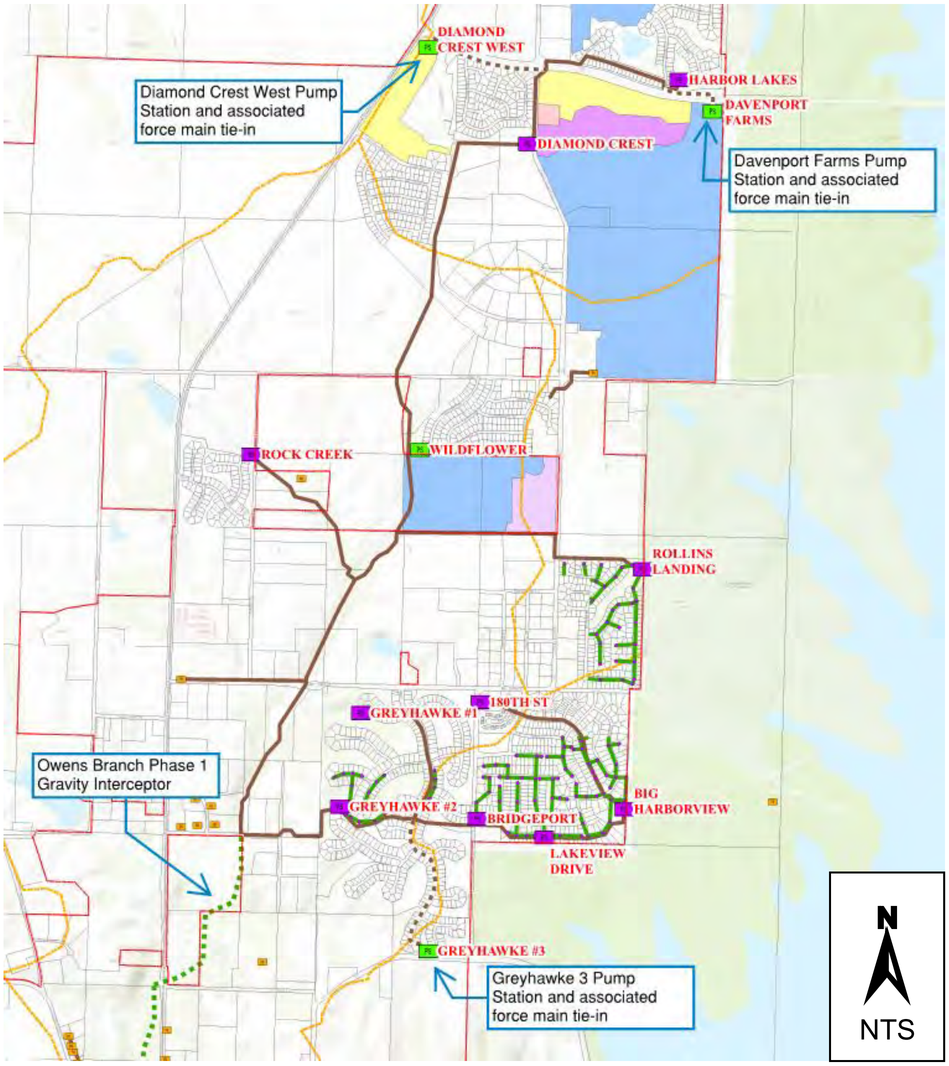
The available capacity of the North Force Main will accommodate a population increase of 1,580 or approximately 33% of the anticipated ten-year citywide population growth of 4,500. Assuming half of all growth occurs in the north portion of the City, the North Force Main is estimated to have available capacity for approximately 7 years. The City should begin to plan for future capacity upgrades in the next two to three years to allow time for design, easement acquisition, and construction before capacity of the existing system is reached.

Portions of Davenport Farms and the land north of Diamond Crest and west of Hwy 169 are anticipated to be developed within the next ten years. These areas fall in separate watersheds, therefore gravity tributaries are not possible and pump stations will be required to convey flow to the North Force Main. The model includes these future pump stations as “Davenport Farms” and “Diamond Crest West”.

A third proposed pump station will be named “Greyhawke 3”. The location and need for this pump station is known by the City. Investigations into the required size and capacity of this pump station have previously been completed by the developer.

In order to update the existing system to handle increasing flows, it is recommended that a portion of the Owens Branch Gravity Interceptor from the WWTP to Hillcrest Drive be constructed within ten years. The construction of this portion of the interceptor will reduce the operating pressure and increase overall capacity within the remaining North Force Main.

Figure 6-2. North Smithville Ten-year Improvements



Appendix A contains the following maps showing anticipated development and recommended infrastructure improvements:

- Figure A-7 Ten-year Development – North
- Figure A-8 Ten-year Infrastructure – North
- Figure A-9 Ten-year Development and Infrastructure – North

Table 6-2. Owens Branch Interceptor – Phase 1 Total Cost

OWENS BRANCH INTERCEPTOR - PHASE 1 TOTAL COST	Pipe Length (Ft.)	Pipe Size (In.)	Total Cost[1,2,3]
Owens Branch - Phase 1	9,157	30	$6,517,000

Notes:

1. Includes complete installation of pipes, MHs, and other ancillary structure and surface restoration

Table 6-2. Owens Branch Interceptor – Phase 1 Total Cost

OWENS BRANCH INTERCEPTOR - PHASE 1 TOTAL COST	Pipe Length (Ft.)	Pipe Size (In.)	Total Cost[1,2,3]

2. Includes 20% for survey, engineering, legal, & easements and 30% contingency.

3. Estimated cost in 2020 dollars.

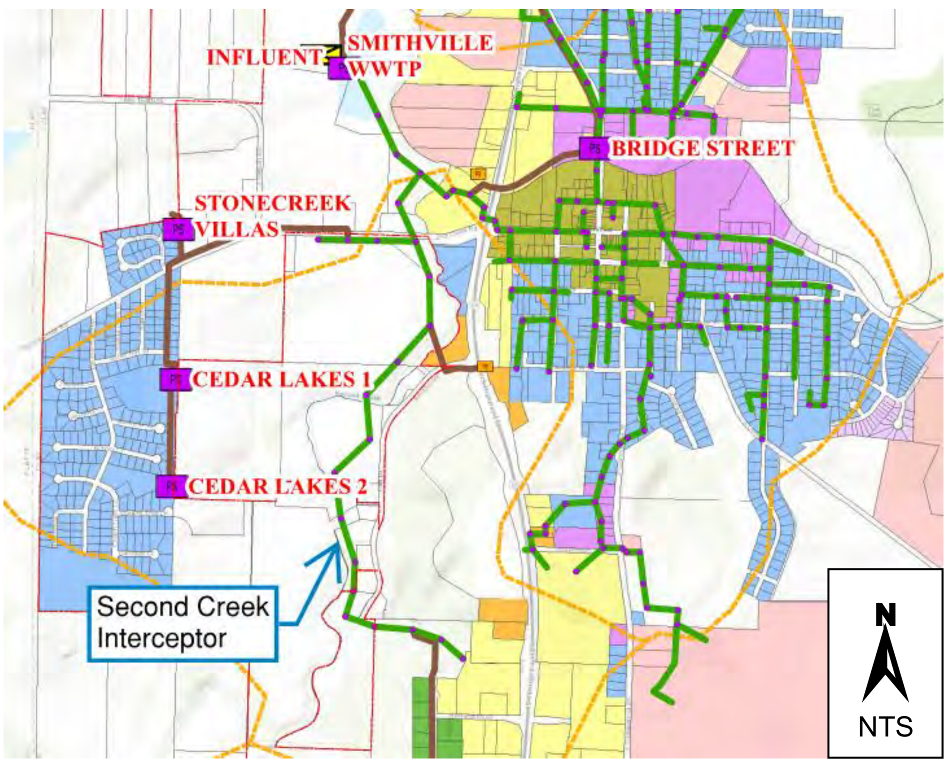
6.2.2 South Smithville

1. Recent and Ongoing Improvements

Second Creek Interceptor

The recent completion of the first phase of the Second Creek/First Creek Interceptor from the Wastewater Treatment Plant to approximately Richardson Street has reduced the length and overall operating pressures within the existing South Force Main. This has provided additional capacity to accommodate the flow from the Forest Oaks subdivision and anticipated development within the southern portion of the City in the near future. This project is shown in Figure 6-3.

Figure 6-3. Second Creek Interceptor



Rocky Branch Interceptor

The Rocky Branch Interceptor is a planned gravity interceptor that will convey flow from Forest Oaks subdivision to the WWTP by way of the South Force Main. This flow is currently treated by the Rocky Brach WWTP which is outside of Smithville City limits and is owned and operated by the City of Kansas City, Missouri (KCMO). Implementation of this interceptor will allow the Smithville WWTP to treat the wastewater from Forest Oaks, and will provide a sewer connection to possible developments in the south. This project is shown below in Figure 6-4.

South Booster Pump Station

The South Booster pump station is a planned pump station that will be located along 144th Street east of 169th Highway. With an updated system of gravity sewers, this pump station will collect wastewater from the surrounding area and convey the flow to the WWTP by way of the South Force Main. The addition of this pump station and associated piping will consolidate the flows from multiple existing pump stations into a single route, allowing Diversified Metal, McDonalds, Platte Valley, and Hills of Shannon pump stations to be decommissioned. This pump station will be sized to allow for additional capacity in the area and will provide service to possible future developments. This project is shown below in Figure 6-4. A separate study by HDR in 2017 provided a cost estimate adjusted to 2020 dollars shown in Table 6-3.

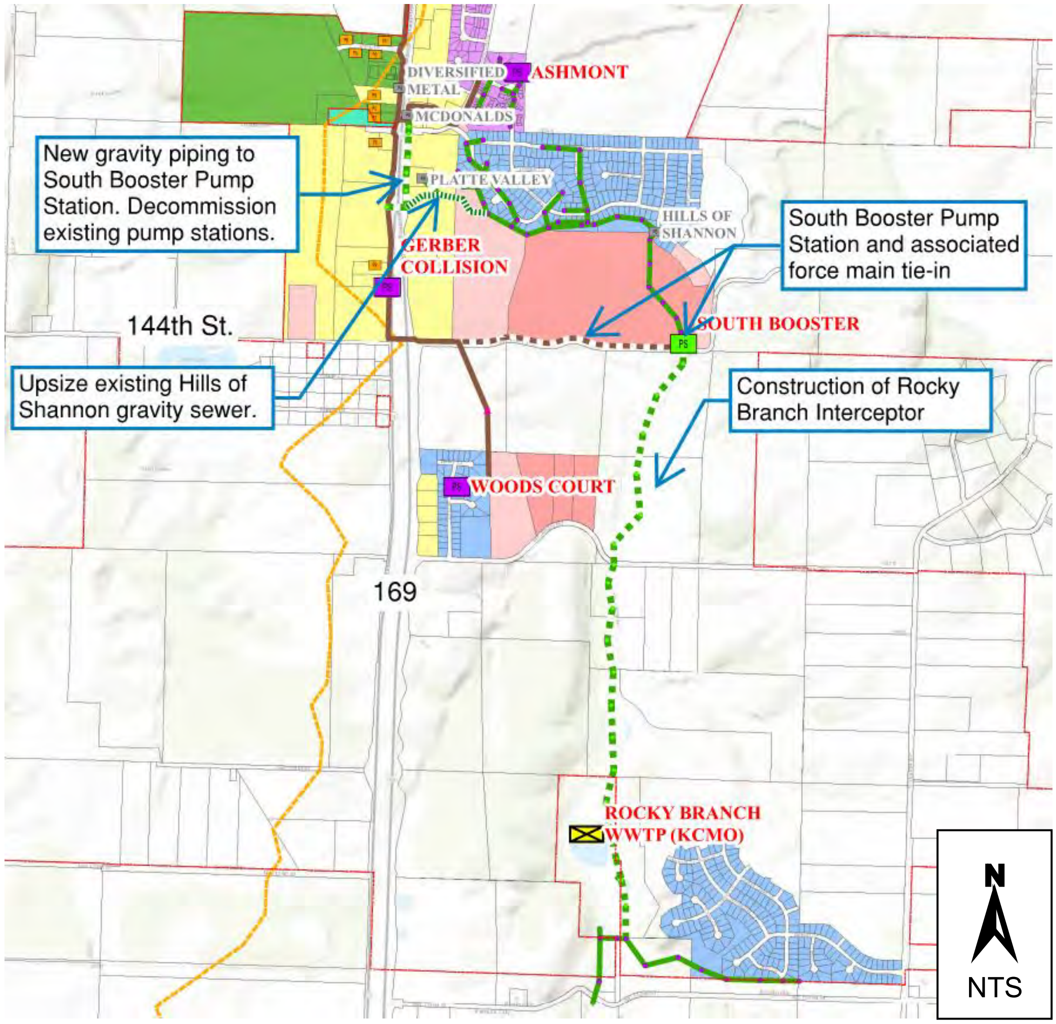
Portions of the Hills of Shannon gravity sewer will require upsizing prior to decommissioning Diversified Metal, McDonalds, and Platte Valley pump stations.

Table 6-3. South Booster Pump Station and Piping Cost Estimate

Description	Cost[1]
New Sewer Extension to West Side of HWY 169	565,410.00
Upsize Existing Hills of Shannon Sewer from 8" to 12"	567,720.00
South Booster Pump Station at 144th Street	827,950.00
Gravity Sewer Connections to Eliminate Platte Valley and McDonald's Pump Stations	421,470.00
Total	**2,382,550.00**

Notes:
1. Estimate cost in 2020 dollars.

Figure 6-4. Rocky Branch Interceptor and South Booster Pump Station Projects



2. Southeast Smithville

The construction of the South Booster Pump Station and South Interceptor Project, which is currently in property acquisition, will provide the collection system infrastructure “backbone” to convey the majority of the anticipated flow east of Hwy 169 and south of Hwy 92 for remaining ten year growth projections. Additional improvements in the south portion of the City to facilitate development will be limited to sewer extensions or upsizing existing pump stations and tributary lines to the South Interceptor. The cost for these projects will be the responsibility of the developer and construction costs have not been included in this Master Plan.

3. Southwest Smithville

There is minimal anticipated short-term development in the area south of Hwy 92 and west of Hwy 169, except for the frontage of Hwy 169. The area fronting Hwy 169 between 144th Street and Commercial Street will be served by connections to the existing South Force Main or a gravity extension draining east across Hwy 169. The cost for these projects will be the responsibility of the developer and construction costs have not been included in this Master Plan.

The following maps showing anticipated development and recommended infrastructure improvements can be found in Appendix A:

- Figure A-10 Ten-year Development – South
- Figure A-11 Ten-year Infrastructure – South
- Figure A-12 Ten-year Development and Infrastructure – South

6.3 Proposed Ultimate Improvements

As mentioned previously, the proposed ultimate wastewater collection solution is to construct three interceptor sewers to convey the majority of wastewater flow by gravity to the treatment plant. To accurately plan a comprehensive design, the ultimate build-out conditions of Smithville were analyzed.

6.3.1 North Smithville

The proposed ultimate improvements in the north assumes entire build-out of the City in accordance with the existing land use plan as shown in Appendix A, Figure A-13 Ultimate Development - North.

Owens Branch Interceptor Ultimate Build-out

Due to the large size of the Owens Branch watershed, a large gravity interceptor is proposed to provide a wastewater collection foundation for the northern portion of the City. This interceptor shall be built along Owens Branch, following the path of the existing force main. The long-term goal of this interceptor is to maximize the amount of wastewater conveyed solely by gravity sewers, decreasing the need for pump stations, and reducing ongoing operation and maintenance expenses required. The main benefits gained by the implementation of the Owens Branch Interceptor and associated tributaries are summarized below:

REDUCED LOAD ON NORTH FORCE MAIN – With the installation of the Owens Branch Interceptor, the force main downstream of Greyhawke 1, 2, 3, Big Harborview, Lakeview Drive, Bridgeport, Rollins Landing, and Rock Creek will see reduced operating pressures due to shorter force main lengths and more capacity within the interceptor.

ELIMINATING PUMP STATIONS - When the entirety of the Owens Branch Interceptor is installed, it will eliminate the need for the Wildflower pump station and allow for it to be decommissioned. With the future addition of Owens Branch Tributary 3, the flows determined to be pumped by Greyhawke 3 may be conveyed by gravity as well and Greyhawke 3 can be decommissioned.

GRAVITY FLOW WITHIN WATERSHED – With the foundation provided by the Owens Branch Interceptor, future development within the watershed can be conveyed to the WWTP by gravity sewers.

Davenport Farms South and Lake Remote Pump Stations

The Davenport Farms South and Lake Remote pump stations and associated force mains will be required if the land develops as planned, as these developments are outside of the Owens Branch watershed. The costs for these projects will be the responsibility of the developer and construction costs have not been included in this Master Plan.

These proposed improvements are shown in Appendix A; Figure A-14 Ultimate Infrastructure - North and Figure A-15 Ultimate Development and Infrastructure - North.

6.3.2 South Smithville

The proposed ultimate improvements in the south assumes entire build-out of the City in accordance with the existing land use plan as shown in Appendix A, Figure A-16 Ultimate Development - South.

1. Southeast Smithville

The Wilkerson Creek watershed is also large, therefore, a gravity interceptor is proposed to provide a wastewater collection foundation for the southeast portion of the City. This interceptor shall be built along Wilkerson Creek, with tributaries to serve other areas. The long-term goal of this interceptor is to maximize the amount of wastewater conveyed by gravity sewers, decreasing the need for pump stations and reducing the operation and maintenance required. The main benefits gained by the implementation of the Wilkerson Creek Interceptor and associated tributaries are summarized below:

ELIMINATING PUMP STATIONS - When the entirety of the Wilkerson Creek Interceptor and associated tributaries is installed, it will eliminate the need for Bridge Street, Strawberry Hill, Daycare, Stone Bridge, and South Booster pump stations, allowing them to be decommissioned as the interceptor is built out.

GRAVITY FLOW WITHIN WATERSHED – With the foundation provided by the Wilkerson Creek Interceptor, future development within the watershed can be conveyed to the WWTP by gravity sewers.

2. Southwest Smithville

Due to the broad amount of land lying within the First Creek watershed, a large gravity interceptor is proposed to provide a wastewater collection foundation for the southwest portion of the City. This interceptor shall be built along First Creek, continuing south to serve future development. As there is currently little development within the watershed, the long-term goal of this interceptor is to facilitate growth by providing gravity sewer connections to developments as needed.

These proposed improvements are shown in Appendix A; Figure A-17 Ultimate Infrastructure and Figure A-18 Ultimate Development and Infrastructure.

6.3.3 Proposed Phasing

The proposed interceptors are large scale improvements that will be installed in phases. The timeline of installation depends on the speed of development and available funding. As the interceptors are constructed, many pump stations can be strategically decommissioned as described above. A recommended phasing approach is proposed in Sections 6.3.3.1 through 6.3.3.3 and shown in Appendix A; Figure A-19 Ultimate Interceptor Proposed Phasing - North and Figure A-20 Ultimate Interceptor Proposed Phasing - South.

1. Owens Branch Interceptor

Table 6-4. Owens Branch Interceptor Proposed Phasing

Phase	Segments	Description
1	Segment 1 Segment 2 Segment 3	Phase 1 is recommended to be implemented during the ten-year planning period. Install gravity sewers along Owens Branch north of the WWTP to Hillcrest Drive and connect to the existing force main tie-in. Constructing gravity sewers to this point reduces the load on upstream pump stations including Greyhawke 1, 2, 3, Big Harborview, Lakeview Drive, and Bridgeport by increasing the capacity of the force main. This will increase the capacity of the North Force Main enough to allow for planned development during the next ten years. Additionally, the KK force main flow can be incorporated into this gravity sewer, as well as any tributaries required by future development.
2	Segment 4 Segment 5	Continue the installation of gravity sewers along Owens Branch north of Phase 1 up to the Rollins Landing force main tie-in. This continuation reduces the load on upstream pump stations such as Rock Creek and Rollins Landing by increasing the capacity of the force main. Additionally, tributaries that flow into the interceptor can be constructed as required by development.
3	Segment 6	Continue the installation of gravity sewers along Owens Branch north of Phase 2 up to 188th Street. This is the end of the natural pathway of gravity along the existing force main route. This continuation allows flow from the Wildflower subdivision and soon to be constructed Eagle Heights subdivision to be conveyed entirely by gravity. It also provides a potential tie-in point for the future Davenport Farms South pump station. Segment 6 could be extended north with the addition of Owens Branch Tributary 5 to allow potential development north of Hwy 169 to be served by the gravity system.

2. First Creek Interceptor

Table 6-5. First Creek Interceptor Proposed Phasing

Phase	Segments	Description
1	Segment 1	Install gravity sewers south along First Creek starting from the recently completed Second Creek/First Creek Interceptor and extending to Highway 92. This will provide a sewer connection for additional development in the southwest region, starting centrally and progressing south.
2	Segment 2 Segment 3	Continue the installation of gravity sewers along First Creek south of Phase 1 down to south of 144th Street as indicated in Figure A-20. At this point the Creek begins to run west, and out of City limits. This portion will provide a sewer connection for developments further south.
3	Segment 4	Continue the installation of gravity sewers south following low-lying terrain as needed to serve future development in the southwest.

3. Wilkerson Creek Interceptor

Table 6-6. Wilkerson Creek Interceptor Proposed Phasing

Phase	Segments	Description
1	Segment 1	Install gravity sewer east from the manhole shown on Figure A-20 to Bridge Street and connect to receive flows currently handled by the Bridge Street pump station. This will allow for a large amount of flow originating in the center of the City north of Little Platte River to be conveyed entirely by gravity to the WWTP.

Table 6-6. Wilkerson Creek Interceptor Proposed Phasing

Phase	Segments	Description
2	Segment 2 Segment 3	Continue the installation of gravity sewer southeast along Wilkerson Creek from Phase 1 to 159th Street as shown on Figure A-20. At this location, a small tributary cutting east to Strawberry Hill pump station would convey the flows from Harbortowne and Quail Ridge pump stations to the gravity system, eliminating the need for the Strawberry Hill pump station and reducing the load on the Smith's Fork pump station which currently receives these flows. Additionally, this will provide a sewer connection for developments within its watershed.
3	Segment 4 Segment 5	Continue the installation of gravity sewer south along Wilkerson Creek from Phase 2 until the creek splits into Rocky Branch and Wilkerson Creek as shown on Figure A-20. At this point, two tributaries could be constructed to allow currently served areas to tie into the gravity system and decommission pump stations. First, installing an interceptor cutting west along Highway 92 would convey the flows from Daycare and Stone Bridge pump stations, allowing them to be decommissioned. Second, extending the sewer south along Rocky Branch to the proposed South Booster pump station located on 144th Street would convey the flows from the pump station, allowing it to be decommissioned. Additionally, this will provide a sewer connection for a large area of potential developments in the southeast portion of the City.
4	Segment 6	Continue the installation of gravity sewer southeast along Wilkerson Creek as needed to serve future developments in the southeast as well as the proposed annexation area.

The total cost, in 2020 dollars for these projects are shown in Table 6-6.

Table 6-7. Collection System Ultimate Interceptor Expansion

Collection System Ultimate Interceptor Expansion	Length (LF)	Size (IN)	Total Cost[1,2,3]
Owens Branch Phase 2	9,075	18	$ 3,342,700
Owens Branch Phase 3	3,478	8	$ 826,000
Owens Branch Tributary 1	1,249	8	$ 297,500
Owens Branch Tributary 2	4,950	10	$ 1,471,300
Owens Branch Tributary 3	2,884	8	$ 683,900
Owens Branch Tributary 4	5,309	10	$ 1,580,800
First Creek Phase 1	2,279	21	$ 974,200
First Creek Phase 2	6,317	18	$ 2,327,300
First Creek Phase 3	9,075	10 - 18	$ 2,167,300
Wilkerson Creek Phase 1	1,373	36	$ 1,115,400
Wilkerson Creek Phase 2	8,109	36	$ 6,542,300
Wilkerson Creek Phase 3	6,580	27 - 30	$ 4,315,700
Wilkerson Creek Phase 4	10,839	21	$ 4,628,800
Wilkerson Creek Tributary 1	1,638	8	$ 390,500

Table 6-7. Collection System Ultimate Interceptor Expansion

Collection System Ultimate Interceptor Expansion	Length (LF)	Size (IN)	Total Cost[1,2,3]
Wilkerson Creek Tributary 2	3,686	10	$ 1,092,700
Rocky Branch Segment 1	5,938	21	$ 2,539,100
TOTAL	**80,382**		**$ 34,295,500**

Notes

1. Includes complete installation of pipes, MHs, and other ancillary structure and surface restoration.

2. Includes 20% for survey, engineering, legal, & easements and 30% contingency.

3. Estimated cost in 2020 dollars.

7 Wastewater Treatment Plant Evaluation

The North Force Main conveys all flows generated north of the City's wastewater treatment plant, while the South Force Main performs the same function for the southern portion of the City. The flows from these force mains are directed to the WWTP where the water is treated and discharged to the Little Platte River.

The existing wastewater treatment plant utilizes the activated sludge process using Sequencing Batch Reactor (SBR) technology. The plant was originally constructed in 1995 and replaced an existing lagoon system. An expansion was completed to increase the capacity of the WWTP to a 1.125 MGD average daily flow in 2007. The WWTP consists of an influent pump station, Headworks facility, three SBR basins, UV disinfection, effluent pumping, two sludge digester basins, and an excess flow holding tank to store peak flows during wet weather events.

7.1 Flows and Loadings

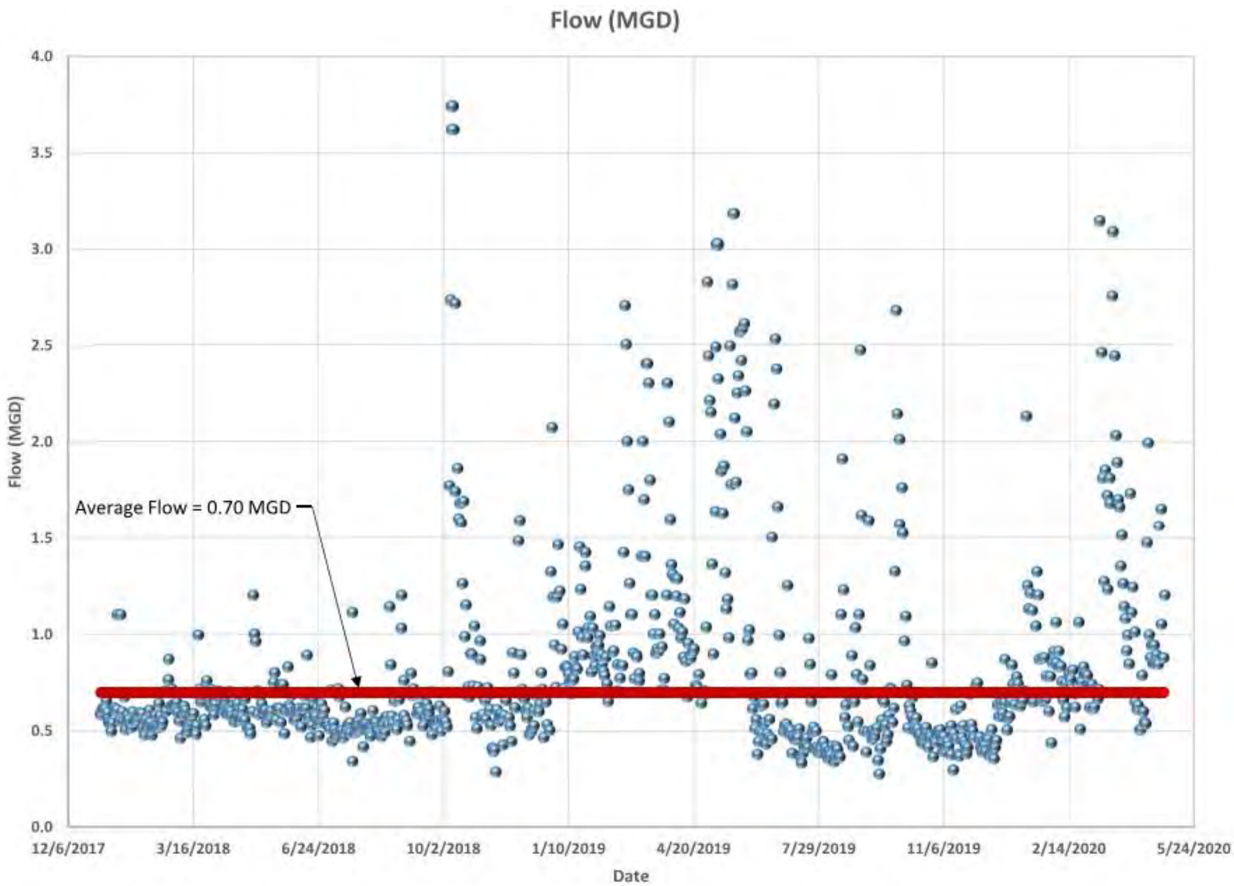
7.1.1 Existing Flows and Loadings

Daily Monitoring Reports (DMRs) were analyzed to determine the current flows and loadings at the Smithville Wastewater Treatment Plant from January 2018 to May 2020.

Existing Flows

Figure 7-1 is a graphical representation of the historical daily recorded flows at the WWTP.

Figure 7-1. WWTP Historical Flow



Based upon the evaluation, the current average daily flow and peak daily flow are as follows:

- Average Daily Flow = 0.70 mgd
- Peak Daily Flow = 3.7 mgd

Existing Influent Loadings

Existing influent wastewater loading rates were determined using the DMR data. The existing rates are shown graphically in Figure 7-2 and summarized in Table 6-3.

Figure 7-2. WWTP Historical Influent Loadings

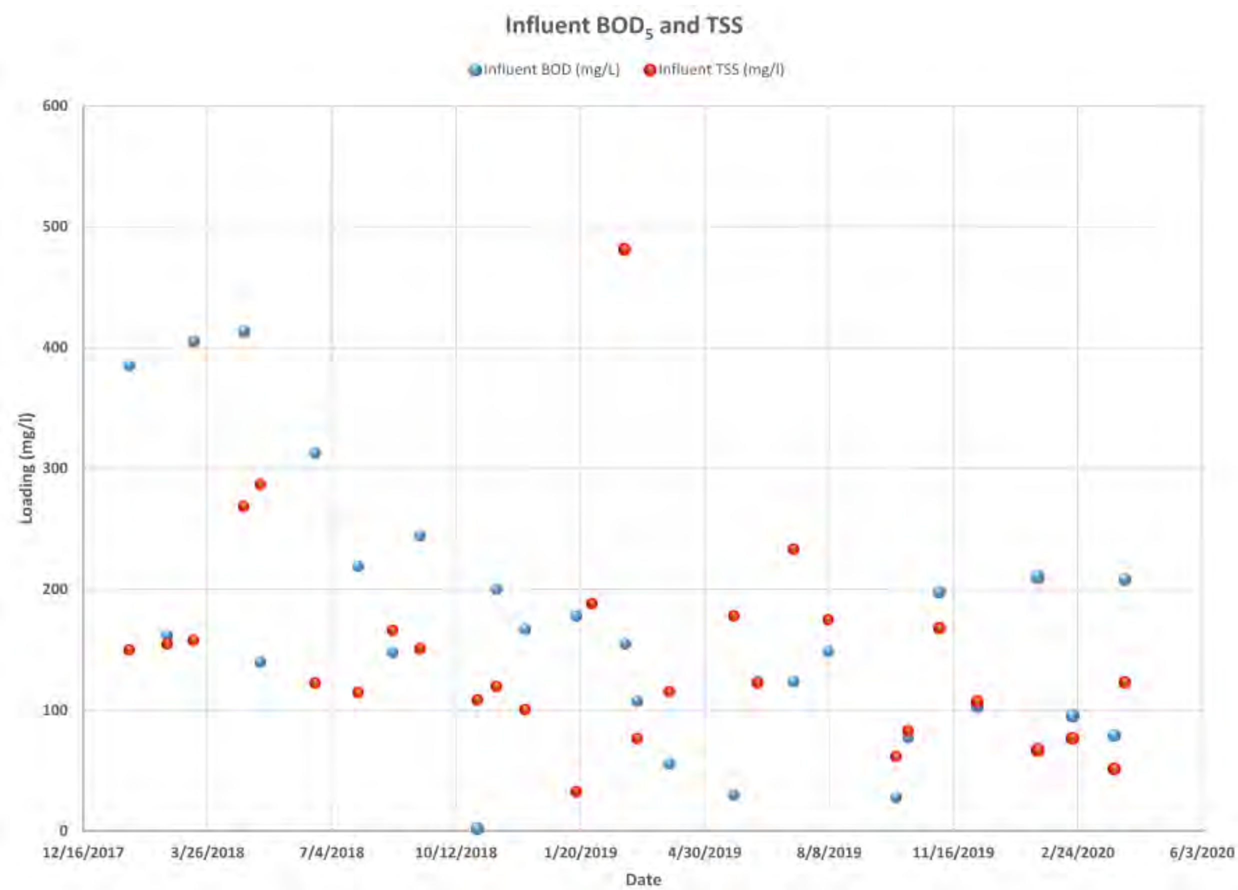


Table 7-1. Existing Influent Loadings at the Existing WWTP

Smithville Wastewater Treatment Plant		
Parameter	**Average Day (mg/L)**	**Maximum Day (mg/L)**
BOD_5 (mg/L)	169	413
TSS (mg/L)	146	481
PH	7	8.5

7.1.2 Existing and Potential Future Effluent Limits

The Smithville WWTP operates under the Missouri Department of Natural Resources (MDNR) Permit Number MO-0055204 and discharges to the Little Platte River. The facility's effluent limits are based on several factors including, but not limited to, the design flow, mixing assumptions with the receiving stream, criteria designed to protect designated uses in the receiving stream, and effluent regulations. Because these factors can change over time, existing permit limits will likely differ from those in the future. Projected effluent limits for existing and future conditions are discussed below. For purposes of this document, estimated future effluent limits are projected for the year 2030.

Existing Effluent Limits

The most recent permit for the Smithville WWTP expired on June 30, 2020. It is anticipated that MDNR will renew this permit by the end of 2020. With the exception of ammonia, it is anticipated that permit limits will remain unchanged at permit renewal. The updated ammonia limits will likely be based on the Department's *2020 Total Ammonia Nitrogen Criteria Implementation Guidance* (guidance document). The guidance document includes ecoregional default temperature and pH assumptions for setting monthly ammonia limits. Based on the facility's location in the Western Corn Belt Plains, a design flow of 1.125 million gallons per day (MGD), and mixing assumptions found in the previous permit (expiration date June 30, 2020), projected effluent limits for the renewed permit are included in Table 7-2. However, these could potentially be increased if the City elects to pursue site-specific temperature and pH assumptions during the permit renewal period.

Prior to the submittal of this report, the permit has been renewed (expires June 30, 2025) and can be found in Appendix G.

Table 7-2. Anticipated Effluent Limits for the Existing Smithville WWTP

Parameter	Daily Maximum	Weekly Average	Monthly Average
BOD_5 (mg/L)	-	45	30
TSS (mg/L)	-	45	30
E. coli (#/100ml)	-	1030	206
Oil & Grease (mg/L)	15	-	10
pH (SU)	6-9	-	6-9
Total Phosphorus (mg/L)	*	-	*
Total Nitrogen (mg/L)	*	-	*
Ammonia as N (January) (mg/L)	8.6	-	4.7
Ammonia as N (February) (mg/L)	8.6	-	4.7
Ammonia as N (March) (mg/L)	8.6	-	4.7
Ammonia as N (April) (mg/L)	7.1	-	3.7
Ammonia as N (May) (mg/L)	7.6	-	3.3
Ammonia as N (June) (mg/L)	7.1	-	2.0
Ammonia as N (July) (mg/L)	7.1	-	1.7
Ammonia as N (August) (mg/L)	8.6	-	2.0
Ammonia as N (September) (mg/L)	7.1	-	2.3
Ammonia as N (October) (mg/L)	7.1	-	3.7
Ammonia as N (November) (mg/L)	8.6	-	4.7
Ammonia as N (December) (mg/L)	8.6	-	4.7

*Monitoring only

Potential Future Effluent Limits

Potential future effluent limits for the year 2030 were projected based on an expanded design flow of 1.5 MGD (Table 7-3). Major considerations for projecting future limits included updated ammonia criteria, potential nutrient removal requirements, and antidegradation.

- *Ammonia criteria* – In 2013, the U.S. Environmental Protection Agency (USEPA) finalized new water quality criteria recommendations. The updated criteria are based on new toxicity data which demonstrate that some organisms, particularly some species of gill-breathing snails and freshwater mussels, are more sensitive to ammonia than other organisms in the national toxicity dataset used in the previous recommendations. It is anticipated that Missouri could adopt the updated ammonia criteria recommendations within the next 3 to 5 years. Projected future ammonia limits in Table 7-3 are based on the updated criteria, existing mixing assumptions, and default assumptions from MDNR's 2020 ammonia guidance document.
- *Nutrient removal* – Missouri does not currently implement statewide nutrient removal requirements at wastewater treatment facilities, but this could change within the next ten years. MDNR has made no specific recommendations at this time, but widespread implementation of nutrient removal will most likely be based on reasonable technology-based requirements. Based on other USEPA Region 7 states, final nutrient effluent limitations could be in the following ranges: 8-10 mg/L total nitrogen (TN) and 0.5 – 1.0 mg/L total phosphorus (TP).
- *Antidegradation* – Antidegradation reviews are required for all new or expanded discharges to evaluate the impacts on water quality and designated beneficial uses. The purpose of an antidegadation review is to prevent any lowering of water quality unless it is necessary and important. In Missouri, antidegradation reviews typically consist of an alternatives analysis or demonstration of insignificance and a dissolved oxygen (DO) model. The projected future limits in Table 7-3 are anticipated to satisfy antidegradation requirements without an alternatives analysis, which could necessitate more stringent limits. However, the full implications of antidegradation cannot be known until after MDNR completes its review and it has been public noticed along with a draft permit. Pollutant-by-pollutant considerations are discussed below:
  - BOD_5 and TSS – The lower-end of the projected limits is based on a preliminary DO model, whereas the upper-end is based on "capping" the mass-loading. It should be noted that modeling instream DO is a complex endeavor beyond the scope of this report. State guidance is also unclear as to whether "capped" BOD_5 and TSS limits could be used in lieu of model-based limits. Due to this uncertainty, projected future limits are presented as a range of potential values.
  - Ammonia – As the existing permit includes water quality-based ammonia limits, Tier 1 protections may apply (i.e., existing permitted conditions are already at or near water quality standards). If so, water quality-based limits

alone could satisfy antidegradation requirements. Alternatively, it could be demonstrated that the future projected ammonia criteria will result in a reduced mass-loading with respect to the average monthly limits (i.e., insignificant).

- TN and TP – There are currently no stream criteria for TN or TP in Missouri. Therefore, TN and TP will not likely be considered a pollutant of concern for purposes of antidegradation.
- Other parameters – Water quality-based limits for *E. coli*, oil & grease, and pH are typically sufficient to satisfy antidegradation requirements in Missouri.

Table 7-3. Potential Future Limits for the Expanded Smithville WWTP

Parameter	Daily Maximum	Weekly Average	Monthly Average
BOD_5 (mg/L)	-	15-34	10-23
TSS (mg/L)	-	15-34	10-23
E. coli (#/100ml)	-	1030	206
Oil & Grease (mg/L)	15	-	10
pH (SU)	6-9	-	6-9
Total Phosphorus (mg/L)*	-	-	0.5 – 1.0
Total Nitrogen (mg/L)*	-	-	8 - 10
Ammonia as N (January) (mg/L)	9.0	-	3.1
Ammonia as N (February) (mg/L)	9.0	-	3.1
Ammonia as N (March) (mg/L)	9.0	-	2.7
Ammonia as N (April) (mg/L)	4.7	-	1.5
Ammonia as N (May) (mg/L)	3.9	-	1.3
Ammonia as N (June) (mg/L)	2.0	-	0.8
Ammonia as N (July) (mg/L)	1.6	-	0.7
Ammonia as N (August) (mg/L)	2.0	-	0.8
Ammonia as N (September) (mg/L)	2.5	-	0.9
Ammonia as N (October) (mg/L)	4.6	-	1.5
Ammonia as N (November) (mg/L)	8.9	-	2.5
Ammonia as N (December) (mg/L)	9.0	-	3.1

*It is unclear at this time whether nutrient limits would apply as an average monthly or average annual limit.

Other Future Considerations

There are a number of issues that could potentially impact future operations of the Smithville WWTP but the timing of these drivers is not clear. Two of the most potentially significant issues are outlined below.

- *Coliphage criteria* – For several years, USEPA has been evaluating the use of coliphages (viruses that infect *E. coli*) for use as recreational water quality criteria. It is anticipated that USEPA could propose coliphage criteria within the next few years, although finalization of the rule could be prolonged due to the anticipated extended response to comments provided during the rulemaking process. Adoption of the new criteria by MDNR after that could take several more years. Further study and evaluation will be required to determine appropriate treatment processes if coliphages are adopted for recreational water quality criteria.

- *Per- and Polyfluoroalky substances (PFAS)* – In recent years there has been heightened concern over PFAS due to its widespread use and persistence in the environment. In 2019, USEPA issued a PFAS Action Plan to address the PFAS issue and is continuing to gather information. As part of this plan, USEPA is considering potentially developing surface water quality criteria for PFAS and is evaluating the risks of PFAS in biosolids. Additionally, some states are already taking action to regulate PFAS in wastewater effluent and biosolids. For example, recent actions in Maine effectively bans land application of biosolids due to PFAS unless monitoring data are available to alleviate environmental concerns.

7.2 Treatment Plant Capacity Evaluation

The existing wastewater treatment plant utilizes the activated sludge process using Sequencing Batch Reactor technology. As mentioned previously it was constructed in 1995 and replaced an existing lagoon system. Table 7-4 below summarizes the major components and their hydraulic capacities. Subsequent sections contain a more detailed summary of each component.

Table 7-4. Major Plant Components Average Daily Flow Capacities

Component	Hydraulic Capacity (MGD)
Influent Pump Station	
Dry Weather Pumps	4.0
Wet Weather Pumps	5.0
Headworks	
Bar Screen	6.0
Sequencing Batch Reactors (SBRs)	
Average Daily Flow, each basin	0.375
Peak Instantaneous Flow, each basin	1.315
Total Average Daily Flow, 3 basins	1.125
Total Peak Instantaneous Flow, 3 basins	3.95
UV Disinfection	6.0
Effluent Pumping	7.9
Excess Flow Holding Tank (1.2 MG)	5.0

7.2.1 Influent Pump Station

The Influent Pump Station consists of a divided wet well that feeds both dry weather and wet weather pumps. One side of the wetwell will receive all influent flow from the new 42" gravity sewer. Up to 4.0 MGD will be pumped from the wetwell to the Headworks structure. When influent flows exceed WWTP capacity, a weir wall will divert excess flow to the second, or wet weather, wetwell. From the second wetwell, up to 5.0 MGD will be pumped to the 1.2 MG Excess Flow Holding Tank (EFHT).

A vault located on the upstream side of the wetwell includes a manually operated slide gate that when open directs flow to the wetwell. The gate can be closed to divert flow over a weir wall to the EFHT pumps to allow for cleaning or maintenance in the WWTP wetwell.

The Influent Pump Station includes a valve vault that contains the check valve and plug valve for each pump. Valves will be accessed for maintenance through hatches in the top slab of the vault. A 12" force main runs from the IPS to the Headworks and flow is measured via a magnetic flow meter.

The yard piping and valves allow for flows from the 10 IN North Force Main to be directed either to the IPS or to the headworks. The flows are directed to the IPS under normal operation, but may be sent directly to the headworks for maintenance on the IPS.

Dry Weather Pumps

Number of Pumps:	3
Motor:	45 HP
Capacity, 1 Pump:	1,600 GPM
Capacity, 2 Pumps:	2,800 GPM
Total Dynamic Head:	80 feet TDH
Maximum Speed:	1,775 RPM

Wet Weather Pumps

Number of Pumps:	3
Motor:	45 HP
Capacity, 1 Pump:	2,200 GPM
Capacity, 2 Pumps:	3,500 GPM
Total Dynamic Head:	20 feet TDH
Maximum Speed:	900 RPM

7.2.2 Headworks

The headworks structure receives flow from a 12" PVC influent force main. The structure consists of two channels, one containing a manual bar rack with ¼" openings and the other containing a mechanically cleaned bar screen. The mechanical bar screen retains the debris and a traveling rake engages the bar rack from the rear. A chute deposits the screenings to a dumpster. The operating conditions of the bar screen are:

Maximum Flow:	6.0 MGD
Maximum Water Level:	≈ 28”
Upstream/Downstream Velocity:	≈ 2.5 ft/sec
Channel Width:	24”
Screening Width:	24”
Channel Depth:	48”
Bar Dimensions:	¼” Wide x 2’-1/2” Deep
Bar Spacing:	½” Clear Openings

A 10” pipe located in the effluent chamber of the Headworks serves as an overflow to the Aerobic Digester Basin No. 2.

7.2.3 SBR Basins

Wastewater flows from the headworks to the SBR basins through a 16” pipe. The wastewater passes through an aeration and clarification stage while in the batch reactor basins. There are five basic cycles in each batch operation: fill, react, settle, decant, and idle.

The fill cycle is initiated as an anoxic cycle. The basin is filled with influent wastewater and the BOD is absorbed and stored by the biomass already contained within the basin. When the basin is 75% full, aeration is initiated. The oxygen creates an environment for the biomass to metabolize the stored BOD. When the basin has been filled, the react cycle begins. Aeration continues until biodegradation is complete. No influent will be added during this cycle in order to ensure that the biomass consumes the BOD. The next cycle is the settle cycle, which allows the biomass to separate from the water by settling. The decant cycle removes water from the basin. The decant water is removed 18” below the surface to prevent floating solids from contaminating the discharge. The water is decanted from the basin until approximately 33% of the basin is drained. During the idle cycle settled sludge is withdrawn. The sludge must be wasted during this cycle to prevent the build up of biomass. The solids retention time (SRT) will affect the amount of biomass developed.

The current design parameters are listed below:

Average Flow:	1.125 MGD
Peak Wet Weather Flow:	1.50 MGD
Peak Instantaneous Flow:	3.95 MGD
Number of Basins:	3
Diameter:	52 feet
Max SWD:	20 feet
Min SWD:	14 feet
Volume:	0.64 MG
HRT (based upon 20’ SWD):	20.5 Hours*
BOD to aeration:	250 mg/l
Effluent BOD:	10 mg/l
Influent NH3:	30 mg/l
Effluent NH3:	1.0 mg/l
MLSS:	2,800 mg/l

Design F:M:	0.110
AOR:	4,068 lbs/day
SOR:	6,999 lbs/day

There are several other components that make up the SBR basins. Their design parameters, per each basin, are detailed as follows:

Aeration Blowers

Number of Blowers:	2
Motor:	50 HP
Design Air Flow (per blower):	840 SCFM
Pressure:	8.4 psig
Maximum Speed:	3,500 RPM

Mixer Pumps

Number of Pumps:	1
Motor:	30 HP
Capacity:	4,030 GPM
Total Dynamic Head:	20 feet TDH
Maximum Speed:	900 RPM

Jet Aeration Headers

Number of Aeration Headers:	1
Number of Jets:	22
SOR for Aeration:	222 lbs/hour
Design Air Flow:	834 SCFM

Floating Effluent Decanters

Volume per Decant:	93,750 Gallons
Cycles per day:	4
Decant Flow:	3,177 GPM

Sludge Pump

Number of Pumps:	1
Motor:	7-1/2 HP
Flow Capacity:	450 GPM @ 30” TDH 250 GPM @ 37’ TDH
Shut Off Head:	47 inches
Maximum Speed:	1,150 RPM

7.2.4 UV Disinfection and Effluent Pumping

Flow enters the UV Disinfection and Effluent Pumping via a 15” pipe from the SBR basins. There is one UV Disinfection channel which contains two banks of UV lamps, each bank consists of four modules and a baffle that can be removed in the future to add a fifth module. Flow will be discharged through the outfall pipe to the Little Platte River. If the water level in the Little Platte River is raised, the effluent pumps will engage and pump the effluent to a higher water level to overcome the system head.

UV Disinfection

Number of Channels:	1
Number of Banks:	2
Number of Modules:	4
Number of Lamps:	64
Capacity:	6 MGD

Effluent Pumps

Number of Pumps:	2
Motor:	50 HP
Capacity, 1 Pump:	4,167 GPM
Total Dynamic Head:	20 feet TDH
Maximum Speed:	900 RPM

7.2.5 Sludge Storage Basins (Biosolids Digestion/Storage)

The sludge wasted from the SBR basins is sent to the sludge digesters. The basin information and sludge calculations are provided below:

Number of Basins:	2
Diameter:	
Basin No. 1	52 feet
Basin No. 2	65 feet
Max SWD:	20 feet
Volume:	
Basin No. 1	317,730 gallons
Basin No. 2	496,170 gallons

The sections below provide information pertaining to the components of the sludge digester basin.

Aerobic Digester Basin No. 1 Blowers

Number of Blowers:	2
Motor:	25 HP
Size:	6” Suction and Discharge
Design Air Flow (per blower):	625 SCFM

Pressure:	4.5 PSIG
Maximum Speed:	1,244 RPM

Aerobic Digester Basin No. 2 Floating Aerator

Number of Aerators:	1
Motor:	100 HP

The amount of storage provided by the sludge digesters is calculated below:

1.125 MGD x 200 mg/l BOD5 x 8.34 x 0.70 yield = 1,314 lb/day

(1,314 lb/day) / (2.5% Solids)(8.34) = 6,300 gallons/day

813,900 gal of storage / 6,300 gal/day = 130 days digestion and storage

The sludge digester provides 130 days of storage at 2.5% solids. The Missouri Department of Natural Resources regulations, Water Quality Pamphlet 424 and 426, provide that at least 40 to 60 days of aerobic digestion should be provided in conjunction with at least 90 days of sludge storage.

7.2.6 Land Application

The City currently land applies their sludge on City owned land adjacent to the current wastewater treatment plant site. The City owns their own tanker and land application equipment. The available surface area is 15.4 acres. Land application still remains the most cost-effective disposal method, but as expansion and growth occur the amount of land available will not meet sludge production rates. Future expansions should include a cost analysis to determine if thickening and hauling should be implemented in lieu of land application.

7.3 Condition Assessment and Plant Optimization

HDR met with plant staff on April 28, 2020 to tour the plant and to perform a rapid condition assessment. The findings of the rapid condition assessment include the following recommendations:

Headworks Structure:

- Apply coating to influent chamber concrete.
- Replace aluminum components damaged by H2S deterioration, including control and electrical panel supports.
- Install washer/compactor with bagging system to reduce the number of screenings and issues with current disposal system (i.e. current chute has tendency to freeze during cold weather months).

SBR Basins:

- Paint exterior piping.
- Connect the blower piping for SBR No. 1 and SBR No. 2 to allow for redundancy in event of a blower failure.

UV Disinfection and Effluent Pumping:

- Paint exterior piping.

Aerobic Digester Basins:

- Replace aeration system in Digester Basin No. 1 with floating aerator.
- Expand platform at Digester Basin No. 2 to accommodate maintenance of the floating aerator.
- Modify Digester Basin No. 2 to allow direct connection with tanker trucks.

Laboratory:

- Expand laboratory with future expansions.
- Upgrade SCADA system.

HDR met with plant staff on July 10, 2020 to discuss plant performance and suggestions to optimize operations. The discussion began with an evaluation of the DMR data and historical performance.

Figures 7-3, 7-4, 7-5, and 7-6 below contain graphical representations of the historical BOD_5, TSS, Ammonia, Total Phosphorous (TP), and Total Nitrogen (TN), respectively. On each graph, a line indicating the current limit and anticipated future limit has been added to compare the likelihood of the plant meeting the effluent limits through its current operations.

Figure 7-3. WWTP Historical Effluent BOD5 and TSS

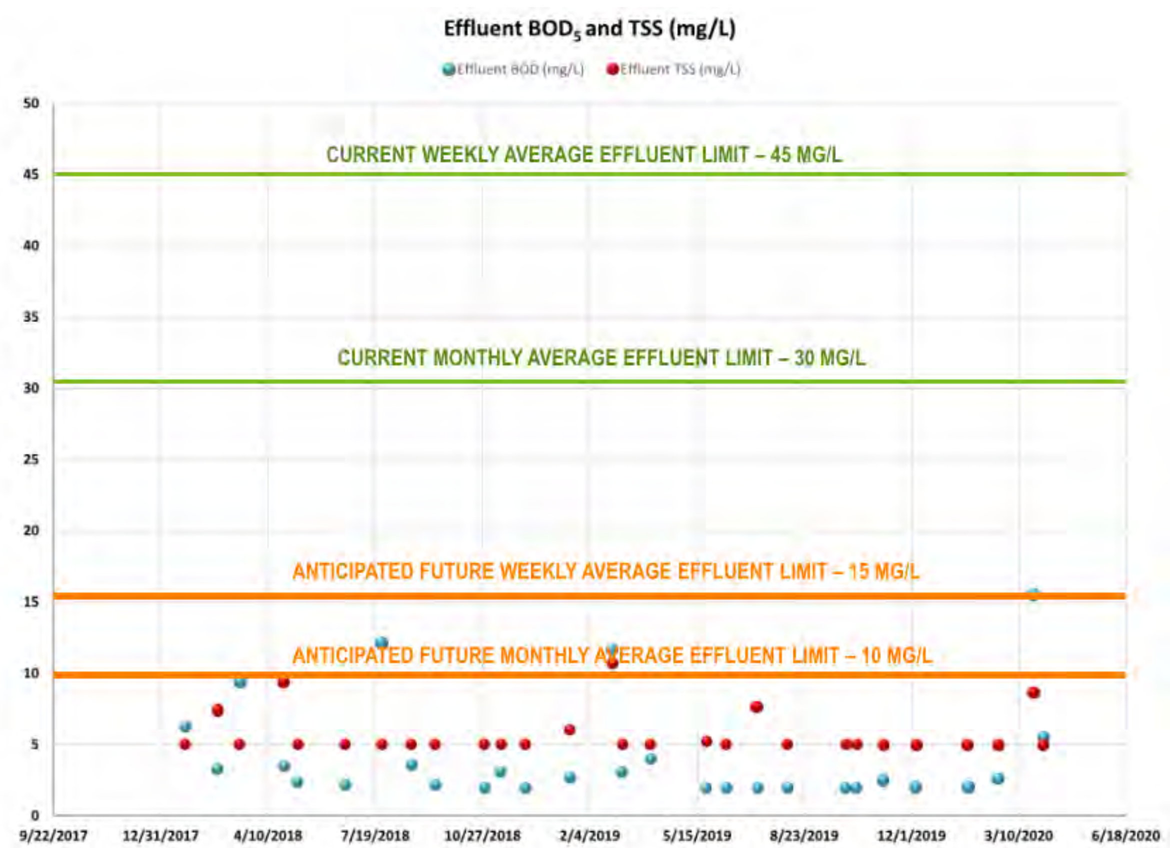


Figure 7-4. WWTP Historical Effluent Ammonia

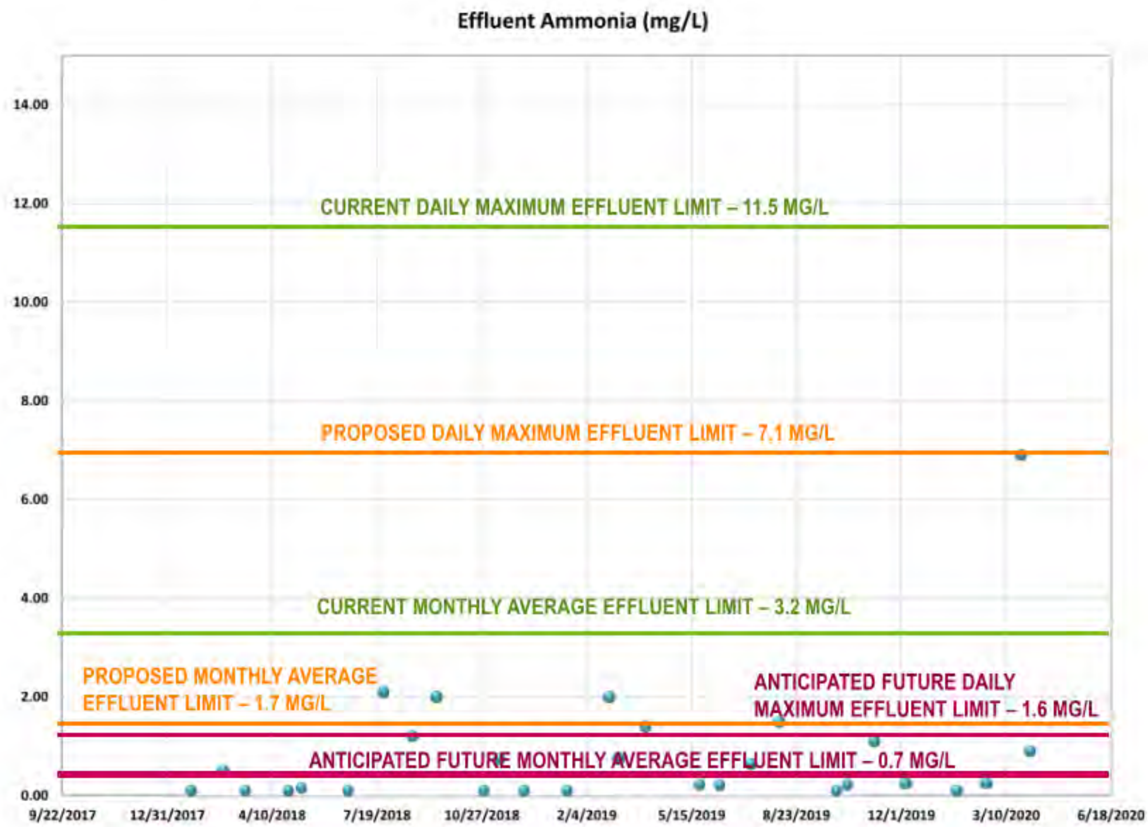


Figure 7-5. WWTP Historical Effluent TP

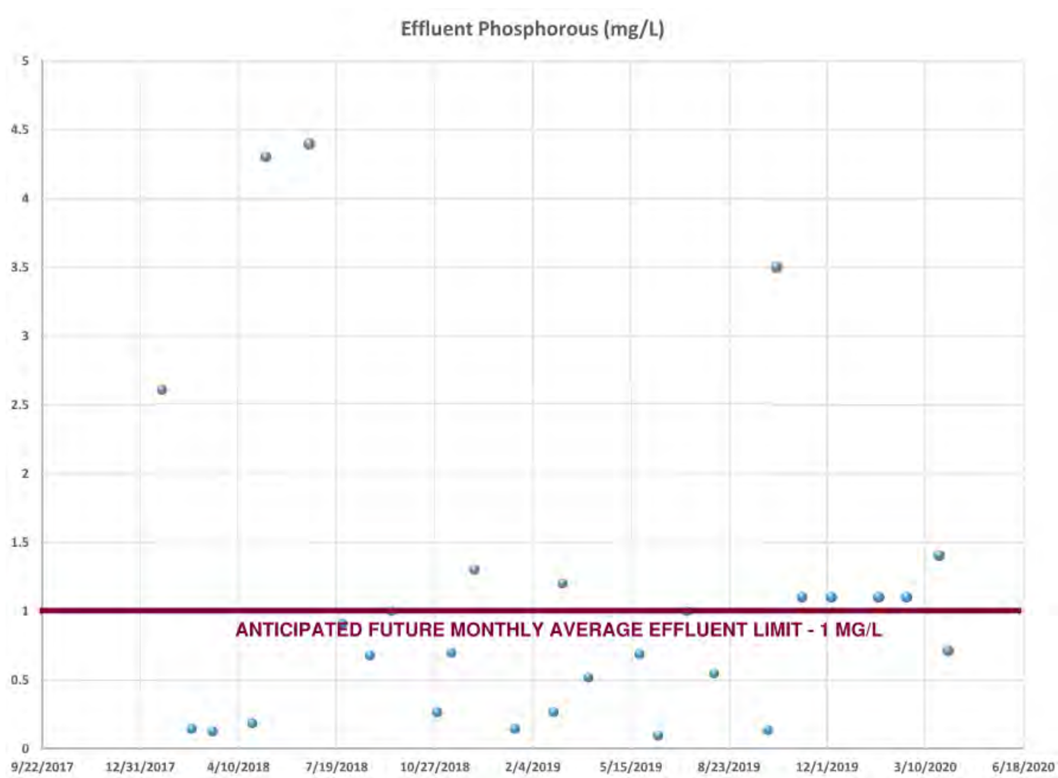
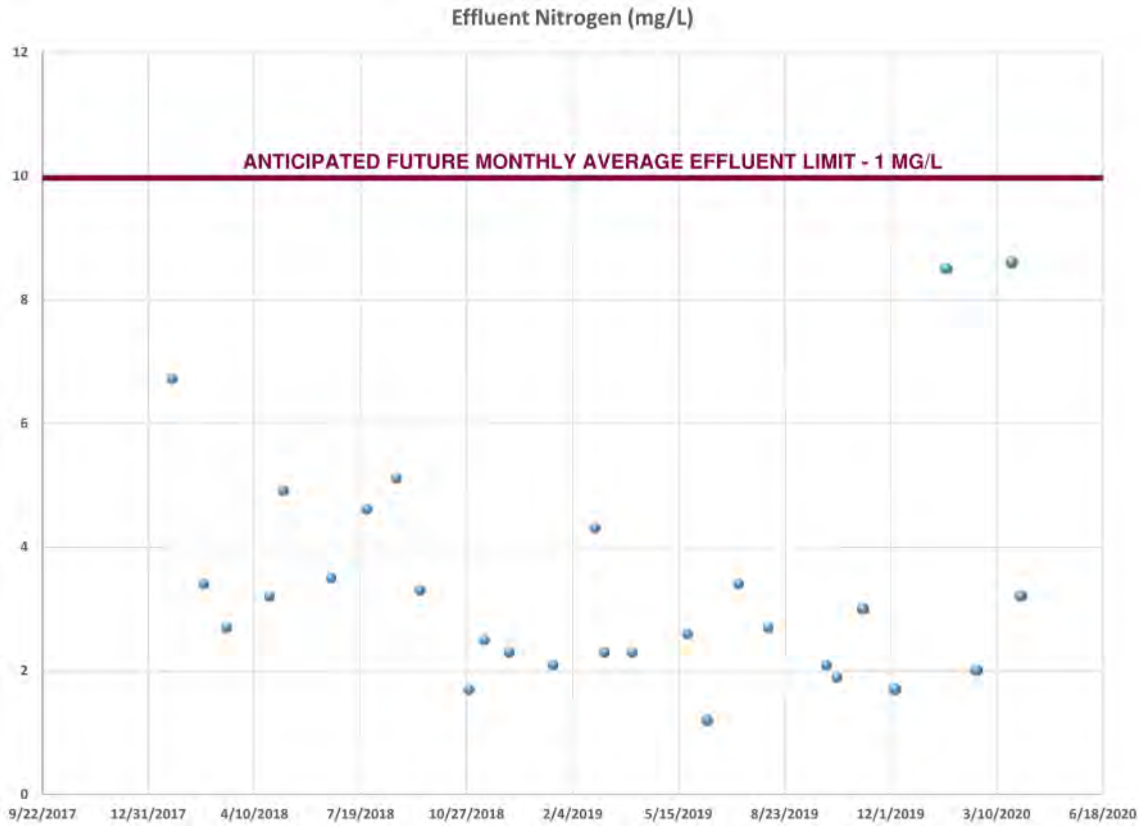


Figure 7-6. WWTP Historical Effluent TN



Based upon current operations, the plant should experience few issues with meeting the future anticipated effluent limits for BOD5, TSS, and TN. However, some operational changes would be required to meet the more stringent anticipated effluent limits for Ammonia and TP.

Based upon a review of the DMR data and discussions with staff, it is recommended that the cycles for the SBR basins be adjusted such that instead of running it anoxic, it be run anaerobic. To aid in this, plant should consider taking additional DO readings especially at close to the end of the react cycle. Staff should be sure the DO probe is calibrated and compare it to a bench test. Additionally, plant staff should consider operating the SBR cycles on MLSS in lieu of through sludge age. While it appears that there is some naturally occurring Biological Phosphorous, it seems that chemical addition will be required to meet anticipated future TP limits.

7.4 Future Wastewater Service

For ease of construction and cost, two phases for expansion were developed for this alternative. They are:

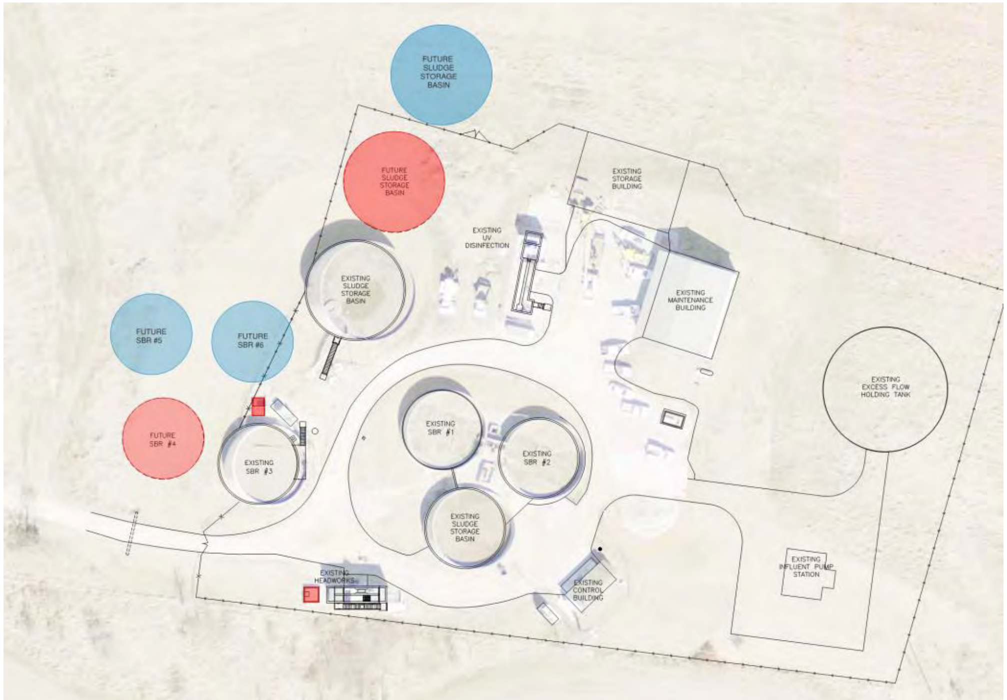
- Phase I – 0.375 MGD Expansion, 1.5 MGD Total Plant Capacity
- Phase II – 0.375 MGD Expansion, 2.25 MGD Total Plant Capacity

The Phase I expansion, indicated in the figure below, includes expanding the existing plant utilizing Sequencing Batch Reactor treatment technology. The land west of the existing site must be utilized for plant expansion. A fourth SBR basin is required as well as upgrades to the influent valve vault, effluent valve vault, and the addition of an additional sludge storage tank. As shown in the capacity evaluation above, the existing influent pump station, bar screen, UV disinfection, and effluent pump station have sufficient hydraulic capacity to meet the Phase I expansion.

Figure 7-7. WWTP Site Layout for Phase I Expansion

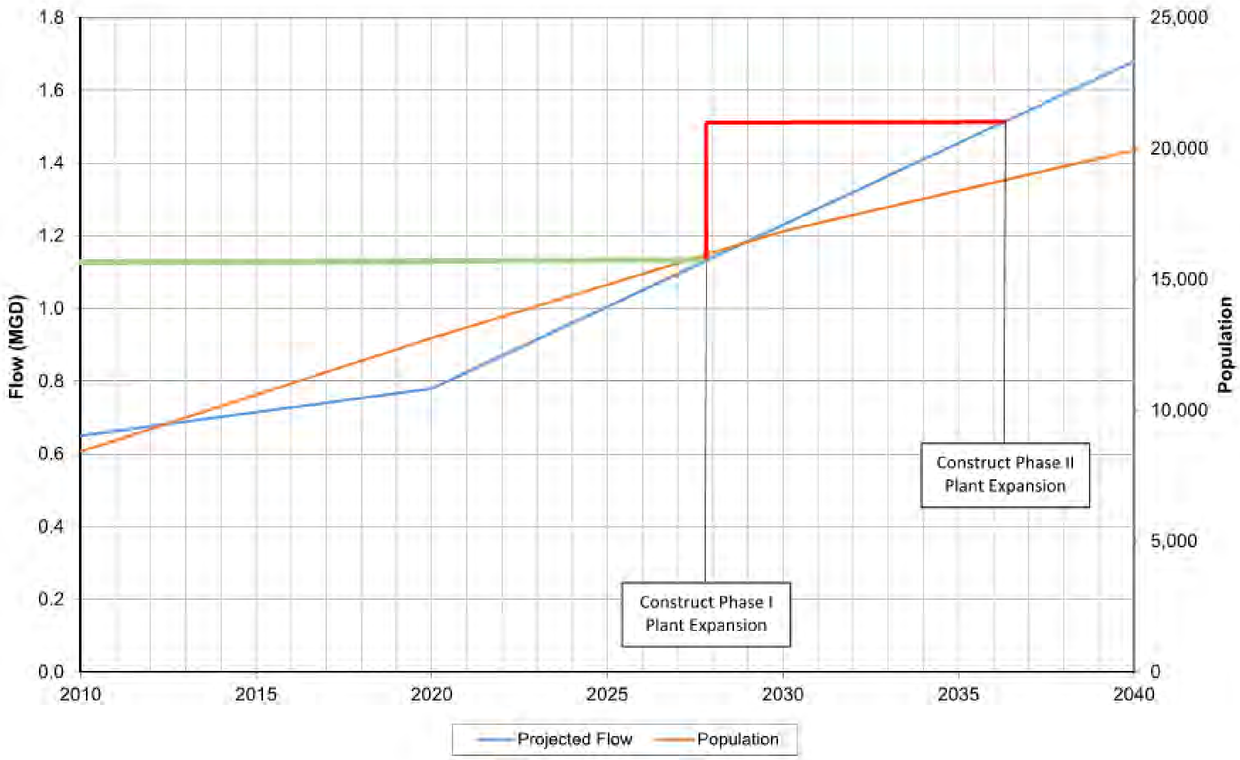
Phase II expansion will require the addition of a fifth and sixth SBR basin. Again, upgrades are required at the influent valve vault and effluent valve vault. Additional bulbs will be added to the UV equipment to increase the design capacity. One more additional sludge storage tank will need to be added to the treatment plant to increase sludge storage capacity.

Figure 7-8. WWTP Site Layout for Phase II Expansion



The projected growth was used to determine the timing of the future expansions. As can be seen on the chart below, Phase I expansion should be completed by 2028.

Figure 7-9. WWTP Facility Phasing Using Future Development



The estimated capital construction costs for the Phase I expansion are approximately $2,283,000 for the liquids improvements and $1,799,000 for the solids improvements.

Table 7-5. Phase I Cost Estimate

Item	Cost[1]
Site/Civil	$25,000
Site Piping	$129,500
SBR Basin No. 4	$911,150
Influent Valve Vault Modification	$50,000
Effluent Valve Vault	$35,000
Electrical and I&C / SCADA (15%)	$172,598
Subtotal	***$1,323,248***
Mobilization and Contractor Overhead (15%)	$198,487
Subtotal	***$1,521,735***
Contingency (25%)	$380,434
Subtotal	***$1,902,168***
Engineering (20%)	$380,434
Subtotal	***$2,282,602***
TOTAL (2020 Dollars)	**$2,283,000**

Notes:

1. Cost estimate in 2020 dollars

Table 7-6. Phase II Cost Estimate

Item	Cost[1]
Site/Civil	$160,000
Site Piping	$56,000
Sludge Storage Basin	$690,700
Electrical and I&C / SCADA (15%)	$136,005
Subtotal	***$1,042,705***
Mobilization and Contractor Overhead (15%)	$156,406
Subtotal	***$1,199,111***
Contingency (25%)	$299,778
Subtotal	***$1,498,888***
Engineering (20%)	$299,778
Subtotal	***$1,798,666***
TOTAL (2020 Dollars)	**$1,799,000**

Notes:

1. Cost estimate in 2020 dollars

Appendix A. Figures

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SMITHVILLE missouri THRIVING AHEAD

EXISTING DEVELOPMENT
NORTH SMITHVILLE
FIGURE A-1

HDR SMITHVILLE missouri THRIVING AHEAD

EXISTING DEVELOPMENT
SOUTH SMITHVILLE
FIGURE A-2

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

HDR SMITHVILLE missouri THRIVING AHEAD

EXISTING INFRASTRUCTURE
NORTH SMITHVILLE
FIGURE A-3

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

0 300 600 1,200 1,800
Feet

HDR
SMITHVILLE missouri THRIVING AHEAD

EXISTING INFRASTRUCTURE
SOUTH SMITHVILLE
FIGURE A-4

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

EXISTING DEVELOPMENT AND INFRASTRUCTURE

NORTH SMITHVILLE

FIGURE A-5

0 300 600 1,200 1,800
Feet

EXISTING DEVELOPMENT AND INFRASTRUCTURE
SOUTH SMITHVILLE
FIGURE A-6

HDR | SMITHVILLE missouri THRIVING AHEAD

TEN-YEAR DEVELOPMENT
NORTH SMITHVILLE
FIGURE A-7

HDR
SMITHVILLE missouri THRIVING AHEAD

TEN-YEAR INFRASTRUCTURE
NORTH SMITHVILLE
FIGURE A-8

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

0 300 600 1,200 1,800
Feet

SMITHVILLE missouri THRIVING AHEAD

TEN-YEAR DEVELOPMENT AND INFRASTRUCTURE
NORTH SMITHVILLE
FIGURE A-9

HDR SMITHVILLE missouri THRIVING AHEAD

TEN-YEAR DEVELOPMENT
SOUTH SMITHVILLE
FIGURE A-10

HDR | SMITHVILLE missouri | THRIVING AHEAD

TEN-YEAR INFRASTRUCTURE
SOUTH SMITHVILLE
FIGURE A-11

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

0 300 600 1,200 1,800
Feet

TEN-YEAR DEVELOPMENT AND INFRASTRUCTURE
SOUTH SMITHVILLE
FIGURE A-12

ULTIMATE DEVELOPMENT
NORTH SMITHVILLE
FIGURE A-13

SMITHVILLE missouri THRIVING AHEAD

0 300 600 1,200 1,800
Feet

ULTIMATE INFRASTRUCTURE
NORTH SMITHVILLE
FIGURE A-14

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

ULTIMATE DEVELOPMENT AND INFRASTRUCTURE
NORTH SMITHVILLE
FIGURE A-15

HDR SMITHVILLE missouri THRIVING AHEAD

ULTIMATE DEVELOPMENT
SOUTH SMITHVILLE
FIGURE A-16

ULTIMATE INFRASTRUCTURE
SOUTH SMITHVILLE
FIGURE A-17

CITY OF SMITHVILLE, MISSOURI: WASTEWATER MASTER PLAN

HDR | SMITHVILLE missouri THRIVING AHEAD

ULTIMATE DEVELOPMENT AND INFRASTRUCTURE
SOUTH SMITHVILLE
FIGURE A-18

ULTIMATE INTERCEPTOR PROPOSED PHASING
NORTH SMITHVILLE
FIGURE A-19

ULTIMATE INTERCEPTOR PROPOSED PHASING

SOUTH SMITHVILLE

FIGURE A-20

Appendix B. Zoning Designation

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ZONING DESIGNATION

CITY OF SMITHVILLE, MO

FIGURE B-1

NOTES RECORDED DURING MEETING HELD ON 5/20

ZONING DESIGNATION

CITY OF SMITHVILLE, MO

FIGURE B-2

Appendix C. Population Projection Memorandum

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City of Smithville
Comprehensive Plan
Updated July 1, 2020 (Prior Version March 6, 2020)

Population Projections Memorandum

(Working Draft – Findings Subject to Change)

Purpose of This Document

The purpose of this document is to communicate preliminary findings of projected population changes that may occur in Smithville in the next ten years. These projections provide baseline data used in a variety of ways throughout the Comprehensive Plan process and final document, including implications on future land use planning, projected infrastructure needs and facilities, and the landscape and character of Smithville.

Methodology and Data Sources

This analysis looks at key data sources and projection methodologies to understand a range in population and household increases that Smithville may see over the coming decade. Our methodology includes data from leading providers such as ESRI, Census, and American Community Survey data, regional data through the MARC, state-supplied data (county-level) through the Division of Budget and Planning at the State of Missouri Office of Administration, and development data supplied by Smithville's Planning Staff.

Considering the significant number of factors that may impact future population growth and the unlikelihood for any source to predict the specific population in the next ten years, we compare four methodologies for conducting these projection figures and provide a range of growth scenarios that may occur. The methodologies include projecting the population growth and change based on:

1. Projecting ESRI's (a leading demographic data supplier) Population Forecast for population change between 2019 -2024 and assuming this five-year annual growth rate will continue for the ten-year period.
2. Calculating the change in annual estimates of population by the American Community Survey between 2010 and 2018 and assuming the average annual growth rate over this time period will continue for the ten-year period to 2030.
3. Leveraging forecasts provided by MARC for expected population and household change between 2020 and 2030.
4. Averaging annual housing permit data provided by the city to project annual supply increase, assuming these rates will continue for the next ten years. This model assesses three different average rates: 2015-2019 (Methodology 4), 2010-2019 (Methodology 5), and 2001-2019 (Methodology 6).

Key Findings

All assessed data sources indicate that the population of Smithville will continue to in over the coming years. No data sources indicate that populations and households will decline. Key findings include:

- Based on the six population projection scenarios, Smithville's population will likely grow at an annual rate between 1.5% and 3.3%. The average of the scenarios results in a 2.2% projected annual growth rate (2020-2030).
- Smithville will likely see an increase of approximately 1,500 to 4,500 new residents over the next ten years for a projected total population in 2030 between 11,300 and 14,600 residents.
- In 2017, Smithville had a residential ratio of one resident per 1.6 acres (as stated on Smithville's website). Based on the average projected population scenarios, population growth will decrease this ratio to approximately one resident per 1.2 acres. (This is based on total gross acreage and does not reflect development patterns and densities.)
- Regional projections provided through MARC anticipate the highest growth rates (approximately 34%) over the next ten years. Continuation of the growth rate based on Census estimates from 2011 to 2018 project approximately 28% total growth over the ten years, and the ESRI population forecasts are the most conservative at approximately 16% growth between now and 2030.
- The housing market and development trends play an essential role in the growing population of Smithville. To account for this, we assessed the average annual number of residential permits over three different time periods, ranging from an average of 116 annual residential permits between 2015 through 2019 and an average of 79 annual residential permits from 2001 through 2019. Projected anticipated population growth through these models are consistent with the other models assessed with a projected annual growth rate between 1.8% and 2.5% for total projected population growth between 19% and 28%. This methodology projects population increase between 2,000 and 3,000 residents from 2020 and 2030 for a total projected 2030 population between approximately 13,000 and 14,000 residents.
- Smithville's 2005 Comprehensive Plan anticipated that 23,000 people might live in Smithville in 2030 (25-year projection at the time). Our population projections do not forecast growth at this rate.

Recommended Figures for the Comprehensive Plan

Based on the above findings and the projection models, we anticipate the baseline projected population of Smithville to range from approximately 13,500 to 14,500 residents in 2030. This assumes an annual growth rate of 2.3% - 3.0%, with a total population growth of 25% - 35% between 2020 and 2030.

Considerations for the Comprehensive Plan Process and Next Steps

Growing populations bring more people and households, disposable income and purchasing power to support both existing and new business opportunities, and increase the tax base for the city. However, higher populations at the same time result in increases in needed city services, and new housing stock can change the character of the city. The Comprehensive Plan and process is the optimal time for Smithville to consider interventions to the growth (Does the city and community want to see higher levels of population? Does the city and community want to control where and how growth occurs?) and opportunities to leverage this population increase to achieve the desired community vision. Our team is looking forward to discussing implications and opportunities during the Task Force Meetings.

Figure 1: Smithville Population Projections and Summary

Methodology and Data Source		Projected Growth Rates		Projected Population (2030)		Projected Households (2030)	
		Annual Rate	Total Rate	Total Population	Change in Population	Total Households	Change in Households
1	ESRI Population Forecasts	1.5%	15.7%	11,309	1,536	4,189	569
2	Continuation of 2011-2018 Growth	2.5%	27.8%	13,756	2,992	5,096	1,108
3	MARC Projections	3.3%	34.1%	14,582	4,079	4,900	1,566
Population and Housing Growth Range		1.5% – 3.3%	16%-34%	11,300-14,600	1,500 – 4,100	4,200 – 5,100	600 – 1,600

Source: ESRI Community Analyst; American Community Survey; MARC

Figure 2: Smithville Population Projections and Summary Based on Local Housing Permit Rates

Methodology		Average Annual Res. Permits	Projected Growth Rate		Projected Population (2030)		Projected Households (2030)	
			Annual Rate	Total Rate	Total Population	Change in Population	Total Households	Change in Households
4	Based on 2015 – 2019 Rate	116	2.5%	28.3%	13,806	3,042	4,189	1,127
5	Based on 2010 – 2019 Rate	89	2.0%	21.7%	13,097	2,333	5,096	864
6	Based on 2001 – 2019 Rate	79	1.8%	19.2%	12,832	2,068	4,753	766
Population and Housing Growth Range			1.8% - 2.5%	19% - 28%	12,800 – 13,800	2,100 – 3,000	4,200 — 5,100	800 – 1,110

Note: This projection model assumes the 2019 housing vacancy rate of 2.7% (provided through ESRI Community Analyst) will remain constant over the next ten years. This model also assumes that the average household size (provided through ESRI Community Analyst) will remain at 2.7 for the next ten years.

Source: City of Smithville Residential Development Permits; ESRI Community Analyst

Figure 3: Smithville Population Density per Projection Model (2030 Projection)

Projection Model	Projected 2030 Population	Acreage per Resident
ESRI Population Forecasts (Based on ESRI's Projected 2019-2024 Growth Rate)	11,309	1.39
Continuation of 2011-2018 Growth (American Community Survey)	13,756	1.14
MARC Projections	14,582	1.08
Projections Based on Permit Trends (2015 – 2019 Rate)	13,806	1.14
Projections Based on Permit Trends (2010 – 2019 Rate)	13,097	1.20
Projections Based on Permit Trends (2001 – 2019 Rate)	12,832	1.22
Average of Projection Models	13,230	1.19

Note: The above density calculations are based on Smithville's 2017 ratio of population to acreage and thus assumes that Smithville contains 15,677 total acres.

Demographic Changes Between 2005 Comprehensive Plan and Current Conditions

Demographic data in Comprehensive Plans provide an essential benchmark for communities. To supplement the population projections, we assessed key demographic data to understand how the demographic conditions of Smithville have changed since the previous 2005 Comprehensive Plan. Key takeaways include:

- The median housing value in Smithville continues to be higher than Clay County and the state of Missouri. Smithville's median housing value has increased by nearly $72,000 when adjusting for inflation. Clay County and the state have both seen an increase of approximately $50,000.
- The percent of homes in Smithville that are owner-occupied has remained relatively consistent since 2005. This is unsurprising as the housing stock built has been predominately single-family with some duplex/triplex/quadplexes. The 2% change in owner-occupied rates may be a result of an increase in either renter-occupied homes or slight increases in vacancy. The percent of Smithville's housing stock that is single-family has decreased slightly by approximately 5%.
- Smithville residents continue to become more educated, with an increase of 13% of the adult population having some level of post-high school education. As a likely result, the median household income in Smithville has grown by nearly $18,500 after adjusting for inflation. This increase exceeds the increase of median household incomes in Clay County ($6,000) and the state of Missouri ($4,000). Smithville's increasing median household income helps support the rise in the median home value as purchasing power increases with income.

Figure 4: Demographic Comparisons

Demographic Data Points	Past Conditions in 2005 Comp Plan	Current Conditions (2019 Data)	Change
Median Housing Value (Smithville)	$155,865 ($118,000)	$227,310	$71,445
Median Housing Value (Clay County)	$138,562 ($104,900)	$180,514	$49,952
Median Housing Value (Missouri)	$118,748 ($89,900)	$167,653	$41,952
Percent of Homes Owner-Occupied	77.5%	75.5%	-2.0%
Percent of Homes Renter-Occupied	n/a	21.8%	n/a
Percent of Single-Family Housing Stock	82.8%	78.0%*	-4.8%
Percent of Pop. Traditional Married Couples w/ or w/o Children	62.7%	57.7%	-5.0%
Percent of Adult Population with Post-High School Education	53.5%	66.9%	13.4%
Median Household Income (Smithville)	$69,530 ($52,639)	$87,972	$18,442
Median Household Income (Clay County)	$63,861 ($48,347)	$69,807	$5,946
Median Household Income (Missouri)	$50,107 ($37,934)	$54,440	$4,333

Note: The above 2005-dollar figures are adjusted for inflation. The dollar figures in parentheses represent the original figures presented in the 2005 Comprehensive Plan. Current demographic data provided through ESRI Community Analyst.

**Data based on 2013-2017 American Community Survey estimates.*
Source: 2005 Comprehensive Plan Update; ERSI Community Analyst

Employment Projections for 2030

Smithville's employment base will likely increase between 420 and 930 employees, creating a total employment base between 2,755 and 3,265 employees in Smithville by 2030. These projection estimates are based on past employment growth trends in Clay County and the Kansas City MSA and assume that the average growth rates will continue for the next ten years. During the Comprehensive Planning process, additional economic development growth drivers will be evaluated. These drivers may impact the baseline employment projects detailed in Figure 5.

Figure 5: Smithville Employment Projections (2030)

Projection Model	Projections
Annual Employment Growth Rate	2.4%
Total Employment Growth Rate	28%
Estimated Annual Employment Growth	42 – 93 Employees
Anticipated Change in Employment (Between 2020 and 2030)	420 – 930 Employees
Total 2030 Projected Employment	**2,755 – 3,265 Total Employment Base**

Note: Employment projections derived from Clay Count and Kansas City MSA employment growth rates (2010-2018) from MARC annual employment estimates. The total projected employment base assumes that the current (2019) employment base of Smithville is 2,335 employees.

Appendix D. Interceptor Sizing Summary

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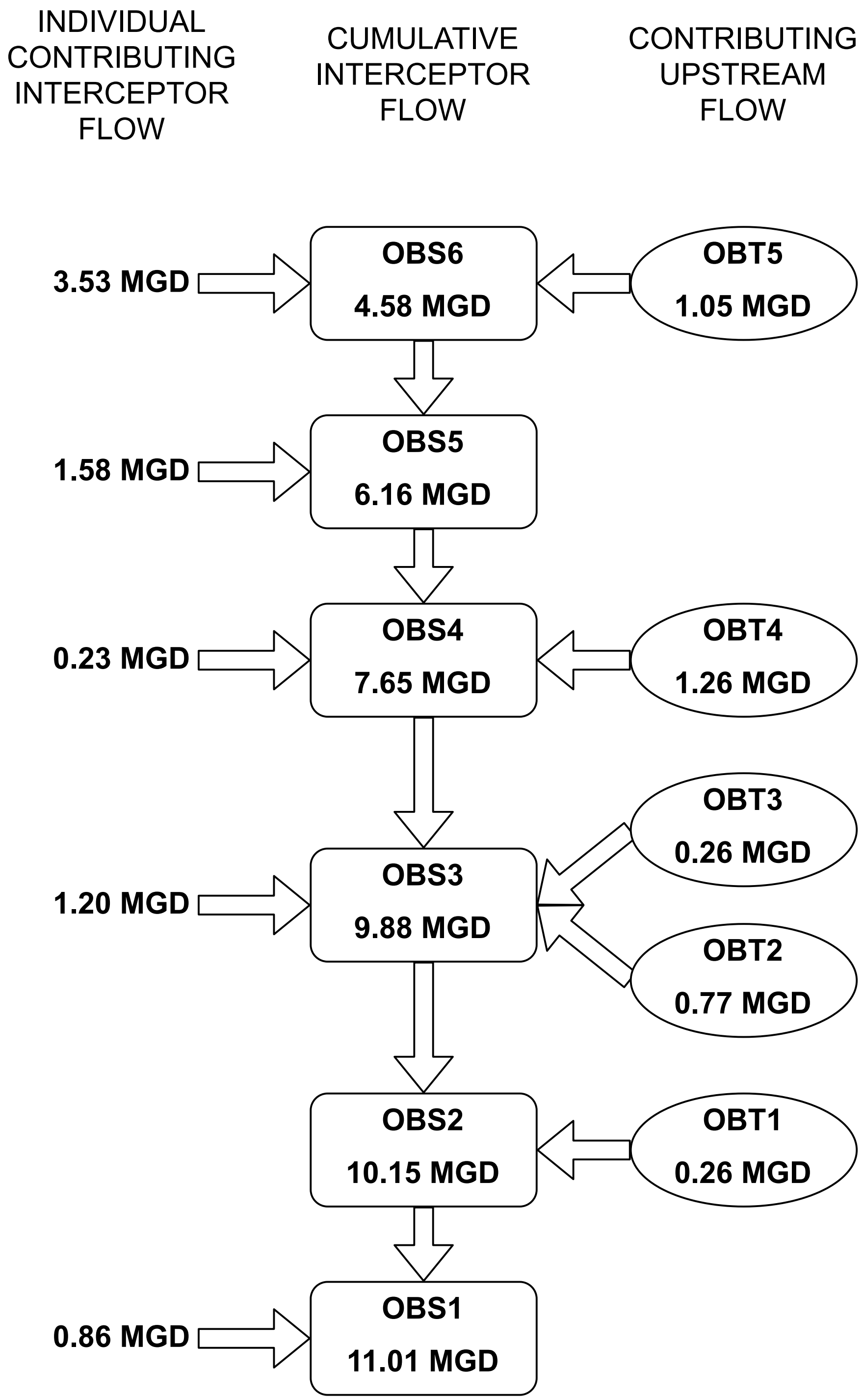
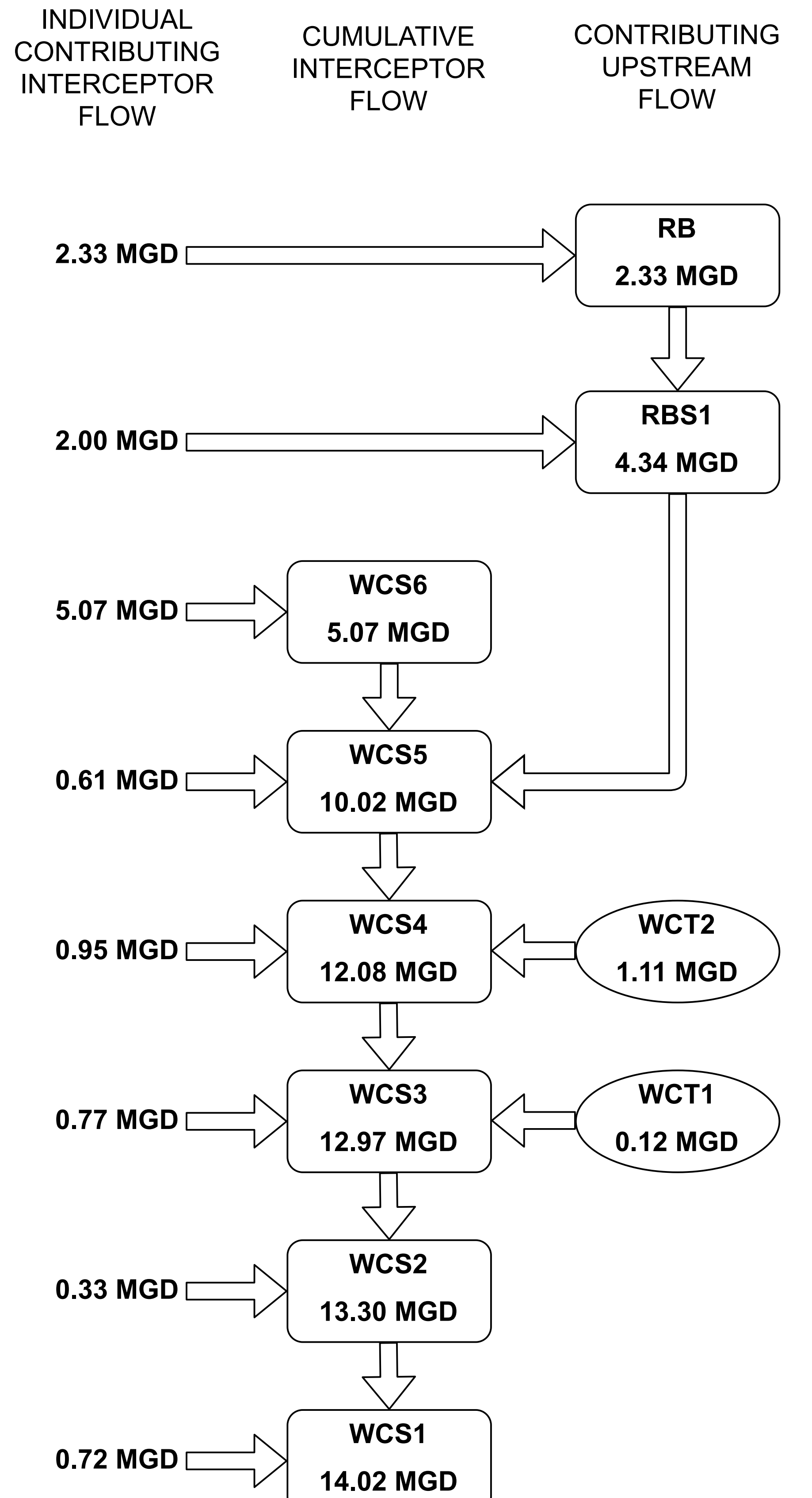
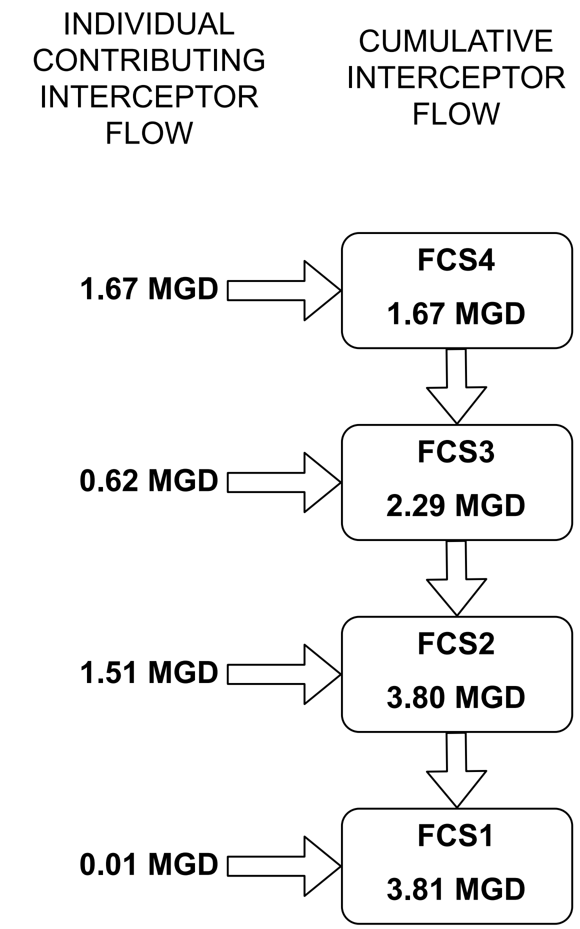
OWENS BRANCH INTERCEPTOR ULTIAMTE FLOW DIAGRAM



WILKERSON CREEK INTERCEPTOR ULTIMATE FLOW DIAGRAM



FIRST CREEK INTERCEPTOR ULTIMATE FLOW DIAGRAM



OBS 1

OWENS BRANCH SEGMENT 1	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.86
CUMULATIVE FLOW (MGD)	11.01
SIZE (IN)	30

PUMP STATIONS	
NAME	FLOW (MGD)
Cub Cadet	0.01

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	266.25	799	2157	0.22	0.86	Typical Residential

OBS 2

OWENS BRANCH SEGMENT 2	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.00
CUMULATIVE FLOW (MGD)	10.15
SIZE (IN)	30

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	0.00	0	0	0.00	0.00	Typical Residential

OBS 3

OWENS BRANCH SEGMENT 3	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.20
CUMULATIVE FLOW (MGD)	9.88
SIZE (IN)	30

PUMP STATIONS	
NAME	FLOW (MGD)
Big Harborview	0.54
Lakeview Drive	0.22
Bridgeport	0.10
Greyhawke #1	0.22
Greyhawke #2	0.13

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	0.00	0	0	0.00	0.00	Typical Residential

OBS 4

OWENS BRANCH SEGMENT 4	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.23
CUMULATIVE FLOW (MGD)	7.65
SIZE (IN)	18

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	67.02	201	543	0.05	0.23	Typical Residential

O
B
S
5

OWENS BRANCH SEGMENT 5	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.58
CUMULATIVE FLOW (MGD)	6.16
SIZE (IN)	18

PUMP STATIONS	
NAME	FLOW (MGD)
Rollins Landing	0.29
Rock Creek	0.25

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	309.78	929	2509	0.25	1.04	Typical Residential

O
B
S
6

OWENS BRANCH SEGMENT 6	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	3.53
CUMULATIVE FLOW (MGD)	4.58
SIZE (IN)	16

PUMP STATIONS	
NAME	FLOW (MGD)
Harbor Lakes	0.56
Diamond Crest	0.49
Wildflower	0.22

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	60.39	80	216	0.02	0.09	Defined Residential
	672.01	2016	5443	0.54	2.17	Typical Residential

O
B
T
1

OWENS BRANCH TRIB 1	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.26
CUMULATIVE FLOW (MGD)	0.26
SIZE (IN)	8

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	77.44	232	627	0.06	0.26	Typical Residential

O
B
T
2

OWENS BRANCH TRIB 2	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.77
CUMULATIVE FLOW (MGD)	0.77
SIZE (IN)	10

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	235.92	708	1911	0.19	0.77	Typical Residential

OBT3

OWENS BRANCH TRIB 3	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.26
CUMULATIVE FLOW (MGD)	0.26
SIZE (IN)	8

PUMP STATIONS	
NAME	FLOW (MGD)
Greyhawke #3	0.26

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	0.00	0	0	0.00	0.00	Typical Residential

OBT4

OWENS BRANCH TRIB 4	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.26
CUMULATIVE FLOW (MGD)	1.26
SIZE (IN)	10

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	402.69	1208	3262	0.33	1.26	Typical Residential

OBT5

OWENS BRANCH TRIB 5	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.05
CUMULATIVE FLOW (MGD)	1.05
SIZE (IN)	8

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	91.78	0	600	0.00	0.24	Commercial
	15.04	40	108	0.01	0.05	Defined Residential
	237.53	713	1924	0.19	0.77	Typical Residential

FCS1

FIRST CREEK SEGMENT 1	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.01
CUMULATIVE FLOW (MGD)	3.81
SIZE (IN)	21

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	34.33	5	14	0.00	0.01	Defined Residential
	0.00	0	0	0.00	0.00	Typical Residential

FCS2

FIRST CREEK SEGMENT 2	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.51
CUMULATIVE FLOW (MGD)	3.80
SIZE (IN)	18

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	210.24	0	1374	0.00	0.55	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	289.23	868	2343	0.23	0.96	Typical Residential

FCS3

FIRST CREEK SEGMENT 3	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.62
CUMULATIVE FLOW (MGD)	2.29
SIZE (IN)	18

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	193.01	579	1563	0.16	0.62	Typical Residential

FCS4

FIRST CREEK SEGMENT 4	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.67
CUMULATIVE FLOW (MGD)	1.67
SIZE (IN)	10

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	53.46	0	349	0.00	0.14	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	476.02	1428	3856	0.39	1.53	Typical Residential

WCS1

WILKERSON CREEK SEGMENT 1	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.72
CUMULATIVE FLOW (MGD)	14.02
SIZE (IN)	36

PUMP STATIONS	
NAME	FLOW (MGD)
Bridge Street	0.72

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	0.00	0	0	0.00	0.00	Typical Residential

W C S 2

WILKERSON CREEK SEGMENT 2	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.33
CUMULATIVE FLOW (MGD)	13.30
SIZE (IN)	36

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	100.97	303	818	0.08	0.33	Typical Residential

W C S 3

WILKERSON CREEK SEGMENT 3	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.77
CUMULATIVE FLOW (MGD)	12.97
SIZE (IN)	36

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	249.45	748	2021	0.20	0.77	Typical Residential

W C S 4

WILKERSON CREEK SEGMENT 4	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.95
CUMULATIVE FLOW (MGD)	12.08
SIZE (IN)	30

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	304.57	914	2467	0.25	0.95	Typical Residential

W C S 5

WILKERSON CREEK SEGMENT 5	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.61
CUMULATIVE FLOW (MGD)	10.02
SIZE (IN)	27

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	54.37	0	355	0.00	0.14	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	148.22	445	1201	0.12	0.47	Typical Residential

WCS6

WILKERSON CREEK SEGMENT 6	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	5.07
CUMULATIVE FLOW (MGD)	5.07
SIZE (IN)	21

PUMP STATIONS	
NAME	FLOW (MGD)
N/A	0.00

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	73.61	22	59	0.01	0.03	Defined Residential
	1875.42	4689	12659	1.27	3.61	Low Density Residential
	456.35	1369	3696	0.37	1.43	Typical Residential

WCT1

WILKERSON CREEK TRIB 1	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	0.12
CUMULATIVE FLOW (MGD)	0.12
SIZE (IN)	8

PUMP STATIONS	
NAME	FLOW (MGD)
Strawberry Hill	0.12

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	0.00	0	0	0.00	0.00	Typical Residential

WCT2

WILKERSON CREEK TRIB 2	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	1.11
CUMULATIVE FLOW (MGD)	1.11
SIZE (IN)	10

PUMP STATIONS	
NAME	FLOW (MGD)
Daycare	0.14

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	0.00	0	0	0.00	0.00	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	313.19	940	2537	0.25	0.96	Typical Residential

RBS1

ROCKY BRANCH SEGMENT 1	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	2.00
CUMULATIVE FLOW (MGD)	4.34
SIZE (IN)	21

PUMP STATIONS	
NAME	FLOW (MGD)
South Booster Design Capacity	1.73

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	44.02	0	288	0.00	0.12	Commercial
	89.60	12	32	0.00	0.01	Defined Residential
	43.52	131	353	0.04	0.15	Typical Residential

R B

ROCKY BRANCH	
INDIVIDUAL CONTRIBUTING FLOW (MGD)	2.33
CUMULATIVE FLOW (MGD)	2.33
SIZE (IN)	N/A

PUMP STATIONS	
NAME	FLOW (MGD)
Forest Oaks Subdivision	0.21

PARCELS						
FIELD	ACRES	RESIDENCES	POPULATION	MDNR FLOW (MGD)	MDNR PEAK FLOW (MGD)	CALCULATION TYPE
GIS Field	acres_calc	Residences	Population	MDNR_MGD	MDNRPK_MGD	Calc_Type
	118.55	0	775	0.00	0.31	Commercial
	0.00	0	0	0.00	0.00	Defined Residential
	548.17	1645	4440	0.44	1.82	Typical Residential

FDR SMITHVILLE missouri THRIVING AHEAD

ULTIMATE DEVELOPMENT PROPOSED SANITARY SEWER SIZING
CITY OF SMITHVILLE, MISSOURI
FIGURE D-1

Appendix E. Model Results

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Table E-1 - Calculated Peak Flows

Calculated Peak Flows			
Model Node Label	Existing Peak Flow (gpm)	10 Year Peak Flow (gpm)	Ultimate Peak Flow (gpm)
180th St	32	32	32
Big Harborview	169	375	375
Bridgeport	16	66	66
Bristol	112	-	-
Campground	95	95	-
Cedar Lakes 1	80	275	275
Cedar Lakes 2	81	180	180
Davenport Farms	-	129	678
Daycare	339	-	-
Diamond Crest	114	295	295
Diamond Crest West	-	70	70
Diversified Metal	50	-	-
Gerber Collision	44	11	11
Greyhawke 1	37	150	150
Greyhawke 2	86	90	90
Greyhawke 3	-	196	180
Harbor Lakes	114	162	162
Hills of Shannon	190	-	-
Influent	610	610	610
Lakeview Dr	120	155	155
McDonald's	574	-	-
Platte Valley	28	-	-
Rock Creek	46	68	68
Rollins Landing	145	179	179
Stone Bridge	74	-	-
Stone Creek Villas	19	30	30
Town-North	249	249	249.1
Town-South	398	398	398
Wildflower	146	309	309
Woods Court	63	105	105
Campground Interceptor	-	-	251
First Creek Segment 1	-	-	4
First Creek Segment 2	-	-	1048
First Creek Segment 3	-	-	430
First Creek Segment 4	-	-	1162
Owens Branch Segment 1	-	-	600
Owens Branch Segment 3	-	-	836
Owens Branch Segment 4	-	-	160
Owens Branch Segment 5	-	-	1094
Owens Branch Segment 6	-	-	2452
Owens Branch Segment 7	-	-	565
Owens Branch Tributary 1	-	-	183
Owens Branch Tributary 2	-	-	532
Owens Branch Tributary 3	-	-	180
Owens Branch Tributary 4	-	-	878
Rocky Branch	-	-	1621
Rocky Branch Segment 1	-	-	1392
Wilkerson Creek Segment 1	-	-	500
Wilkerson Creek Segment 2	-	-	232
Wilkerson Creek Segment 3	-	-	535
Wilkerson Creek Segment 4	-	-	661
Wilkerson Creek Segment 5	-	-	423
Wilkerson Creek Tributary 1	-	-	83
Wilkerson Creek Tributary 2	-	-	770
Wilkerson Creek Tributary 3	-	-	3521

UNIT HYDROGRAPH - EXISTING FLOWS

Diamond Crest			Wildflower			Woods Court			180th St			Greyhawke #2			Bridgeport			Influent			Hills of Shannon		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0410	28.4	0:15	0.0524	36.4	0:15	0.0226	15.7	0:15	0.0114	7.9	0:15	0.0308	21.4	0:15	0.0058	4.0	0:15	0.2195	152.4	0:15	0.0683	47.5
0:30	0.0819	56.9	0:30	0.1048	72.8	0:30	0.0452	31.4	0:30	0.0229	15.9	0:30	0.0616	42.8	0:30	0.0116	8.1	0:30	0.4390	304.9	0:30	0.1367	94.9
0:45	0.1229	85.3	0:45	0.1572	109.2	0:45	0.0678	47.1	0:45	0.0343	23.8	0:45	0.0925	64.2	0:45	0.0174	12.1	0:45	0.6585	457.3	0:45	0.2050	142.4
1:00	0.1638	113.8	**1:00**	0.2096	145.6	**1:00**	0.0904	62.8	**1:00**	0.0457	31.8	**1:00**	0.1233	85.6	**1:00**	0.0233	16.2	**1:00**	0.8780	609.7	**1:00**	0.2733	189.8
1:15	0.1604	111.4	1:15	0.2053	142.5	1:15	0.0885	61.5	1:15	0.0448	31.1	1:15	0.1207	83.8	1:15	0.0228	15.8	1:15	0.8597	597.0	1:15	0.2677	185.9
1:30	0.1570	109.0	1:30	0.2009	139.5	1:30	0.0866	60.2	1:30	0.0438	30.4	1:30	0.1182	82.0	1:30	0.0223	15.5	1:30	0.8414	584.3	1:30	0.2620	181.9
1:45	0.1536	106.7	1:45	0.1965	136.5	1:45	0.0848	58.9	1:45	0.0429	29.8	1:45	0.1156	80.3	1:45	0.0218	15.1	1:45	0.8231	571.6	1:45	0.2563	178.0
2:00	0.1502	104.3	2:00	0.1922	133.5	2:00	0.0829	57.5	2:00	0.0419	29.1	2:00	0.1130	78.5	2:00	0.0213	14.8	2:00	0.8049	558.9	2:00	0.2506	174.0
2:15	0.1468	101.9	2:15	0.1878	130.4	2:15	0.0810	56.2	2:15	0.0410	28.4	2:15	0.1104	76.7	2:15	0.0208	14.5	2:15	0.7866	546.2	2:15	0.2449	170.1
2:30	0.1433	99.5	2:30	0.1834	127.4	2:30	0.0791	54.9	2:30	0.0400	27.8	2:30	0.1079	74.9	2:30	0.0204	14.1	2:30	0.7683	533.5	2:30	0.2392	166.1
2:45	0.1399	97.2	2:45	0.1791	124.4	2:45	0.0772	53.6	2:45	0.0391	27.1	2:45	0.1053	73.1	2:45	0.0199	13.8	2:45	0.7500	520.8	2:45	0.2335	162.1
3:00	0.1365	94.8	3:00	0.1747	121.3	3:00	0.0753	52.3	3:00	0.0381	26.5	3:00	0.1027	71.3	3:00	0.0194	13.5	3:00	0.7317	508.1	3:00	0.2278	158.2
3:15	0.1331	92.4	3:15	0.1703	118.3	3:15	0.0735	51.0	3:15	0.0372	25.8	3:15	0.1002	69.6	3:15	0.0189	13.1	3:15	0.7134	495.4	3:15	0.2221	154.2
3:30	0.1297	90.1	3:30	0.1660	115.3	3:30	0.0716	49.7	3:30	0.0362	25.1	3:30	0.0976	67.8	3:30	0.0184	12.8	3:30	0.6951	482.7	3:30	0.2164	150.3
3:45	0.1263	87.7	3:45	0.1616	112.2	3:45	0.0697	48.4	3:45	0.0353	24.5	3:45	0.0950	66.0	3:45	0.0179	12.5	3:45	0.6768	470.0	3:45	0.2107	146.3
4:00	0.1229	85.3	4:00	0.1572	109.2	4:00	0.0678	47.1	4:00	0.0343	23.8	4:00	0.0925	64.2	4:00	0.0174	12.1	4:00	0.6585	457.3	4:00	0.2050	142.4
4:15	0.1195	83.0	4:15	0.1529	106.2	4:15	0.0659	45.8	4:15	0.0333	23.2	4:15	0.0899	62.4	4:15	0.0170	11.8	4:15	0.6402	444.6	4:15	0.1993	138.4
4:30	0.1160	80.6	4:30	0.1485	103.1	4:30	0.0640	44.5	4:30	0.0324	22.5	4:30	0.0873	60.6	4:30	0.0165	11.4	4:30	0.6219	431.9	4:30	0.1936	134.5
4:45	0.1126	78.2	4:45	0.1441	100.1	4:45	0.0622	43.2	4:45	0.0314	21.8	4:45	0.0848	58.9	4:45	0.0160	11.1	4:45	0.6036	419.2	4:45	0.1879	130.5
5:00	0.1092	75.8	5:00	0.1398	97.1	5:00	0.0603	41.9	5:00	0.0305	21.2	5:00	0.0822	57.1	5:00	0.0155	10.8	5:00	0.5854	406.5	5:00	0.1822	126.5
5:15	0.1058	73.5	5:15	0.1354	94.0	5:15	0.0584	40.5	5:15	0.0295	20.5	5:15	0.0796	55.3	5:15	0.0150	10.4	5:15	0.5671	393.8	5:15	0.1765	122.6
5:30	0.1024	71.1	5:30	0.1310	91.0	5:30	0.0565	39.2	5:30	0.0286	19.8	5:30	0.0771	53.5	5:30	0.0145	10.1	5:30	0.5488	381.1	5:30	0.1708	118.6
5:45	0.0990	68.7	5:45	0.1267	88.0	5:45	0.0546	37.9	5:45	0.0276	19.2	5:45	0.0745	51.7	5:45	0.0141	9.8	5:45	0.5305	368.4	5:45	0.1651	114.7
6:00	0.0956	66.4	6:00	0.1223	84.9	6:00	0.0527	36.6	6:00	0.0267	18.5	6:00	0.0719	49.9	6:00	0.0136	9.4	6:00	0.5122	355.7	6:00	0.1595	110.7
6:15	0.0922	64.0	6:15	0.1179	81.9	6:15	0.0509	35.3	6:15	0.0257	17.9	6:15	0.0693	48.2	6:15	0.0131	9.1	6:15	0.4939	343.0	6:15	0.1538	106.8
6:30	0.0887	61.6	6:30	0.1136	78.9	6:30	0.0490	34.0	6:30	0.0248	17.2	6:30	0.0668	46.4	6:30	0.0126	8.8	6:30	0.4756	330.3	6:30	0.1481	102.8
6:45	0.0853	59.3	6:45	0.1092	75.8	6:45	0.0471	32.7	6:45	0.0238	16.5	6:45	0.0642	44.6	6:45	0.0121	8.4	6:45	0.4573	317.6	6:45	0.1424	98.9
7:00	0.0819	56.9	7:00	0.1048	72.8	7:00	0.0452	31.4	7:00	0.0229	15.9	7:00	0.0616	42.8	7:00	0.0116	8.1	7:00	0.4390	304.9	7:00	0.1367	94.9
7:15	0.0785	54.5	7:15	0.1005	69.8	7:15	0.0433	30.1	7:15	0.0219	15.2	7:15	0.0591	41.0	7:15	0.0111	7.7	7:15	0.4207	292.2	7:15	0.1310	91.0
7:30	0.0751	52.1	7:30	0.0961	66.7	7:30	0.0414	28.8	7:30	0.0210	14.6	7:30	0.0565	39.2	7:30	0.0107	7.4	7:30	0.4024	279.5	7:30	0.1253	87.0
7:45	0.0717	49.8	7:45	0.0917	63.7	7:45	0.0396	27.5	7:45	0.0200	13.9	7:45	0.0539	37.5	7:45	0.0102	7.1	7:45	0.3841	266.8	7:45	0.1196	83.0
8:00	0.0683	47.4	8:00	0.0873	60.7	8:00	0.0377	26.2	8:00	0.0191	13.2	8:00	0.0514	35.7	8:00	0.0097	6.7	8:00	0.3658	254.1	8:00	0.1139	79.1
8:15	0.0648	45.0	8:15	0.0830	57.6	8:15	0.0358	24.9	8:15	0.0181	12.6	8:15	0.0488	33.9	8:15	0.0092	6.4	8:15	0.3476	241.4	8:15	0.1082	75.1
8:30	0.0614	42.7	8:30	0.0786	54.6	8:30	0.0339	23.5	8:30	0.0171	11.9	8:30	0.0462	32.1	8:30	0.0087	6.1	8:30	0.3293	228.7	8:30	0.1025	71.2
8:45	0.0580	40.3	8:45	0.0742	51.6	8:45	0.0320	22.2	8:45	0.0162	11.2	8:45	0.0437	30.3	8:45	0.0082	5.7	8:45	0.3110	215.9	8:45	0.0968	67.2
9:00	0.0546	37.9	9:00	0.0699	48.5	9:00	0.0301	20.9	9:00	0.0152	10.6	9:00	0.0411	28.5	9:00	0.0078	5.4	9:00	0.2927	203.2	9:00	0.0911	63.3
9:15	0.0512	35.6	9:15	0.0655	45.5	9:15	0.0283	19.6	9:15	0.0143	9.9	9:15	0.0385	26.8	9:15	0.0073	5.0	9:15	0.2744	190.5	9:15	0.0854	59.3
9:30	0.0478	33.2	9:30	0.0611	42.5	9:30	0.0264	18.3	9:30	0.0133	9.3	9:30	0.0360	25.0	9:30	0.0068	4.7	9:30	0.2561	177.8	9:30	0.0797	55.4
9:45	0.0444	30.8	9:45	0.0568	39.4	9:45	0.0245	17.0	9:45	0.0124	8.6	9:45	0.0334	23.2	9:45	0.0063	4.4	9:45	0.2378	165.1	9:45	0.0740	51.4
10:00	0.0410	28.4	10:00	0.0524	36.4	10:00	0.0226	15.7	10:00	0.0114	7.9	10:00	0.0308	21.4	10:00	0.0058	4.0	10:00	0.2195	152.4	10:00	0.0683	47.5
10:15	0.0375	26.1	10:15	0.0480	33.4	10:15	0.0207	14.4	10:15	0.0105	7.3	10:15	0.0283	19.6	10:15	0.0053	3.7	10:15	0.2012	139.7	10:15	0.0626	43.5
10:30	0.0341	23.7	10:30	0.0437	30.3	10:30	0.0188	13.1	10:30	0.0095	6.6	10:30	0.0257	17.8	10:30	0.0048	3.4	10:30	0.1829	127.0	10:30	0.0569	39.5
10:45	0.0307	21.3	10:45	0.0393	27.3	10:45	0.0170	11.8	10:45	0.0086	6.0	10:45	0.0231	16.1	10:45	0.0044	3.0	10:45	0.1646	114.3	10:45	0.0513	35.6
11:00	0.0273	19.0	11:00	0.0349	24.3	11:00	0.0151	10.5	11:00	0.0076	5.3	11:00	0.0205	14.3	11:00	0.0039	2.7	11:00	0.1463	101.6	11:00	0.0456	31.6
11:15	0.0239	16.6	11:15	0.0306	21.2	11:15	0.0132	9.2	11:15	0.0067	4.6	11:15	0.0180	12.5	11:15	0.0034	2.4	11:15	0.1280	88.9	11:15	0.0399	27.7
11:30	0.0205	14.2	11:30	0.0262	18.2	11:30	0.0113	7.8	11:30	0.0057	4.0	11:30	0.0154	10.7	11:30	0.0029	2.0	11:30	0.1098	76.2	11:30	0.0342	23.7
11:45	0.0171	11.9	11:45	0.0218	15.2	11:45	0.0094	6.5	11:45	0.0048	3.3	11:45	0.0128	8.9	11:45	0.0024	1.7	11:45	0.0915	63.5	11:45	0.0285	19.8
12:00	0.0137	9.5	12:00	0.0175	12.1	12:00	0.0075	5.2	12:00	0.0038	2.6	12:00	0.0103	7.1	12:00	0.0019	1.3	12:00	0.0732	50.8	12:00	0.0228	15.8
12:15	0.0102	7.1	12:15	0.0131	9.1	12:15	0.0057	3.9	12:15	0.0029	2.0	12:15	0.0077	5.4	12:15	0.0015	1.0	12:15	0.0549	38.1	12:15	0.0171	11.9
12:30	0.0068	4.7	12:30	0.0087	6.1	12:30	0.0038	2.6	12:30	0.0019	1.3	12:30	0.0051	3.6	12:30	0.0010	0.7	12:30	0.0366	25.4	12:30	0.0114	7.9
12:45	0.0034	2.4	12:45	0.0044	3.0	12:45	0.0019	1.3	12:45	0.0010	0.7	12:45	0.0026	1.8	12:45	0.0005	0.3	12:45	0.0183	12.7	12:45	0.0057	4.0
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - EXISTING FLOWS																										
Stone Bridge			Cedar Lakes 2			Cedar Lakes 1			Stone Creek Villas			Greyhawke #1			Lakeview Drive			Big Harborview			Rollins Landing			Rock Creek		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0266	18.5	0:15	0.0292	20.3	0:15	0.0287	19.9	0:15	0.0070	4.8	0:15	0.0134	9.3	0:15	0.0433	30.0	0:15	0.0609	42.3	0:15	0.0522	36.2	0:15	0.0167	11.6
0:30	0.0532	36.9	0:30	0.0585	40.6	0:30	0.0574	39.9	0:30	0.0139	9.7	0:30	0.0267	18.6	0:30	0.0865	60.1	0:30	0.1218	84.6	0:30	0.1043	72.4	0:30	0.0333	23.1
0:45	0.0798	55.4	0:45	0.0877	60.9	0:45	0.0861	59.8	0:45	0.0209	14.5	0:45	0.0401	27.9	0:45	0.1298	90.1	0:45	0.1828	126.9	0:45	0.1565	108.7	0:45	0.0500	34.7
1:00	0.1064	73.9	**1:00**	0.1170	81.2	**1:00**	0.1149	79.8	**1:00**	0.0278	19.3	**1:00**	0.0535	37.1	**1:00**	0.1731	120.2	**1:00**	0.2437	169.2	**1:00**	0.2086	144.9	**1:00**	0.0666	46.3
1:15	0.1042	72.3	1:15	0.1145	79.5	1:15	0.1125	78.1	1:15	0.0272	18.9	1:15	0.0524	36.4	1:15	0.1695	117.7	1:15	0.2386	165.7	1:15	0.2043	141.9	1:15	0.0652	45.3
1:30	0.1020	70.8	1:30	0.1121	77.8	1:30	0.1101	76.4	1:30	0.0266	18.5	1:30	0.0512	35.6	1:30	0.1659	115.2	1:30	0.2335	162.2	1:30	0.1999	138.8	1:30	0.0639	44.3
1:45	0.0997	69.3	1:45	0.1097	76.2	1:45	0.1077	74.8	1:45	0.0261	18.1	1:45	0.0501	34.8	1:45	0.1622	112.7	1:45	0.2284	158.6	1:45	0.1956	135.8	1:45	0.0625	43.4
2:00	0.0975	67.7	2:00	0.1072	74.5	2:00	0.1053	73.1	2:00	0.0255	17.7	2:00	0.0490	34.0	2:00	0.1586	110.2	2:00	0.2234	155.1	2:00	0.1912	132.8	2:00	0.0611	42.4
2:15	0.0953	66.2	2:15	0.1048	72.8	2:15	0.1029	71.5	2:15	0.0249	17.3	2:15	0.0479	33.3	2:15	0.1550	107.7	2:15	0.2183	151.6	2:15	0.1869	129.8	2:15	0.0597	41.4
2:30	0.0931	64.7	2:30	0.1024	71.1	2:30	0.1005	69.8	2:30	0.0243	16.9	2:30	0.0468	32.5	2:30	0.1514	105.2	2:30	0.2132	148.1	2:30	0.1826	126.8	2:30	0.0583	40.5
2:45	0.0909	63.1	2:45	0.0999	69.4	2:45	0.0981	68.1	2:45	0.0237	16.5	2:45	0.0457	31.7	2:45	0.1478	102.7	2:45	0.2081	144.5	2:45	0.1782	123.8	2:45	0.0569	39.5
3:00	0.0887	61.6	3:00	0.0975	67.7	3:00	0.0957	66.5	3:00	0.0232	16.1	3:00	0.0446	30.9	3:00	0.1442	100.2	3:00	0.2031	141.0	3:00	0.1739	120.7	3:00	0.0555	38.6
3:15	0.0864	60.0	3:15	0.0950	66.0	3:15	0.0933	64.8	3:15	0.0226	15.7	3:15	0.0434	30.2	3:15	0.1406	97.6	3:15	0.1980	137.5	3:15	0.1695	117.7	3:15	0.0541	37.6
3:30	0.0842	58.5	3:30	0.0926	64.3	3:30	0.0909	63.1	3:30	0.0220	15.3	3:30	0.0423	29.4	3:30	0.1370	95.1	3:30	0.1929	134.0	3:30	0.1652	114.7	3:30	0.0527	36.6
3:45	0.0820	57.0	3:45	0.0902	62.6	3:45	0.0885	61.5	3:45	0.0214	14.9	3:45	0.0412	28.6	3:45	0.1334	92.6	3:45	0.1878	130.4	3:45	0.1608	111.7	3:45	0.0514	35.7
4:00	0.0798	55.4	4:00	0.0877	60.9	4:00	0.0861	59.8	4:00	0.0209	14.5	4:00	0.0401	27.9	4:00	0.1298	90.1	4:00	0.1828	126.9	4:00	0.1565	108.7	4:00	0.0500	34.7
4:15	0.0776	53.9	4:15	0.0853	59.2	4:15	0.0838	58.2	4:15	0.0203	14.1	4:15	0.0390	27.1	4:15	0.1262	87.6	4:15	0.1777	123.4	4:15	0.1521	105.6	4:15	0.0486	33.7
4:30	0.0754	52.3	4:30	0.0829	57.5	4:30	0.0814	56.5	4:30	0.0197	13.7	4:30	0.0379	26.3	4:30	0.1226	85.1	4:30	0.1726	119.9	4:30	0.1478	102.6	4:30	0.0472	32.8
4:45	0.0731	50.8	4:45	0.0804	55.8	4:45	0.0790	54.8	4:45	0.0191	13.3	4:45	0.0368	25.5	4:45	0.1190	82.6	4:45	0.1675	116.3	4:45	0.1434	99.6	4:45	0.0458	31.8
5:00	0.0709	49.3	5:00	0.0780	54.2	5:00	0.0766	53.2	5:00	0.0185	12.9	5:00	0.0356	24.8	5:00	0.1154	80.1	5:00	0.1625	112.8	5:00	0.1391	96.6	5:00	0.0444	30.8
5:15	0.0687	47.7	5:15	0.0755	52.5	5:15	0.0742	51.5	5:15	0.0180	12.5	5:15	0.0345	24.0	5:15	0.1118	77.6	5:15	0.1574	109.3	5:15	0.1347	93.6	5:15	0.0430	29.9
5:30	0.0665	46.2	5:30	0.0731	50.8	5:30	0.0718	49.9	5:30	0.0174	12.1	5:30	0.0334	23.2	5:30	0.1082	75.1	5:30	0.1523	105.8	5:30	0.1304	90.6	5:30	0.0416	28.9
5:45	0.0643	44.6	5:45	0.0707	49.1	5:45	0.0694	48.2	5:45	0.0168	11.7	5:45	0.0323	22.4	5:45	0.1046	72.6	5:45	0.1472	102.2	5:45	0.1260	87.5	5:45	0.0403	28.0
6:00	0.0621	43.1	6:00	0.0682	47.4	6:00	0.0670	46.5	6:00	0.0162	11.3	6:00	0.0312	21.7	6:00	0.1010	70.1	6:00	0.1421	98.7	6:00	0.1217	84.5	6:00	0.0389	27.0
6:15	0.0598	41.6	6:15	0.0658	45.7	6:15	0.0646	44.9	6:15	0.0156	10.9	6:15	0.0301	20.9	6:15	0.0973	67.6	6:15	0.1371	95.2	6:15	0.1174	81.5	6:15	0.0375	26.0
6:30	0.0576	40.0	6:30	0.0634	44.0	6:30	0.0622	43.2	6:30	0.0151	10.5	6:30	0.0290	20.1	6:30	0.0937	65.1	6:30	0.1320	91.7	6:30	0.1130	78.5	6:30	0.0361	25.1
6:45	0.0554	38.5	6:45	0.0609	42.3	6:45	0.0598	41.5	6:45	0.0145	10.1	6:45	0.0279	19.3	6:45	0.0901	62.6	6:45	0.1269	88.1	6:45	0.1087	75.5	6:45	0.0347	24.1
7:00	0.0532	36.9	7:00	0.0585	40.6	7:00	0.0574	39.9	7:00	0.0139	9.7	7:00	0.0267	18.6	7:00	0.0865	60.1	7:00	0.1218	84.6	7:00	0.1043	72.4	7:00	0.0333	23.1
7:15	0.0510	35.4	7:15	0.0560	38.9	7:15	0.0550	38.2	7:15	0.0133	9.3	7:15	0.0256	17.8	7:15	0.0829	57.6	7:15	0.1168	81.1	7:15	0.1000	69.4	7:15	0.0319	22.2
7:30	0.0488	33.9	7:30	0.0536	37.2	7:30	0.0526	36.6	7:30	0.0127	8.8	7:30	0.0245	17.0	7:30	0.0793	55.1	7:30	0.1117	77.6	7:30	0.0956	66.4	7:30	0.0305	21.2
7:45	0.0465	32.3	7:45	0.0512	35.5	7:45	0.0503	34.9	7:45	0.0122	8.4	7:45	0.0234	16.2	7:45	0.0757	52.6	7:45	0.1066	74.0	7:45	0.0913	63.4	7:45	0.0291	20.2
8:00	0.0443	30.8	8:00	0.0487	33.8	8:00	0.0479	33.2	8:00	0.0116	8.0	8:00	0.0223	15.5	8:00	0.0721	50.1	8:00	0.1015	70.5	8:00	0.0869	60.4	8:00	0.0278	19.3
8:15	0.0421	29.2	8:15	0.0463	32.2	8:15	0.0455	31.6	8:15	0.0110	7.6	8:15	0.0212	14.7	8:15	0.0685	47.6	8:15	0.0965	67.0	8:15	0.0826	57.3	8:15	0.0264	18.3
8:30	0.0399	27.7	8:30	0.0439	30.5	8:30	0.0431	29.9	8:30	0.0104	7.2	8:30	0.0201	13.9	8:30	0.0649	45.1	8:30	0.0914	63.5	8:30	0.0782	54.3	8:30	0.0250	17.4
8:45	0.0377	26.2	8:45	0.0414	28.8	8:45	0.0407	28.3	8:45	0.0098	6.8	8:45	0.0189	13.2	8:45	0.0613	42.6	8:45	0.0863	59.9	8:45	0.0739	51.3	8:45	0.0236	16.4
9:00	0.0355	24.6	9:00	0.0390	27.1	9:00	0.0383	26.6	9:00	0.0093	6.4	9:00	0.0178	12.4	9:00	0.0577	40.1	9:00	0.0812	56.4	9:00	0.0695	48.3	9:00	0.0222	15.4
9:15	0.0332	23.1	9:15	0.0366	25.4	9:15	0.0359	24.9	9:15	0.0087	6.0	9:15	0.0167	11.6	9:15	0.0541	37.6	9:15	0.0761	52.9	9:15	0.0652	45.3	9:15	0.0208	14.5
9:30	0.0310	21.6	9:30	0.0341	23.7	9:30	0.0335	23.3	9:30	0.0081	5.6	9:30	0.0156	10.8	9:30	0.0505	35.1	9:30	0.0711	49.4	9:30	0.0609	42.3	9:30	0.0194	13.5
9:45	0.0288	20.0	9:45	0.0317	22.0	9:45	0.0311	21.6	9:45	0.0075	5.2	9:45	0.0145	10.1	9:45	0.0469	32.5	9:45	0.0660	45.8	9:45	0.0565	39.2	9:45	0.0180	12.5
10:00	0.0266	18.5	10:00	0.0292	20.3	10:00	0.0287	19.9	10:00	0.0070	4.8	10:00	0.0134	9.3	10:00	0.0433	30.0	10:00	0.0609	42.3	10:00	0.0522	36.2	10:00	0.0167	11.6
10:15	0.0244	16.9	10:15	0.0268	18.6	10:15	0.0263	18.3	10:15	0.0064	4.4	10:15	0.0123	8.5	10:15	0.0397	27.5	10:15	0.0558	38.8	10:15	0.0478	33.2	10:15	0.0153	10.6
10:30	0.0222	15.4	10:30	0.0244	16.9	10:30	0.0239	16.6	10:30	0.0058	4.0	10:30	0.0111	7.7	10:30	0.0361	25.0	10:30	0.0508	35.3	10:30	0.0435	30.2	10:30	0.0139	9.6
10:45	0.0199	13.9	10:45	0.0219	15.2	10:45	0.0215	15.0	10:45	0.0052	3.6	10:45	0.0100	7.0	10:45	0.0324	22.5	10:45	0.0457	31.7	10:45	0.0391	27.2	10:45	0.0125	8.7
11:00	0.0177	12.3	11:00	0.0195	13.5	11:00	0.0191	13.3	11:00	0.0046	3.2	11:00	0.0089	6.2	11:00	0.0288	20.0	11:00	0.0406	28.2	11:00	0.0348	24.1	11:00	0.0111	7.7
11:15	0.0155	10.8	11:15	0.0171	11.8	11:15	0.0168	11.6	11:15	0.0041	2.8	11:15	0.0078	5.4	11:15	0.0252	17.5	11:15	0.0355	24.7	11:15	0.0304	21.1	11:15	0.0097	6.7
11:30	0.0133	9.2	11:30	0.0146	10.2	11:30	0.0144	10.0	11:30	0.0035	2.4	11:30	0.0067	4.6	11:30	0.0216	15.0	11:30	0.0305	21.2	11:30	0.0261	18.1	11:30	0.0083	5.8
11:45	0.0111	7.7	11:45	0.0122	8.5	11:45	0.0120	8.3	11:45	0.0029	2.0	11:45	0.0056	3.9	11:45	0.0180	12.5	11:45	0.0254	17.6	11:45	0.0217	15.1	11:45	0.0069	4.8
12:00	0.0089	6.2	12:00	0.0097	6.8	12:00	0.0096	6.6	12:00	0.0023	1.6	12:00	0.0045	3.1	12:00	0.0144	10.0	12:00	0.0203	14.1	12:00	0.0174	12.1	12:00	0.0056	3.9
12:15	0.0066	4.6	12:15	0.0073	5.1	12:15	0.0072	5.0	12:15	0.0017	1.2	12:15	0.0033	2.3	12:15	0.0108	7.5	12:15	0.0152	10.6	12:15	0.0130	9.1	12:15	0.0042	2.9
12:30	0.0044	3.1	12:30	0.0049	3.4	12:30	0.0048	3.3	12:30	0.0012	0.8	12:30	0.0022	1.5	12:30	0.0072	5.0	12:30	0.0102	7.1	12:30	0.0087	6.0	12:30	0.0028	1.9
12:45	0.0022	1.5	12:45	0.0024	1.7	12:45	0.0024	1.7	12:45	0.0006	0.4	12:45	0.0011	0.8	12:45	0.0036	2.5	12:45	0.0051	3.5	12:45	0.0043	3.0	12:45	0.0014	1.0
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - EXISTING FLOWS

Harbor Lakes		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0410	28.4
0:30	0.0819	56.9
0:45	0.1229	85.3
1:00	0.1638	113.8
1:15	0.1604	111.4
1:30	0.1570	109.0
1:45	0.1536	106.7
2:00	0.1502	104.3
2:15	0.1468	101.9
2:30	0.1433	99.5
2:45	0.1399	97.2
3:00	0.1365	94.8
3:15	0.1331	92.4
3:30	0.1297	90.1
3:45	0.1263	87.7
4:00	0.1229	85.3
4:15	0.1195	83.0
4:30	0.1160	80.6
4:45	0.1126	78.2
5:00	0.1092	75.8
5:15	0.1058	73.5
5:30	0.1024	71.1
5:45	0.0990	68.7
6:00	0.0956	66.4
6:15	0.0922	64.0
6:30	0.0887	61.6
6:45	0.0853	59.3
7:00	0.0819	56.9
7:15	0.0785	54.5
7:30	0.0751	52.1
7:45	0.0717	49.8
8:00	0.0683	47.4
8:15	0.0648	45.0
8:30	0.0614	42.7
8:45	0.0580	40.3
9:00	0.0546	37.9
9:15	0.0512	35.6
9:30	0.0478	33.2
9:45	0.0444	30.8
10:00	0.0410	28.4
10:15	0.0375	26.1
10:30	0.0341	23.7
10:45	0.0307	21.3
11:00	0.0273	19.0
11:15	0.0239	16.6
11:30	0.0205	14.2
11:45	0.0171	11.9
12:00	0.0137	9.5
12:15	0.0102	7.1
12:30	0.0068	4.7
12:45	0.0034	2.4
13:00	0.0000	0.0

Bristol		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0402	27.9
0:30	0.0804	55.8
0:45	0.1206	83.7
1:00	0.1607	111.6
1:15	0.1574	109.3
1:30	0.1540	107.0
1:45	0.1507	104.6
2:00	0.1473	102.3
2:15	0.1440	100.0
2:30	0.1406	97.7
2:45	0.1373	95.3
3:00	0.1339	93.0
3:15	0.1306	90.7
3:30	0.1272	88.4
3:45	0.1239	86.0
4:00	0.1206	83.7
4:15	0.1172	81.4
4:30	0.1139	79.1
4:45	0.1105	76.7
5:00	0.1072	74.4
5:15	0.1038	72.1
5:30	0.1005	69.8
5:45	0.0971	67.4
6:00	0.0938	65.1
6:15	0.0904	62.8
6:30	0.0871	60.5
6:45	0.0837	58.1
7:00	0.0804	55.8
7:15	0.0770	53.5
7:30	0.0737	51.2
7:45	0.0703	48.8
8:00	0.0670	46.5
8:15	0.0636	44.2
8:30	0.0603	41.9
8:45	0.0569	39.5
9:00	0.0536	37.2
9:15	0.0502	34.9
9:30	0.0469	32.6
9:45	0.0435	30.2
10:00	0.0402	27.9
10:15	0.0368	25.6
10:30	0.0335	23.3
10:45	0.0301	20.9
11:00	0.0268	18.6
11:15	0.0234	16.3
11:30	0.0201	14.0
11:45	0.0167	11.6
12:00	0.0134	9.3
12:15	0.0100	7.0
12:30	0.0067	4.7
12:45	0.0033	2.3
13:00	0.0000	0.0

McDonald's		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.2067	143.5
0:30	0.4134	287.1
0:45	0.6200	430.6
1:00	0.8267	574.1
1:15	0.8095	562.2
1:30	0.7923	550.2
1:45	0.7751	538.2
2:00	0.7578	526.3
2:15	0.7406	514.3
2:30	0.7234	502.3
2:45	0.7062	490.4
3:00	0.6889	478.4
3:15	0.6717	466.5
3:30	0.6545	454.5
3:45	0.6373	442.5
4:00	0.6200	430.6
4:15	0.6028	418.6
4:30	0.5856	406.7
4:45	0.5684	394.7
5:00	0.5511	382.7
5:15	0.5339	370.8
5:30	0.5167	358.8
5:45	0.4995	346.9
6:00	0.4823	334.9
6:15	0.4650	322.9
6:30	0.4478	311.0
6:45	0.4306	299.0
7:00	0.4134	287.1
7:15	0.3961	275.1
7:30	0.3789	263.1
7:45	0.3617	251.2
8:00	0.3445	239.2
8:15	0.3272	227.3
8:30	0.3100	215.3
8:45	0.2928	203.3
9:00	0.2756	191.4
9:15	0.2584	179.4
9:30	0.2411	167.4
9:45	0.2239	155.5
10:00	0.2067	143.5
10:15	0.1895	131.6
10:30	0.1722	119.6
10:45	0.1550	107.6
11:00	0.1378	95.7
11:15	0.1206	83.7
11:30	0.1033	71.8
11:45	0.0861	59.8
12:00	0.0689	47.8
12:15	0.0517	35.9
12:30	0.0344	23.9
12:45	0.0172	12.0
13:00	0.0000	0.0

Diversified Metal		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0180	12.5
0:30	0.0360	25.0
0:45	0.0540	37.5
1:00	0.0720	50.0
1:15	0.0705	49.0
1:30	0.0690	47.9
1:45	0.0675	46.9
2:00	0.0660	45.8
2:15	0.0645	44.8
2:30	0.0630	43.8
2:45	0.0615	42.7
3:00	0.0600	41.7
3:15	0.0585	40.6
3:30	0.0570	39.6
3:45	0.0555	38.5
4:00	0.0540	37.5
4:15	0.0525	36.5
4:30	0.0510	35.4
4:45	0.0495	34.4
5:00	0.0480	33.3
5:15	0.0465	32.3
5:30	0.0450	31.3
5:45	0.0435	30.2
6:00	0.0420	29.2
6:15	0.0405	28.1
6:30	0.0390	27.1
6:45	0.0375	26.0
7:00	0.0360	25.0
7:15	0.0345	24.0
7:30	0.0330	22.9
7:45	0.0315	21.9
8:00	0.0300	20.8
8:15	0.0285	19.8
8:30	0.0270	18.8
8:45	0.0255	17.7
9:00	0.0240	16.7
9:15	0.0225	15.6
9:30	0.0210	14.6
9:45	0.0195	13.5
10:00	0.0180	12.5
10:15	0.0165	11.5
10:30	0.0150	10.4
10:45	0.0135	9.4
11:00	0.0120	8.3
11:15	0.0105	7.3
11:30	0.0090	6.3
11:45	0.0075	5.2
12:00	0.0060	4.2
12:15	0.0045	3.1
12:30	0.0030	2.1
12:45	0.0015	1.0
13:00	0.0000	0.0

Platte Valley		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0100	6.9
0:30	0.0200	13.9
0:45	0.0300	20.8
1:00	0.0400	27.8
1:15	0.0392	27.2
1:30	0.0383	26.6
1:45	0.0375	26.0
2:00	0.0367	25.5
2:15	0.0358	24.9
2:30	0.0350	24.3
2:45	0.0342	23.7
3:00	0.0333	23.1
3:15	0.0325	22.6
3:30	0.0317	22.0
3:45	0.0308	21.4
4:00	0.0300	20.8
4:15	0.0292	20.3
4:30	0.0283	19.7
4:45	0.0275	19.1
5:00	0.0267	18.5
5:15	0.0258	17.9
5:30	0.0250	17.4
5:45	0.0242	16.8
6:00	0.0233	16.2
6:15	0.0225	15.6
6:30	0.0217	15.0
6:45	0.0208	14.5
7:00	0.0200	13.9
7:15	0.0192	13.3
7:30	0.0183	12.7
7:45	0.0175	12.2
8:00	0.0167	11.6
8:15	0.0158	11.0
8:30	0.0150	10.4
8:45	0.0142	9.8
9:00	0.0133	9.3
9:15	0.0125	8.7
9:30	0.0117	8.1
9:45	0.0108	7.5
10:00	0.0100	6.9
10:15	0.0092	6.4
10:30	0.0083	5.8
10:45	0.0075	5.2
11:00	0.0067	4.6
11:15	0.0058	4.1
11:30	0.0050	3.5
11:45	0.0042	2.9
12:00	0.0033	2.3
12:15	0.0025	1.7
12:30	0.0017	1.2
12:45	0.0008	0.6
13:00	0.0000	0.0

Gerber Collision		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0160	11.1
0:30	0.0320	22.2
0:45	0.0480	33.3
1:00	0.0640	44.4
1:15	0.0627	43.5
1:30	0.0613	42.6
1:45	0.0600	41.7
2:00	0.0587	40.7
2:15	0.0573	39.8
2:30	0.0560	38.9
2:45	0.0547	38.0
3:00	0.0533	37.0
3:15	0.0520	36.1
3:30	0.0507	35.2
3:45	0.0493	34.3
4:00	0.0480	33.3
4:15	0.0467	32.4
4:30	0.0453	31.5
4:45	0.0440	30.6
5:00	0.0427	29.6
5:15	0.0413	28.7
5:30	0.0400	27.8
5:45	0.0387	26.9
6:00	0.0373	25.9
6:15	0.0360	25.0
6:30	0.0347	24.1
6:45	0.0333	23.1
7:00	0.0320	22.2
7:15	0.0307	21.3
7:30	0.0293	20.4
7:45	0.0280	19.4
8:00	0.0267	18.5
8:15	0.0253	17.6
8:30	0.0240	16.7
8:45	0.0227	15.7
9:00	0.0213	14.8
9:15	0.0200	13.9
9:30	0.0187	13.0
9:45	0.0173	12.0
10:00	0.0160	11.1
10:15	0.0147	10.2
10:30	0.0133	9.3
10:45	0.0120	8.3
11:00	0.0107	7.4
11:15	0.0093	6.5
11:30	0.0080	5.6
11:45	0.0067	4.6
12:00	0.0053	3.7
12:15	0.0040	2.8
12:30	0.0027	1.9
12:45	0.0013	0.9
13:00	0.0000	0.0

Daycare		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1220	84.8
0:30	0.2441	169.5
0:45	0.3661	254.3
1:00	0.4882	339.0
1:15	0.4780	331.9
1:30	0.4678	324.9
1:45	0.4577	317.8
2:00	0.4475	310.8
2:15	0.4373	303.7
2:30	0.4271	296.6
2:45	0.4170	289.6
3:00	0.4068	282.5
3:15	0.3966	275.4
3:30	0.3865	268.4
3:45	0.3763	261.3
4:00	0.3661	254.3
4:15	0.3560	247.2
4:30	0.3458	240.1
4:45	0.3356	233.1
5:00	0.3254	226.0
5:15	0.3153	218.9
5:30	0.3051	211.9
5:45	0.2949	204.8
6:00	0.2848	197.8
6:15	0.2746	190.7
6:30	0.2644	183.6
6:45	0.2543	176.6
7:00	0.2441	169.5
7:15	0.2339	162.4
7:30	0.2237	155.4
7:45	0.2136	148.3
8:00	0.2034	141.3
8:15	0.1932	134.2
8:30	0.1831	127.1
8:45	0.1729	120.1
9:00	0.1627	113.0
9:15	0.1526	105.9
9:30	0.1424	98.9
9:45	0.1322	91.8
10:00	0.1220	84.8
10:15	0.1119	77.7
10:30	0.1017	70.6
10:45	0.0915	63.6
11:00	0.0814	56.5
11:15	0.0712	49.4
11:30	0.0610	42.4
11:45	0.0509	35.3
12:00	0.0407	28.3
12:15	0.0305	21.2
12:30	0.0203	14.1
12:45	0.0102	7.1
13:00	0.0000	0.0

Town North		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0897	62.3
0:30	0.1793	124.5
0:45	0.2690	186.8
1:00	0.3587	249.1
1:15	0.3512	243.9
1:30	0.3437	238.7
1:45	0.3363	233.5
2:00	0.3288	228.3
2:15	0.3213	223.1
2:30	0.3138	217.9
2:45	0.3064	212.8
3:00	0.2989	207.6
3:15	0.2914	202.4
3:30	0.2839	197.2
3:45	0.2765	192.0
4:00	0.2690	186.8
4:15	0.2615	181.6
4:30	0.2541	176.4
4:45	0.2466	171.2
5:00	0.2391	166.1
5:15	0.2316	160.9
5:30	0.2242	155.7
5:45	0.2167	150.5
6:00	0.2092	145.3
6:15	0.2018	140.1
6:30	0.1943	134.9
6:45	0.1868	129.7
7:00	0.1793	124.5
7:15	0.1719	119.3
7:30	0.1644	114.2
7:45	0.1569	109.0
8:00	0.1494	103.8
8:15	0.1420	98.6
8:30	0.1345	93.4
8:45	0.1270	88.2
9:00	0.1196	83.0
9:15	0.1121	77.8
9:30	0.1046	72.6
9:45	0.0971	67.5
10:00	0.0897	62.3
10:15	0.0822	57.1
10:30	0.0747	51.9
10:45	0.0673	46.7
11:00	0.0598	41.5
11:15	0.0523	36.3
11:30	0.0448	31.1
11:45	0.0374	25.9
12:00	0.0299	20.8
12:15	0.0224	15.6
12:30	0.0149	10.4
12:45	0.0075	5.2
13:00	0.0000	0.0

Town South		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1433	99.5
0:30	0.2866	199.0
0:45	0.4299	298.5
1:00	0.5732	398.0
1:15	0.5612	389.8
1:30	0.5493	381.5
1:45	0.5374	373.2
2:00	0.5254	364.9
2:15	0.5135	356.6
2:30	0.5015	348.3
2:45	0.4896	340.0
3:00	0.4777	331.7
3:15	0.4657	323.4
3:30	0.4538	315.1
3:45	0.4418	306.8
4:00	0.4299	298.5
4:15	0.4179	290.2
4:30	0.4060	281.9
4:45	0.3941	273.7
5:00	0.3821	265.4
5:15	0.3702	257.1
5:30	0.3582	248.8
5:45	0.3463	240.5
6:00	0.3344	232.2
6:15	0.3224	223.9
6:30	0.3105	215.6
6:45	0.2985	207.3
7:00	0.2866	199.0
7:15	0.2747	190.7
7:30	0.2627	182.4
7:45	0.2508	174.1
8:00	0.2388	165.9
8:15	0.2269	157.6
8:30	0.2149	149.3
8:45	0.2030	141.0
9:00	0.1911	132.7
9:15	0.1791	124.4
9:30	0.1672	116.1
9:45	0.1552	107.8
10:00	0.1433	99.5
10:15	0.1314	91.2
10:30	0.1194	82.9
10:45	0.1075	74.6
11:00	0.0955	66.3
11:15	0.0836	58.0
11:30	0.0716	49.8
11:45	0.0597	41.5
12:00	0.0478	33.2
12:15	0.0358	24.9
12:30	0.0239	16.6
12:45	0.0119	8.3
13:00	0.0000	0.0

Campground		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0342	23.8
0:30	0.0684	47.5
0:45	0.1027	71.3
1:00	0.1369	95.1
1:15	0.1340	93.1
1:30	0.1312	91.1
1:45	0.1283	89.1
2:00	0.1255	87.1
2:15	0.1226	85.2
2:30	0.1198	83.2
2:45	0.1169	81.2
3:00	0.1141	79.2
3:15	0.1112	77.2
3:30	0.1084	75.3
3:45	0.1055	73.3
4:00	0.1027	71.3
4:15	0.0998	69.3
4:30	0.0970	67.3
4:45	0.0941	65.4
5:00	0.0913	63.4
5:15	0.0884	61.4
5:30	0.0856	59.4
5:45	0.0827	57.4
6:00	0.0799	55.5
6:15	0.0770	53.5
6:30	0.0742	51.5
6:45	0.0713	49.5
7:00	0.0684	47.5
7:15	0.0656	45.6
7:30	0.0627	43.6
7:45	0.0599	41.6
8:00	0.0570	39.6
8:15	0.0542	37.6
8:30	0.0513	35.6
8:45	0.0485	33.7
9:00	0.0456	31.7
9:15	0.0428	29.7
9:30	0.0399	27.7
9:45	0.0371	25.7
10:00	0.0342	23.8
10:15	0.0314	21.8
10:30	0.0285	19.8
10:45	0.0257	17.8
11:00	0.0228	15.8
11:15	0.0200	13.9
11:30	0.0171	11.9
11:45	0.0143	9.9
12:00	0.0114	7.9
12:15	0.0086	5.9
12:30	0.0057	4.0
12:45	0.0029	2.0
13:00	0.0000	0.0

180TH ST		
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0114	7.9
0:30	0.0229	15.9
0:45	0.0343	23.8
1:00	0.0457	31.8
1:15	0.0448	31.1
1:30	0.0438	30.4
1:45	0.0429	29.8
2:00	0.0419	29.1
2:15	0.0410	28.4
2:30	0.0400	27.8
2:45	0.0391	27.1
3:00	0.0381	26.5
3:15	0.0372	25.8
3:30	0.0362	25.1
3:45	0.0353	24.5
4:00	0.0343	23.8
4:15	0.0333	23.2
4:30	0.0324	22.5
4:45	0.0314	21.8
5:00	0.0305	21.2
5:15	0.0295	20.5
5:30	0.0286	19.8
5:45	0.0276	19.2
6:00	0.0267	18.5
6:15	0.0257	17.9
6:30	0.0248	17.2
6:45	0.0238	16.5
7:00	0.0229	15.9
7:15	0.0219	15.2
7:30	0.0210	14.6
7:45	0.0200	13.9
8:00	0.0191	13.2
8:15	0.0181	12.6
8:30	0.0171	11.9
8:45	0.0162	11.2
9:00	0.0152	10.6
9:15	0.0143	9.9
9:30	0.0133	9.3
9:45	0.0124	8.6
10:00	0.0114	7.9
10:15	0.0105	7.3
10:30	0.0095	6.6
10:45	0.0086	6.0
11:00	0.0076	5.3
11:15	0.0067	4.6
11:30	0.0057	4.0
11:45	0.0048	3.3
12:00	0.0038	2.6
12:15	0.0029	2.0
12:30	0.0019	1.3
12:45	0.0010	0.7
13:00	0.0000	0.0

UNIT HYDROGRAPH - 10 YEAR FLOWS

Diamond Crest			Harbor Lakes			Davenport Farms		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.1061	73.7	0:15	0.0582	40.4	0:15	0.0465	32.3
0:30	0.2122	147.4	0:30	0.1165	80.9	0:30	0.0930	64.6
0:45	0.3183	221.1	0:45	0.1747	121.3	0:45	0.1395	96.9
1:00	0.4244	294.8	**1:00**	0.2330	161.8	**1:00**	0.1860	129.2
1:15	0.4156	288.6	1:15	0.2281	158.4	1:15	0.1822	126.5
1:30	0.4068	282.5	1:30	0.2232	155.0	1:30	0.1783	123.8
1:45	0.3979	276.3	1:45	0.2184	151.7	1:45	0.1744	121.1
2:00	0.3891	270.2	2:00	0.2135	148.3	2:00	0.1705	118.4
2:15	0.3802	264.0	2:15	0.2087	144.9	2:15	0.1667	115.7
2:30	0.3714	257.9	2:30	0.2038	141.6	2:30	0.1628	113.0
2:45	0.3625	251.8	2:45	0.1990	138.2	2:45	0.1589	110.4
3:00	0.3537	245.6	3:00	0.1941	134.8	3:00	0.1550	107.7
3:15	0.3449	239.5	3:15	0.1893	131.4	3:15	0.1512	105.0
3:30	0.3360	233.3	3:30	0.1844	128.1	3:30	0.1473	102.3
3:45	0.3272	227.2	3:45	0.1796	124.7	3:45	0.1434	99.6
4:00	0.3183	221.1	4:00	0.1747	121.3	4:00	0.1395	96.9
4:15	0.3095	214.9	4:15	0.1699	118.0	4:15	0.1357	94.2
4:30	0.3006	208.8	4:30	0.1650	114.6	4:30	0.1318	91.5
4:45	0.2918	202.6	4:45	0.1602	111.2	4:45	0.1279	88.8
5:00	0.2830	196.5	5:00	0.1553	107.9	5:00	0.1240	86.1
5:15	0.2741	190.4	5:15	0.1505	104.5	5:15	0.1202	83.4
5:30	0.2653	184.2	5:30	0.1456	101.1	5:30	0.1163	80.7
5:45	0.2564	178.1	5:45	0.1407	97.7	5:45	0.1124	78.1
6:00	0.2476	171.9	6:00	0.1359	94.4	6:00	0.1085	75.4
6:15	0.2387	165.8	6:15	0.1310	91.0	6:15	0.1046	72.7
6:30	0.2299	159.7	6:30	0.1262	87.6	6:30	0.1008	70.0
6:45	0.2211	153.5	6:45	0.1213	84.3	6:45	0.0969	67.3
7:00	0.2122	147.4	7:00	0.1165	80.9	7:00	0.0930	64.6
7:15	0.2034	141.2	7:15	0.1116	77.5	7:15	0.0891	61.9
7:30	0.1945	135.1	7:30	0.1068	74.1	7:30	0.0853	59.2
7:45	0.1857	129.0	7:45	0.1019	70.8	7:45	0.0814	56.5
8:00	0.1769	122.8	8:00	0.0971	67.4	8:00	0.0775	53.8
8:15	0.1680	116.7	8:15	0.0922	64.0	8:15	0.0736	51.1
8:30	0.1592	110.5	8:30	0.0874	60.7	8:30	0.0698	48.4
8:45	0.1503	104.4	8:45	0.0825	57.3	8:45	0.0659	45.8
9:00	0.1415	98.3	9:00	0.0777	53.9	9:00	0.0620	43.1
9:15	0.1326	92.1	9:15	0.0728	50.6	9:15	0.0581	40.4
9:30	0.1238	86.0	9:30	0.0679	47.2	9:30	0.0543	37.7
9:45	0.1150	79.8	9:45	0.0631	43.8	9:45	0.0504	35.0
10:00	0.1061	73.7	10:00	0.0582	40.4	10:00	0.0465	32.3
10:15	0.0973	67.5	10:15	0.0534	37.1	10:15	0.0426	29.6
10:30	0.0884	61.4	10:30	0.0485	33.7	10:30	0.0388	26.9
10:45	0.0796	55.3	10:45	0.0437	30.3	10:45	0.0349	24.2
11:00	0.0707	49.1	11:00	0.0388	27.0	11:00	0.0310	21.5
11:15	0.0619	43.0	11:15	0.0340	23.6	11:15	0.0271	18.8
11:30	0.0531	36.8	11:30	0.0291	20.2	11:30	0.0233	16.1
11:45	0.0442	30.7	11:45	0.0243	16.9	11:45	0.0194	13.5
12:00	0.0354	24.6	12:00	0.0194	13.5	12:00	0.0155	10.8
12:15	0.0265	18.4	12:15	0.0146	10.1	12:15	0.0116	8.1
12:30	0.0177	12.3	12:30	0.0097	6.7	12:30	0.0078	5.4
12:45	0.0088	6.1	12:45	0.0049	3.4	12:45	0.0039	2.7
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Diamond Crest West			Wildflower			Rock Creek		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0250	17.4	0:15	0.1114	77.3	0:15	0.0243	16.9
0:30	0.0501	34.8	0:30	0.2227	154.7	0:30	0.0486	33.8
0:45	0.0751	52.2	0:45	0.3341	232.0	0:45	0.0729	50.6
1:00	0.1002	69.6	**1:00**	0.4455	309.4	**1:00**	0.0972	67.5
1:15	0.0981	68.1	1:15	0.4362	302.9	1:15	0.0952	66.1
1:30	0.0960	66.7	1:30	0.4269	296.5	1:30	0.0932	64.7
1:45	0.0939	65.2	1:45	0.4176	290.0	1:45	0.0911	63.3
2:00	0.0918	63.8	2:00	0.4083	283.6	2:00	0.0891	61.9
2:15	0.0897	62.3	2:15	0.3991	277.1	2:15	0.0871	60.5
2:30	0.0876	60.9	2:30	0.3898	270.7	2:30	0.0851	59.1
2:45	0.0856	59.4	2:45	0.3805	264.2	2:45	0.0830	57.7
3:00	0.0835	58.0	3:00	0.3712	257.8	3:00	0.0810	56.3
3:15	0.0814	56.5	3:15	0.3619	251.4	3:15	0.0790	54.8
3:30	0.0793	55.1	3:30	0.3527	244.9	3:30	0.0770	53.4
3:45	0.0772	53.6	3:45	0.3434	238.5	3:45	0.0749	52.0
4:00	0.0751	52.2	4:00	0.3341	232.0	4:00	0.0729	50.6
4:15	0.0730	50.7	4:15	0.3248	225.6	4:15	0.0709	49.2
4:30	0.0710	49.3	4:30	0.3155	219.1	4:30	0.0689	47.8
4:45	0.0689	47.8	4:45	0.3063	212.7	4:45	0.0668	46.4
5:00	0.0668	46.4	5:00	0.2970	206.2	5:00	0.0648	45.0
5:15	0.0647	44.9	5:15	0.2877	199.8	5:15	0.0628	43.6
5:30	0.0626	43.5	5:30	0.2784	193.3	5:30	0.0608	42.2
5:45	0.0605	42.0	5:45	0.2691	186.9	5:45	0.0587	40.8
6:00	0.0584	40.6	6:00	0.2599	180.5	6:00	0.0567	39.4
6:15	0.0563	39.1	6:15	0.2506	174.0	6:15	0.0547	38.0
6:30	0.0543	37.7	6:30	0.2413	167.6	6:30	0.0527	36.6
6:45	0.0522	36.2	6:45	0.2320	161.1	6:45	0.0506	35.2
7:00	0.0501	34.8	7:00	0.2227	154.7	7:00	0.0486	33.8
7:15	0.0480	33.3	7:15	0.2135	148.2	7:15	0.0466	32.3
7:30	0.0459	31.9	7:30	0.2042	141.8	7:30	0.0446	30.9
7:45	0.0438	30.4	7:45	0.1949	135.3	7:45	0.0425	29.5
8:00	0.0417	29.0	8:00	0.1856	128.9	8:00	0.0405	28.1
8:15	0.0396	27.5	8:15	0.1763	122.5	8:15	0.0385	26.7
8:30	0.0376	26.1	8:30	0.1671	116.0	8:30	0.0365	25.3
8:45	0.0355	24.6	8:45	0.1578	109.6	8:45	0.0344	23.9
9:00	0.0334	23.2	9:00	0.1485	103.1	9:00	0.0324	22.5
9:15	0.0313	21.7	9:15	0.1392	96.7	9:15	0.0304	21.1
9:30	0.0292	20.3	9:30	0.1299	90.2	9:30	0.0284	19.7
9:45	0.0271	18.8	9:45	0.1206	83.8	9:45	0.0263	18.3
10:00	0.0250	17.4	10:00	0.1114	77.3	10:00	0.0243	16.9
10:15	0.0230	15.9	10:15	0.1021	70.9	10:15	0.0223	15.5
10:30	0.0209	14.5	10:30	0.0928	64.4	10:30	0.0203	14.1
10:45	0.0188	13.0	10:45	0.0835	58.0	10:45	0.0182	12.7
11:00	0.0167	11.6	11:00	0.0742	51.6	11:00	0.0162	11.3
11:15	0.0146	10.1	11:15	0.0650	45.1	11:15	0.0142	9.8
11:30	0.0125	8.7	11:30	0.0557	38.7	11:30	0.0122	8.4
11:45	0.0104	7.2	11:45	0.0464	32.2	11:45	0.0101	7.0
12:00	0.0083	5.8	12:00	0.0371	25.8	12:00	0.0081	5.6
12:15	0.0063	4.3	12:15	0.0278	19.3	12:15	0.0061	4.2
12:30	0.0042	2.9	12:30	0.0186	12.9	12:30	0.0041	2.8
12:45	0.0021	1.4	12:45	0.0093	6.4	12:45	0.0020	1.4
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Rollins Landing			Big Harborview			Lakeview Drive		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0643	44.6	0:15	0.1350	93.8	0:15	0.0558	38.8
0:30	0.1285	89.3	0:30	0.2700	187.5	0:30	0.1116	77.5
0:45	0.1928	133.9	0:45	0.4050	281.3	0:45	0.1674	116.3
1:00	0.2570	178.5	**1:00**	0.5400	375.0	**1:00**	0.2232	155.0
1:15	0.2517	174.8	1:15	0.5288	367.2	1:15	0.2186	151.8
1:30	0.2463	171.1	1:30	0.5175	359.4	1:30	0.2139	148.5
1:45	0.2410	167.3	1:45	0.5063	351.6	1:45	0.2093	145.3
2:00	0.2356	163.6	2:00	0.4950	343.8	2:00	0.2046	142.1
2:15	0.2303	159.9	2:15	0.4838	335.9	2:15	0.2000	138.9
2:30	0.2249	156.2	2:30	0.4725	328.1	2:30	0.1953	135.6
2:45	0.2196	152.5	2:45	0.4613	320.3	2:45	0.1907	132.4
3:00	0.2142	148.8	3:00	0.4500	312.5	3:00	0.1860	129.2
3:15	0.2088	145.0	3:15	0.4388	304.7	3:15	0.1814	125.9
3:30	0.2035	141.3	3:30	0.4275	296.9	3:30	0.1767	122.7
3:45	0.1981	137.6	3:45	0.4163	289.1	3:45	0.1721	119.5
4:00	0.1928	133.9	4:00	0.4050	281.3	4:00	0.1674	116.3
4:15	0.1874	130.2	4:15	0.3938	273.4	4:15	0.1628	113.0
4:30	0.1821	126.4	4:30	0.3825	265.6	4:30	0.1581	109.8
4:45	0.1767	122.7	4:45	0.3713	257.8	4:45	0.1535	106.6
5:00	0.1714	119.0	5:00	0.3600	250.0	5:00	0.1488	103.3
5:15	0.1660	115.3	5:15	0.3488	242.2	5:15	0.1442	100.1
5:30	0.1607	111.6	5:30	0.3375	234.4	5:30	0.1395	96.9
5:45	0.1553	107.8	5:45	0.3263	226.6	5:45	0.1349	93.6
6:00	0.1499	104.1	6:00	0.3150	218.8	6:00	0.1302	90.4
6:15	0.1446	100.4	6:15	0.3038	210.9	6:15	0.1256	87.2
6:30	0.1392	96.7	6:30	0.2925	203.1	6:30	0.1209	84.0
6:45	0.1339	93.0	6:45	0.2813	195.3	6:45	0.1163	80.7
7:00	0.1285	89.3	7:00	0.2700	187.5	7:00	0.1116	77.5
7:15	0.1232	85.5	7:15	0.2588	179.7	7:15	0.1070	74.3
7:30	0.1178	81.8	7:30	0.2475	171.9	7:30	0.1023	71.0
7:45	0.1125	78.1	7:45	0.2363	164.1	7:45	0.0977	67.8
8:00	0.1071	74.4	8:00	0.2250	156.3	8:00	0.0930	64.6
8:15	0.1017	70.7	8:15	0.2138	148.4	8:15	0.0884	61.4
8:30	0.0964	66.9	8:30	0.2025	140.6	8:30	0.0837	58.1
8:45	0.0910	63.2	8:45	0.1913	132.8	8:45	0.0791	54.9
9:00	0.0857	59.5	9:00	0.1800	125.0	9:00	0.0744	51.7
9:15	0.0803	55.8	9:15	0.1688	117.2	9:15	0.0698	48.4
9:30	0.0750	52.1	9:30	0.1575	109.4	9:30	0.0651	45.2
9:45	0.0696	48.3	9:45	0.1463	101.6	9:45	0.0605	42.0
10:00	0.0643	44.6	10:00	0.1350	93.8	10:00	0.0558	38.8
10:15	0.0589	40.9	10:15	0.1238	85.9	10:15	0.0512	35.5
10:30	0.0536	37.2	10:30	0.1125	78.1	10:30	0.0465	32.3
10:45	0.0482	33.5	10:45	0.1013	70.3	10:45	0.0419	29.1
11:00	0.0428	29.8	11:00	0.0900	62.5	11:00	0.0372	25.8
11:15	0.0375	26.0	11:15	0.0788	54.7	11:15	0.0326	22.6
11:30	0.0321	22.3	11:30	0.0675	46.9	11:30	0.0279	19.4
11:45	0.0268	18.6	11:45	0.0563	39.1	11:45	0.0233	16.1
12:00	0.0214	14.9	12:00	0.0450	31.3	12:00	0.0186	12.9
12:15	0.0161	11.2	12:15	0.0338	23.4	12:15	0.0140	9.7
12:30	0.0107	7.4	12:30	0.0225	15.6	12:30	0.0093	6.5
12:45	0.0054	3.7	12:45	0.0113	7.8	12:45	0.0047	3.2
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - 10 YEAR FLOWS

Bridgeport			Greyhawke 1			Greyhawke 2		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0238	16.5	0:15	0.0540	37.5	0:15	0.0324	22.5
0:30	0.0475	33.0	0:30	0.1080	75.0	0:30	0.0648	45.0
0:45	0.0713	49.5	0:45	0.1620	112.5	0:45	0.0972	67.5
1:00	0.0950	66.0	**1:00**	0.2160	150.0	**1:00**	0.1296	90.0
1:15	0.0931	64.6	1:15	0.2115	146.9	1:15	0.1269	88.1
1:30	0.0911	63.3	1:30	0.2070	143.8	1:30	0.1242	86.3
1:45	0.0891	61.9	1:45	0.2025	140.6	1:45	0.1215	84.4
2:00	0.0871	60.5	2:00	0.1980	137.5	2:00	0.1188	82.5
2:15	0.0851	59.1	2:15	0.1935	134.4	2:15	0.1161	80.6
2:30	0.0832	57.8	2:30	0.1890	131.3	2:30	0.1134	78.8
2:45	0.0812	56.4	2:45	0.1845	128.1	2:45	0.1107	76.9
3:00	0.0792	55.0	3:00	0.1800	125.0	3:00	0.1080	75.0
3:15	0.0772	53.6	3:15	0.1755	121.9	3:15	0.1053	73.1
3:30	0.0752	52.3	3:30	0.1710	118.8	3:30	0.1026	71.3
3:45	0.0733	50.9	3:45	0.1665	115.6	3:45	0.0999	69.4
4:00	0.0713	49.5	4:00	0.1620	112.5	4:00	0.0972	67.5
4:15	0.0693	48.1	4:15	0.1575	109.4	4:15	0.0945	65.6
4:30	0.0673	46.8	4:30	0.1530	106.3	4:30	0.0918	63.8
4:45	0.0653	45.4	4:45	0.1485	103.1	4:45	0.0891	61.9
5:00	0.0634	44.0	5:00	0.1440	100.0	5:00	0.0864	60.0
5:15	0.0614	42.6	5:15	0.1395	96.9	5:15	0.0837	58.1
5:30	0.0594	41.3	5:30	0.1350	93.8	5:30	0.0810	56.3
5:45	0.0574	39.9	5:45	0.1305	90.6	5:45	0.0783	54.4
6:00	0.0554	38.5	6:00	0.1260	87.5	6:00	0.0756	52.5
6:15	0.0535	37.1	6:15	0.1215	84.4	6:15	0.0729	50.6
6:30	0.0515	35.8	6:30	0.1170	81.3	6:30	0.0702	48.8
6:45	0.0495	34.4	6:45	0.1125	78.1	6:45	0.0675	46.9
7:00	0.0475	33.0	7:00	0.1080	75.0	7:00	0.0648	45.0
7:15	0.0455	31.6	7:15	0.1035	71.9	7:15	0.0621	43.1
7:30	0.0436	30.3	7:30	0.0990	68.8	7:30	0.0594	41.3
7:45	0.0416	28.9	7:45	0.0945	65.6	7:45	0.0567	39.4
8:00	0.0396	27.5	8:00	0.0900	62.5	8:00	0.0540	37.5
8:15	0.0376	26.1	8:15	0.0855	59.4	8:15	0.0513	35.6
8:30	0.0356	24.8	8:30	0.0810	56.3	8:30	0.0486	33.8
8:45	0.0337	23.4	8:45	0.0765	53.1	8:45	0.0459	31.9
9:00	0.0317	22.0	9:00	0.0720	50.0	9:00	0.0432	30.0
9:15	0.0297	20.6	9:15	0.0675	46.9	9:15	0.0405	28.1
9:30	0.0277	19.3	9:30	0.0630	43.8	9:30	0.0378	26.3
9:45	0.0257	17.9	9:45	0.0585	40.6	9:45	0.0351	24.4
10:00	0.0238	16.5	10:00	0.0540	37.5	10:00	0.0324	22.5
10:15	0.0218	15.1	10:15	0.0495	34.4	10:15	0.0297	20.6
10:30	0.0198	13.8	10:30	0.0450	31.3	10:30	0.0270	18.8
10:45	0.0178	12.4	10:45	0.0405	28.1	10:45	0.0243	16.9
11:00	0.0158	11.0	11:00	0.0360	25.0	11:00	0.0216	15.0
11:15	0.0139	9.6	11:15	0.0315	21.9	11:15	0.0189	13.1
11:30	0.0119	8.3	11:30	0.0270	18.8	11:30	0.0162	11.3
11:45	0.0099	6.9	11:45	0.0225	15.6	11:45	0.0135	9.4
12:00	0.0079	5.5	12:00	0.0180	12.5	12:00	0.0108	7.5
12:15	0.0059	4.1	12:15	0.0135	9.4	12:15	0.0081	5.6
12:30	0.0040	2.8	12:30	0.0090	6.3	12:30	0.0054	3.8
12:45	0.0020	1.4	12:45	0.0045	3.1	12:45	0.0027	1.9
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Greyhawke 3			Woods Court			South Booster		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0705	49.0	0:15	0.0378	26.3	0:15	0.3823	265.5
0:30	0.1410	97.9	0:30	0.0756	52.5	0:30	0.7646	531.0
0:45	0.2115	146.9	0:45	0.1134	78.8	0:45	1.1470	796.5
1:00	0.2820	195.8	**1:00**	0.1512	105.0	**1:00**	1.5293	1062.0
1:15	0.2761	191.8	1:15	0.1481	102.8	1:15	1.4974	1039.9
1:30	0.2703	187.7	1:30	0.1449	100.6	1:30	1.4656	1017.8
1:45	0.2644	183.6	1:45	0.1418	98.4	1:45	1.4337	995.6
2:00	0.2585	179.5	2:00	0.1386	96.3	2:00	1.4018	973.5
2:15	0.2526	175.4	2:15	0.1355	94.1	2:15	1.3700	951.4
2:30	0.2468	171.4	2:30	0.1323	91.9	2:30	1.3381	929.3
2:45	0.2409	167.3	2:45	0.1292	89.7	2:45	1.3063	907.1
3:00	0.2350	163.2	3:00	0.1260	87.5	3:00	1.2744	885.0
3:15	0.2291	159.1	3:15	0.1229	85.3	3:15	1.2425	862.9
3:30	0.2233	155.0	3:30	0.1197	83.1	3:30	1.2107	840.8
3:45	0.2174	151.0	3:45	0.1166	80.9	3:45	1.1788	818.6
4:00	0.2115	146.9	4:00	0.1134	78.8	4:00	1.1470	796.5
4:15	0.2056	142.8	4:15	0.1103	76.6	4:15	1.1151	774.4
4:30	0.1998	138.7	4:30	0.1071	74.4	4:30	1.0832	752.3
4:45	0.1939	134.6	4:45	0.1040	72.2	4:45	1.0514	730.1
5:00	0.1880	130.6	5:00	0.1008	70.0	5:00	1.0195	708.0
5:15	0.1821	126.5	5:15	0.0977	67.8	5:15	0.9877	685.9
5:30	0.1763	122.4	5:30	0.0945	65.6	5:30	0.9558	663.8
5:45	0.1704	118.3	5:45	0.0914	63.4	5:45	0.9239	641.6
6:00	0.1645	114.2	6:00	0.0882	61.3	6:00	0.8921	619.5
6:15	0.1586	110.2	6:15	0.0851	59.1	6:15	0.8602	597.4
6:30	0.1528	106.1	6:30	0.0819	56.9	6:30	0.8284	575.3
6:45	0.1469	102.0	6:45	0.0788	54.7	6:45	0.7965	553.1
7:00	0.1410	97.9	7:00	0.0756	52.5	7:00	0.7646	531.0
7:15	0.1351	93.8	7:15	0.0725	50.3	7:15	0.7328	508.9
7:30	0.1293	89.8	7:30	0.0693	48.1	7:30	0.7009	486.8
7:45	0.1234	85.7	7:45	0.0662	45.9	7:45	0.6691	464.6
8:00	0.1175	81.6	8:00	0.0630	43.8	8:00	0.6372	442.5
8:15	0.1116	77.5	8:15	0.0599	41.6	8:15	0.6053	420.4
8:30	0.1058	73.4	8:30	0.0567	39.4	8:30	0.5735	398.3
8:45	0.0999	69.4	8:45	0.0536	37.2	8:45	0.5416	376.1
9:00	0.0940	65.3	9:00	0.0504	35.0	9:00	0.5098	354.0
9:15	0.0881	61.2	9:15	0.0473	32.8	9:15	0.4779	331.9
9:30	0.0823	57.1	9:30	0.0441	30.6	9:30	0.4460	309.8
9:45	0.0764	53.0	9:45	0.0410	28.4	9:45	0.4142	287.6
10:00	0.0705	49.0	10:00	0.0378	26.3	10:00	0.3823	265.5
10:15	0.0646	44.9	10:15	0.0347	24.1	10:15	0.3505	243.4
10:30	0.0588	40.8	10:30	0.0315	21.9	10:30	0.3186	221.3
10:45	0.0529	36.7	10:45	0.0284	19.7	10:45	0.2867	199.1
11:00	0.0470	32.6	11:00	0.0252	17.5	11:00	0.2549	177.0
11:15	0.0411	28.6	11:15	0.0221	15.3	11:15	0.2230	154.9
11:30	0.0353	24.5	11:30	0.0189	13.1	11:30	0.1912	132.8
11:45	0.0294	20.4	11:45	0.0158	10.9	11:45	0.1593	110.6
12:00	0.0235	16.3	12:00	0.0126	8.8	12:00	0.1274	88.5
12:15	0.0176	12.2	12:15	0.0095	6.6	12:15	0.0956	66.4
12:30	0.0118	8.2	12:30	0.0063	4.4	12:30	0.0637	44.3
12:45	0.0059	4.1	12:45	0.0032	2.2	12:45	0.0319	22.1
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Gerber Collision			Cedar Lakes 2			Cedar Lakes 1		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0040	2.8	0:15	0.0648	45.0	0:15	0.0990	68.8
0:30	0.0080	5.6	0:30	0.1296	90.0	0:30	0.1980	137.5
0:45	0.0120	8.3	0:45	0.1944	135.0	0:45	0.2970	206.3
1:00	0.0160	11.1	**1:00**	0.2592	180.0	**1:00**	0.3960	275.0
1:15	0.0157	10.9	1:15	0.2538	176.3	1:15	0.3878	269.3
1:30	0.0153	10.6	1:30	0.2484	172.5	1:30	0.3795	263.5
1:45	0.0150	10.4	1:45	0.2430	168.8	1:45	0.3713	257.8
2:00	0.0147	10.2	2:00	0.2376	165.0	2:00	0.3630	252.1
2:15	0.0143	10.0	2:15	0.2322	161.3	2:15	0.3548	246.4
2:30	0.0140	9.7	2:30	0.2268	157.5	2:30	0.3465	240.6
2:45	0.0137	9.5	2:45	0.2214	153.8	2:45	0.3383	234.9
3:00	0.0133	9.3	3:00	0.2160	150.0	3:00	0.3300	229.2
3:15	0.0130	9.0	3:15	0.2106	146.3	3:15	0.3218	223.4
3:30	0.0127	8.8	3:30	0.2052	142.5	3:30	0.3135	217.7
3:45	0.0123	8.6	3:45	0.1998	138.8	3:45	0.3053	212.0
4:00	0.0120	8.3	4:00	0.1944	135.0	4:00	0.2970	206.3
4:15	0.0117	8.1	4:15	0.1890	131.3	4:15	0.2888	200.5
4:30	0.0113	7.9	4:30	0.1836	127.5	4:30	0.2805	194.8
4:45	0.0110	7.6	4:45	0.1782	123.8	4:45	0.2723	189.1
5:00	0.0107	7.4	5:00	0.1728	120.0	5:00	0.2640	183.3
5:15	0.0103	7.2	5:15	0.1674	116.3	5:15	0.2558	177.6
5:30	0.0100	6.9	5:30	0.1620	112.5	5:30	0.2475	171.9
5:45	0.0097	6.7	5:45	0.1566	108.8	5:45	0.2393	166.1
6:00	0.0093	6.5	6:00	0.1512	105.0	6:00	0.2310	160.4
6:15	0.0090	6.3	6:15	0.1458	101.3	6:15	0.2228	154.7
6:30	0.0087	6.0	6:30	0.1404	97.5	6:30	0.2145	149.0
6:45	0.0083	5.8	6:45	0.1350	93.8	6:45	0.2063	143.2
7:00	0.0080	5.6	7:00	0.1296	90.0	7:00	0.1980	137.5
7:15	0.0077	5.3	7:15	0.1242	86.3	7:15	0.1898	131.8
7:30	0.0073	5.1	7:30	0.1188	82.5	7:30	0.1815	126.0
7:45	0.0070	4.9	7:45	0.1134	78.8	7:45	0.1733	120.3
8:00	0.0067	4.6	8:00	0.1080	75.0	8:00	0.1650	114.6
8:15	0.0063	4.4	8:15	0.1026	71.3	8:15	0.1568	108.9
8:30	0.0060	4.2	8:30	0.0972	67.5	8:30	0.1485	103.1
8:45	0.0057	3.9	8:45	0.0918	63.8	8:45	0.1403	97.4
9:00	0.0053	3.7	9:00	0.0864	60.0	9:00	0.1320	91.7
9:15	0.0050	3.5	9:15	0.0810	56.3	9:15	0.1238	85.9
9:30	0.0047	3.2	9:30	0.0756	52.5	9:30	0.1155	80.2
9:45	0.0043	3.0	9:45	0.0702	48.8	9:45	0.1073	74.5
10:00	0.0040	2.8	10:00	0.0648	45.0	10:00	0.0990	68.8
10:15	0.0037	2.5	10:15	0.0594	41.3	10:15	0.0908	63.0
10:30	0.0033	2.3	10:30	0.0540	37.5	10:30	0.0825	57.3
10:45	0.0030	2.1	10:45	0.0486	33.8	10:45	0.0743	51.6
11:00	0.0027	1.9	11:00	0.0432	30.0	11:00	0.0660	45.8
11:15	0.0023	1.6	11:15	0.0378	26.3	11:15	0.0578	40.1
11:30	0.0020	1.4	11:30	0.0324	22.5	11:30	0.0495	34.4
11:45	0.0017	1.2	11:45	0.0270	18.8	11:45	0.0413	28.6
12:00	0.0013	0.9	12:00	0.0216	15.0	12:00	0.0330	22.9
12:15	0.0010	0.7	12:15	0.0162	11.3	12:15	0.0248	17.2
12:30	0.0007	0.5	12:30	0.0108	7.5	12:30	0.0165	11.5
12:45	0.0003	0.2	12:45	0.0054	3.8	12:45	0.0083	5.7
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - 10 YEAR FLOWS								
Stonecreek Villas			Davenport Farms			Diamond Crest_West		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0108	7.5	0:15	0.0465	32.3	0:15	0.0250	17.4
0:30	0.0216	15.0	0:30	0.0930	64.6	0:30	0.0501	34.8
0:45	0.0324	22.5	0:45	0.1395	96.9	0:45	0.0751	52.2
1:00	0.0432	30.0	**1:00**	0.1860	129.2	**1:00**	0.1002	69.6
1:15	0.0423	29.4	1:15	0.0423	29.4	1:15	0.0423	29.4
1:30	0.0414	28.8	1:30	0.0414	28.8	1:30	0.0414	28.8
1:45	0.0405	28.1	1:45	0.0405	28.1	1:45	0.0405	28.1
2:00	0.0396	27.5	2:00	0.0396	27.5	2:00	0.0396	27.5
2:15	0.0387	26.9	2:15	0.0387	26.9	2:15	0.0387	26.9
2:30	0.0378	26.3	2:30	0.0378	26.3	2:30	0.0378	26.3
2:45	0.0369	25.6	2:45	0.0369	25.6	2:45	0.0369	25.6
3:00	0.0360	25.0	3:00	0.0360	25.0	3:00	0.0360	25.0
3:15	0.0351	24.4	3:15	0.0351	24.4	3:15	0.0351	24.4
3:30	0.0342	23.8	3:30	0.0342	23.8	3:30	0.0342	23.8
3:45	0.0333	23.1	3:45	0.0333	23.1	3:45	0.0333	23.1
4:00	0.0324	22.5	4:00	0.0324	22.5	4:00	0.0324	22.5
4:15	0.0315	21.9	4:15	0.0315	21.9	4:15	0.0315	21.9
4:30	0.0306	21.3	4:30	0.0306	21.3	4:30	0.0306	21.3
4:45	0.0297	20.6	4:45	0.0297	20.6	4:45	0.0297	20.6
5:00	0.0288	20.0	5:00	0.0288	20.0	5:00	0.0288	20.0
5:15	0.0279	19.4	5:15	0.0279	19.4	5:15	0.0279	19.4
5:30	0.0270	18.8	5:30	0.0270	18.8	5:30	0.0270	18.8
5:45	0.0261	18.1	5:45	0.0261	18.1	5:45	0.0261	18.1
6:00	0.0252	17.5	6:00	0.0252	17.5	6:00	0.0252	17.5
6:15	0.0243	16.9	6:15	0.0243	16.9	6:15	0.0243	16.9
6:30	0.0234	16.3	6:30	0.0234	16.3	6:30	0.0234	16.3
6:45	0.0225	15.6	6:45	0.0225	15.6	6:45	0.0225	15.6
7:00	0.0216	15.0	7:00	0.0216	15.0	7:00	0.0216	15.0
7:15	0.0207	14.4	7:15	0.0207	14.4	7:15	0.0207	14.4
7:30	0.0198	13.8	7:30	0.0198	13.8	7:30	0.0198	13.8
7:45	0.0189	13.1	7:45	0.0189	13.1	7:45	0.0189	13.1
8:00	0.0180	12.5	8:00	0.0180	12.5	8:00	0.0180	12.5
8:15	0.0171	11.9	8:15	0.0171	11.9	8:15	0.0171	11.9
8:30	0.0162	11.3	8:30	0.0162	11.3	8:30	0.0162	11.3
8:45	0.0153	10.6	8:45	0.0153	10.6	8:45	0.0153	10.6
9:00	0.0144	10.0	9:00	0.0144	10.0	9:00	0.0144	10.0
9:15	0.0135	9.4	9:15	0.0135	9.4	9:15	0.0135	9.4
9:30	0.0126	8.8	9:30	0.0126	8.8	9:30	0.0126	8.8
9:45	0.0117	8.1	9:45	0.0117	8.1	9:45	0.0117	8.1
10:00	0.0108	7.5	10:00	0.0108	7.5	10:00	0.0108	7.5
10:15	0.0099	6.9	10:15	0.0099	6.9	10:15	0.0099	6.9
10:30	0.0090	6.3	10:30	0.0090	6.3	10:30	0.0090	6.3
10:45	0.0081	5.6	10:45	0.0081	5.6	10:45	0.0081	5.6
11:00	0.0072	5.0	11:00	0.0072	5.0	11:00	0.0072	5.0
11:15	0.0063	4.4	11:15	0.0063	4.4	11:15	0.0063	4.4
11:30	0.0054	3.8	11:30	0.0054	3.8	11:30	0.0054	3.8
11:45	0.0045	3.1	11:45	0.0045	3.1	11:45	0.0045	3.1
12:00	0.0036	2.5	12:00	0.0036	2.5	12:00	0.0036	2.5
12:15	0.0027	1.9	12:15	0.0027	1.9	12:15	0.0027	1.9
12:30	0.0018	1.3	12:30	0.0018	1.3	12:30	0.0018	1.3
12:45	0.0009	0.6	12:45	0.0009	0.6	12:45	0.0009	0.6
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - ULTIMATE BUILD OUT FLOWS

Harbor Lakes

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0582	40.4
0:30	0.1165	80.9
0:45	0.1747	121.3
1:00	0.2330	161.8
1:15	0.2281	158.4
1:30	0.2232	155.0
1:45	0.2184	151.7
2:00	0.2135	148.3
2:15	0.2087	144.9
2:30	0.2038	141.6
2:45	0.1990	138.2
3:00	0.1941	134.8
3:15	0.1893	131.4
3:30	0.1844	128.1
3:45	0.1796	124.7
4:00	0.1747	121.3
4:15	0.1699	118.0
4:30	0.1650	114.6
4:45	0.1602	111.2
5:00	0.1553	107.9
5:15	0.1505	104.5
5:30	0.1456	101.1
5:45	0.1407	97.7
6:00	0.1359	94.4
6:15	0.1310	91.0
6:30	0.1262	87.6
6:45	0.1213	84.3
7:00	0.1165	80.9
7:15	0.1116	77.5
7:30	0.1068	74.1
7:45	0.1019	70.8
8:00	0.0971	67.4
8:15	0.0922	64.0
8:30	0.0874	60.7
8:45	0.0825	57.3
9:00	0.0777	53.9
9:15	0.0728	50.6
9:30	0.0679	47.2
9:45	0.0631	43.8
10:00	0.0582	40.4
10:15	0.0534	37.1
10:30	0.0485	33.7
10:45	0.0437	30.3
11:00	0.0388	27.0
11:15	0.0340	23.6
11:30	0.0291	20.2
11:45	0.0243	16.9
12:00	0.0194	13.5
12:15	0.0146	10.1
12:30	0.0097	6.7
12:45	0.0049	3.4
13:00	0.0000	0.0

New PS DF

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.2440	169.4
0:30	0.4879	338.8
0:45	0.7319	508.3
1:00	0.9758	677.7
1:15	0.9555	663.6
1:30	0.9352	649.4
1:45	0.9149	635.3
2:00	0.8945	621.2
2:15	0.8742	607.1
2:30	0.8539	593.0
2:45	0.8335	578.8
3:00	0.8132	564.7
3:15	0.7929	550.6
3:30	0.7725	536.5
3:45	0.7522	522.4
4:00	0.7319	508.3
4:15	0.7116	494.1
4:30	0.6912	480.0
4:45	0.6709	465.9
5:00	0.6506	451.8
5:15	0.6302	437.7
5:30	0.6099	423.5
5:45	0.5896	409.4
6:00	0.5692	395.3
6:15	0.5489	381.2
6:30	0.5286	367.1
6:45	0.5083	353.0
7:00	0.4879	338.8
7:15	0.4676	324.7
7:30	0.4473	310.6
7:45	0.4269	296.5
8:00	0.4066	282.4
8:15	0.3863	268.2
8:30	0.3659	254.1
8:45	0.3456	240.0
9:00	0.3253	225.9
9:15	0.3050	211.8
9:30	0.2846	197.7
9:45	0.2643	183.5
10:00	0.2440	169.4
10:15	0.2236	155.3
10:30	0.2033	141.2
10:45	0.1830	127.1
11:00	0.1626	112.9
11:15	0.1423	98.8
11:30	0.1220	84.7
11:45	0.1017	70.6
12:00	0.0813	56.5
12:15	0.0610	42.4
12:30	0.0407	28.2
12:45	0.0203	14.1
13:00	0.0000	0.0

New PS W of DC

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0250	17.4
0:30	0.0501	34.8
0:45	0.0751	52.2
1:00	0.1002	69.6
1:15	0.0981	68.1
1:30	0.0960	66.7
1:45	0.0939	65.2
2:00	0.0918	63.8
2:15	0.0897	62.3
2:30	0.0876	60.9
2:45	0.0856	59.4
3:00	0.0835	58.0
3:15	0.0814	56.5
3:30	0.0793	55.1
3:45	0.0772	53.6
4:00	0.0751	52.2
4:15	0.0730	50.7
4:30	0.0710	49.3
4:45	0.0689	47.8
5:00	0.0668	46.4
5:15	0.0647	44.9
5:30	0.0626	43.5
5:45	0.0605	42.0
6:00	0.0584	40.6
6:15	0.0563	39.1
6:30	0.0543	37.7
6:45	0.0522	36.2
7:00	0.0501	34.8
7:15	0.0480	33.3
7:30	0.0459	31.9
7:45	0.0438	30.4
8:00	0.0417	29.0
8:15	0.0396	27.5
8:30	0.0376	26.1
8:45	0.0355	24.6
9:00	0.0334	23.2
9:15	0.0313	21.7
9:30	0.0292	20.3
9:45	0.0271	18.8
10:00	0.0250	17.4
10:15	0.0230	15.9
10:30	0.0209	14.5
10:45	0.0188	13.0
11:00	0.0167	11.6
11:15	0.0146	10.1
11:30	0.0125	8.7
11:45	0.0104	7.2
12:00	0.0083	5.8
12:15	0.0063	4.3
12:30	0.0042	2.9
12:45	0.0021	1.4
13:00	0.0000	0.0

Diamond Crest

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1061	73.7
0:30	0.2122	147.4
0:45	0.3183	221.1
1:00	0.4244	294.8
1:15	0.4156	288.6
1:30	0.4068	282.5
1:45	0.3979	276.3
2:00	0.3891	270.2
2:15	0.3802	264.0
2:30	0.3714	257.9
2:45	0.3625	251.8
3:00	0.3537	245.6
3:15	0.3449	239.5
3:30	0.3360	233.3
3:45	0.3272	227.2
4:00	0.3183	221.1
4:15	0.3095	214.9
4:30	0.3006	208.8
4:45	0.2918	202.6
5:00	0.2830	196.5
5:15	0.2741	190.4
5:30	0.2653	184.2
5:45	0.2564	178.1
6:00	0.2476	171.9
6:15	0.2387	165.8
6:30	0.2299	159.7
6:45	0.2211	153.5
7:00	0.2122	147.4
7:15	0.2034	141.2
7:30	0.1945	135.1
7:45	0.1857	129.0
8:00	0.1769	122.8
8:15	0.1680	116.7
8:30	0.1592	110.5
8:45	0.1503	104.4
9:00	0.1415	98.3
9:15	0.1326	92.1
9:30	0.1238	86.0
9:45	0.1150	79.8
10:00	0.1061	73.7
10:15	0.0973	67.5
10:30	0.0884	61.4
10:45	0.0796	55.3
11:00	0.0707	49.1
11:15	0.0619	43.0
11:30	0.0531	36.8
11:45	0.0442	30.7
12:00	0.0354	24.6
12:15	0.0265	18.4
12:30	0.0177	12.3
12:45	0.0088	6.1
13:00	0.0000	0.0

Wildflower

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1114	77.3
0:30	0.2227	154.7
0:45	0.3341	232.0
1:00	0.4455	309.4
1:15	0.4362	302.9
1:30	0.4269	296.5
1:45	0.4176	290.0
2:00	0.4083	283.6
2:15	0.3991	277.1
2:30	0.3898	270.7
2:45	0.3805	264.2
3:00	0.3712	257.8
3:15	0.3619	251.4
3:30	0.3527	244.9
3:45	0.3434	238.5
4:00	0.3341	232.0
4:15	0.3248	225.6
4:30	0.3155	219.1
4:45	0.3063	212.7
5:00	0.2970	206.2
5:15	0.2877	199.8
5:30	0.2784	193.3
5:45	0.2691	186.9
6:00	0.2599	180.5
6:15	0.2506	174.0
6:30	0.2413	167.6
6:45	0.2320	161.1
7:00	0.2227	154.7
7:15	0.2135	148.2
7:30	0.2042	141.8
7:45	0.1949	135.3
8:00	0.1856	128.9
8:15	0.1763	122.5
8:30	0.1671	116.0
8:45	0.1578	109.6
9:00	0.1485	103.1
9:15	0.1392	96.7
9:30	0.1299	90.2
9:45	0.1206	83.8
10:00	0.1114	77.3
10:15	0.1021	70.9
10:30	0.0928	64.4
10:45	0.0835	58.0
11:00	0.0742	51.6
11:15	0.0650	45.1
11:30	0.0557	38.7
11:45	0.0464	32.2
12:00	0.0371	25.8
12:15	0.0278	19.3
12:30	0.0186	12.9
12:45	0.0093	6.4
13:00	0.0000	0.0

Rock Creek

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0243	16.9
0:30	0.0486	33.8
0:45	0.0729	50.6
1:00	0.0972	67.5
1:15	0.0952	66.1
1:30	0.0932	64.7
1:45	0.0911	63.3
2:00	0.0891	61.9
2:15	0.0871	60.5
2:30	0.0851	59.1
2:45	0.0830	57.7
3:00	0.0810	56.3
3:15	0.0790	54.8
3:30	0.0770	53.4
3:45	0.0749	52.0
4:00	0.0729	50.6
4:15	0.0709	49.2
4:30	0.0689	47.8
4:45	0.0668	46.4
5:00	0.0648	45.0
5:15	0.0628	43.6
5:30	0.0608	42.2
5:45	0.0587	40.8
6:00	0.0567	39.4
6:15	0.0547	38.0
6:30	0.0527	36.6
6:45	0.0506	35.2
7:00	0.0486	33.8
7:15	0.0466	32.3
7:30	0.0446	30.9
7:45	0.0425	29.5
8:00	0.0405	28.1
8:15	0.0385	26.7
8:30	0.0365	25.3
8:45	0.0344	23.9
9:00	0.0324	22.5
9:15	0.0304	21.1
9:30	0.0284	19.7
9:45	0.0263	18.3
10:00	0.0243	16.9
10:15	0.0223	15.5
10:30	0.0203	14.1
10:45	0.0182	12.7
11:00	0.0162	11.3
11:15	0.0142	9.8
11:30	0.0122	8.4
11:45	0.0101	7.0
12:00	0.0081	5.6
12:15	0.0061	4.2
12:30	0.0041	2.8
12:45	0.0020	1.4
13:00	0.0000	0.0

Rollins Landing

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0643	44.6
0:30	0.1285	89.3
0:45	0.1928	133.9
1:00	0.2570	178.5
1:15	0.2517	174.8
1:30	0.2463	171.1
1:45	0.2410	167.3
2:00	0.2356	163.6
2:15	0.2303	159.9
2:30	0.2249	156.2
2:45	0.2196	152.5
3:00	0.2142	148.8
3:15	0.2088	145.0
3:30	0.2035	141.3
3:45	0.1981	137.6
4:00	0.1928	133.9
4:15	0.1874	130.2
4:30	0.1821	126.4
4:45	0.1767	122.7
5:00	0.1714	119.0
5:15	0.1660	115.3
5:30	0.1607	111.6
5:45	0.1553	107.8
6:00	0.1499	104.1
6:15	0.1446	100.4
6:30	0.1392	96.7
6:45	0.1339	93.0
7:00	0.1285	89.3
7:15	0.1232	85.5
7:30	0.1178	81.8
7:45	0.1125	78.1
8:00	0.1071	74.4
8:15	0.1017	70.7
8:30	0.0964	66.9
8:45	0.0910	63.2
9:00	0.0857	59.5
9:15	0.0803	55.8
9:30	0.0750	52.1
9:45	0.0696	48.3
10:00	0.0643	44.6
10:15	0.0589	40.9
10:30	0.0536	37.2
10:45	0.0482	33.5
11:00	0.0428	29.8
11:15	0.0375	26.0
11:30	0.0321	22.3
11:45	0.0268	18.6
12:00	0.0214	14.9
12:15	0.0161	11.2
12:30	0.0107	7.4
12:45	0.0054	3.7
13:00	0.0000	0.0

Big Harborview

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1350	93.8
0:30	0.2700	187.5
0:45	0.4050	281.3
1:00	0.5400	375.0
1:15	0.5288	367.2
1:30	0.5175	359.4
1:45	0.5063	351.6
2:00	0.4950	343.8
2:15	0.4838	335.9
2:30	0.4725	328.1
2:45	0.4613	320.3
3:00	0.4500	312.5
3:15	0.4388	304.7
3:30	0.4275	296.9
3:45	0.4163	289.1
4:00	0.4050	281.3
4:15	0.3938	273.4
4:30	0.3825	265.6
4:45	0.3713	257.8
5:00	0.3600	250.0
5:15	0.3488	242.2
5:30	0.3375	234.4
5:45	0.3263	226.6
6:00	0.3150	218.8
6:15	0.3038	210.9
6:30	0.2925	203.1
6:45	0.2813	195.3
7:00	0.2700	187.5
7:15	0.2588	179.7
7:30	0.2475	171.9
7:45	0.2363	164.1
8:00	0.2250	156.3
8:15	0.2138	148.4
8:30	0.2025	140.6
8:45	0.1913	132.8
9:00	0.1800	125.0
9:15	0.1688	117.2
9:30	0.1575	109.4
9:45	0.1463	101.6
10:00	0.1350	93.8
10:15	0.1238	85.9
10:30	0.1125	78.1
10:45	0.1013	70.3
11:00	0.0900	62.5
11:15	0.0788	54.7
11:30	0.0675	46.9
11:45	0.0563	39.1
12:00	0.0450	31.3
12:15	0.0338	23.4
12:30	0.0225	15.6
12:45	0.0113	7.8
13:00	0.0000	0.0

Lakeview Drive

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0558	38.8
0:30	0.1116	77.5
0:45	0.1674	116.3
1:00	0.2232	155.0
1:15	0.2186	151.8
1:30	0.2139	148.5
1:45	0.2093	145.3
2:00	0.2046	142.1
2:15	0.2000	138.9
2:30	0.1953	135.6
2:45	0.1907	132.4
3:00	0.1860	129.2
3:15	0.1814	125.9
3:30	0.1767	122.7
3:45	0.1721	119.5
4:00	0.1674	116.3
4:15	0.1628	113.0
4:30	0.1581	109.8
4:45	0.1535	106.6
5:00	0.1488	103.3
5:15	0.1442	100.1
5:30	0.1395	96.9
5:45	0.1349	93.6
6:00	0.1302	90.4
6:15	0.1256	87.2
6:30	0.1209	84.0
6:45	0.1163	80.7
7:00	0.1116	77.5
7:15	0.1070	74.3
7:30	0.1023	71.0
7:45	0.0977	67.8
8:00	0.0930	64.6
8:15	0.0884	61.4
8:30	0.0837	58.1
8:45	0.0791	54.9
9:00	0.0744	51.7
9:15	0.0698	48.4
9:30	0.0651	45.2
9:45	0.0605	42.0
10:00	0.0558	38.8
10:15	0.0512	35.5
10:30	0.0465	32.3
10:45	0.0419	29.1
11:00	0.0372	25.8
11:15	0.0326	22.6
11:30	0.0279	19.4
11:45	0.0233	16.1
12:00	0.0186	12.9
12:15	0.0140	9.7
12:30	0.0093	6.5
12:45	0.0047	3.2
13:00	0.0000	0.0

Bridgeport

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0238	16.5
0:30	0.0475	33.0
0:45	0.0713	49.5
1:00	0.0950	66.0
1:15	0.0931	64.6
1:30	0.0911	63.3
1:45	0.0891	61.9
2:00	0.0871	60.5
2:15	0.0851	59.1
2:30	0.0832	57.8
2:45	0.0812	56.4
3:00	0.0792	55.0
3:15	0.0772	53.6
3:30	0.0752	52.3
3:45	0.0733	50.9
4:00	0.0713	49.5
4:15	0.0693	48.1
4:30	0.0673	46.8
4:45	0.0653	45.4
5:00	0.0634	44.0
5:15	0.0614	42.6
5:30	0.0594	41.3
5:45	0.0574	39.9
6:00	0.0554	38.5
6:15	0.0535	37.1
6:30	0.0515	35.8
6:45	0.0495	34.4
7:00	0.0475	33.0
7:15	0.0455	31.6
7:30	0.0436	30.3
7:45	0.0416	28.9
8:00	0.0396	27.5
8:15	0.0376	26.1
8:30	0.0356	24.8
8:45	0.0337	23.4
9:00	0.0317	22.0
9:15	0.0297	20.6
9:30	0.0277	19.3
9:45	0.0257	17.9
10:00	0.0238	16.5
10:15	0.0218	15.1
10:30	0.0198	13.8
10:45	0.0178	12.4
11:00	0.0158	11.0
11:15	0.0139	9.6
11:30	0.0119	8.3
11:45	0.0099	6.9
12:00	0.0079	5.5
12:15	0.0059	4.1
12:30	0.0040	2.8
12:45	0.0020	1.4
13:00	0.0000	0.0

Greyhawke 1

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0540	37.5
0:30	0.1080	75.0
0:45	0.1620	112.5
1:00	0.2160	150.0
1:15	0.2115	146.9
1:30	0.2070	143.8
1:45	0.2025	140.6
2:00	0.1980	137.5
2:15	0.1935	134.4
2:30	0.1890	131.3
2:45	0.1845	128.1
3:00	0.1800	125.0
3:15	0.1755	121.9
3:30	0.1710	118.8
3:45	0.1665	115.6
4:00	0.1620	112.5
4:15	0.1575	109.4
4:30	0.1530	106.3
4:45	0.1485	103.1
5:00	0.1440	100.0
5:15	0.1395	96.9
5:30	0.1350	93.8
5:45	0.1305	90.6
6:00	0.1260	87.5
6:15	0.1215	84.4
6:30	0.1170	81.3
6:45	0.1125	78.1
7:00	0.1080	75.0
7:15	0.1035	71.9
7:30	0.0990	68.8
7:45	0.0945	65.6
8:00	0.0900	62.5
8:15	0.0855	59.4
8:30	0.0810	56.3
8:45	0.0765	53.1
9:00	0.0720	50.0
9:15	0.0675	46.9
9:30	0.0630	43.8
9:45	0.0585	40.6
10:00	0.0540	37.5
10:15	0.0495	34.4
10:30	0.0450	31.3
10:45	0.0405	28.1
11:00	0.0360	25.0
11:15	0.0315	21.9
11:30	0.0270	18.8
11:45	0.0225	15.6
12:00	0.0180	12.5
12:15	0.0135	9.4
12:30	0.0090	6.3
12:45	0.0045	3.1
13:00	0.0000	0.0

UNIT HYDROGRAPH - ULTIMATE BUILD OUT FLOWS

Greyhawke 2			Greyhawke 3			Cedar Lakes 2		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0324	22.5	0:15	0.0648	45.0	0:15	0.0648	45.0
0:30	0.0648	45.0	0:30	0.1296	90.0	0:30	0.1296	90.0
0:45	0.0972	67.5	0:45	0.1944	135.0	0:45	0.1944	135.0
1:00	0.1296	90.0	**1:00**	0.2592	180.0	**1:00**	0.2592	180.0
1:15	0.1269	88.1	1:15	0.2538	176.3	1:15	0.2538	176.3
1:30	0.1242	86.3	1:30	0.2484	172.5	1:30	0.2484	172.5
1:45	0.1215	84.4	1:45	0.2430	168.8	1:45	0.2430	168.8
2:00	0.1188	82.5	2:00	0.2376	165.0	2:00	0.2376	165.0
2:15	0.1161	80.6	2:15	0.2322	161.3	2:15	0.2322	161.3
2:30	0.1134	78.8	2:30	0.2268	157.5	2:30	0.2268	157.5
2:45	0.1107	76.9	2:45	0.2214	153.8	2:45	0.2214	153.8
3:00	0.1080	75.0	3:00	0.2160	150.0	3:00	0.2160	150.0
3:15	0.1053	73.1	3:15	0.2106	146.3	3:15	0.2106	146.3
3:30	0.1026	71.3	3:30	0.2052	142.5	3:30	0.2052	142.5
3:45	0.0999	69.4	3:45	0.1998	138.8	3:45	0.1998	138.8
4:00	0.0972	67.5	4:00	0.1944	135.0	4:00	0.1944	135.0
4:15	0.0945	65.6	4:15	0.1890	131.3	4:15	0.1890	131.3
4:30	0.0918	63.8	4:30	0.1836	127.5	4:30	0.1836	127.5
4:45	0.0891	61.9	4:45	0.1782	123.8	4:45	0.1782	123.8
5:00	0.0864	60.0	5:00	0.1728	120.0	5:00	0.1728	120.0
5:15	0.0837	58.1	5:15	0.1674	116.3	5:15	0.1674	116.3
5:30	0.0810	56.3	5:30	0.1620	112.5	5:30	0.1620	112.5
5:45	0.0783	54.4	5:45	0.1566	108.8	5:45	0.1566	108.8
6:00	0.0756	52.5	6:00	0.1512	105.0	6:00	0.1512	105.0
6:15	0.0729	50.6	6:15	0.1458	101.3	6:15	0.1458	101.3
6:30	0.0702	48.8	6:30	0.1404	97.5	6:30	0.1404	97.5
6:45	0.0675	46.9	6:45	0.1350	93.8	6:45	0.1350	93.8
7:00	0.0648	45.0	7:00	0.1296	90.0	7:00	0.1296	90.0
7:15	0.0621	43.1	7:15	0.1242	86.3	7:15	0.1242	86.3
7:30	0.0594	41.3	7:30	0.1188	82.5	7:30	0.1188	82.5
7:45	0.0567	39.4	7:45	0.1134	78.8	7:45	0.1134	78.8
8:00	0.0540	37.5	8:00	0.1080	75.0	8:00	0.1080	75.0
8:15	0.0513	35.6	8:15	0.1026	71.3	8:15	0.1026	71.3
8:30	0.0486	33.8	8:30	0.0972	67.5	8:30	0.0972	67.5
8:45	0.0459	31.9	8:45	0.0918	63.8	8:45	0.0918	63.8
9:00	0.0432	30.0	9:00	0.0864	60.0	9:00	0.0864	60.0
9:15	0.0405	28.1	9:15	0.0810	56.3	9:15	0.0810	56.3
9:30	0.0378	26.3	9:30	0.0756	52.5	9:30	0.0756	52.5
9:45	0.0351	24.4	9:45	0.0702	48.8	9:45	0.0702	48.8
10:00	0.0324	22.5	10:00	0.0648	45.0	10:00	0.0648	45.0
10:15	0.0297	20.6	10:15	0.0594	41.3	10:15	0.0594	41.3
10:30	0.0270	18.8	10:30	0.0540	37.5	10:30	0.0540	37.5
10:45	0.0243	16.9	10:45	0.0486	33.8	10:45	0.0486	33.8
11:00	0.0216	15.0	11:00	0.0432	30.0	11:00	0.0432	30.0
11:15	0.0189	13.1	11:15	0.0378	26.3	11:15	0.0378	26.3
11:30	0.0162	11.3	11:30	0.0324	22.5	11:30	0.0324	22.5
11:45	0.0135	9.4	11:45	0.0270	18.8	11:45	0.0270	18.8
12:00	0.0108	7.5	12:00	0.0216	15.0	12:00	0.0216	15.0
12:15	0.0081	5.6	12:15	0.0162	11.3	12:15	0.0162	11.3
12:30	0.0054	3.8	12:30	0.0108	7.5	12:30	0.0108	7.5
12:45	0.0027	1.9	12:45	0.0054	3.8	12:45	0.0054	3.8
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Cedar Lakes 1			Stonecreek Villas			Woods Court		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0990	68.8	0:15	0.0108	7.5	0:15	0.0378	26.3
0:30	0.1980	137.5	0:30	0.0216	15.0	0:30	0.0756	52.5
0:45	0.2970	206.3	0:45	0.0324	22.5	0:45	0.1134	78.8
1:00	0.3960	275.0	**1:00**	0.0432	30.0	**1:00**	0.1512	105.0
1:15	0.3878	269.3	1:15	0.0423	29.4	1:15	0.1481	102.8
1:30	0.3795	263.5	1:30	0.0414	28.8	1:30	0.1449	100.6
1:45	0.3713	257.8	1:45	0.0405	28.1	1:45	0.1418	98.4
2:00	0.3630	252.1	2:00	0.0396	27.5	2:00	0.1386	96.3
2:15	0.3548	246.4	2:15	0.0387	26.9	2:15	0.1355	94.1
2:30	0.3465	240.6	2:30	0.0378	26.3	2:30	0.1323	91.9
2:45	0.3383	234.9	2:45	0.0369	25.6	2:45	0.1292	89.7
3:00	0.3300	229.2	3:00	0.0360	25.0	3:00	0.1260	87.5
3:15	0.3218	223.4	3:15	0.0351	24.4	3:15	0.1229	85.3
3:30	0.3135	217.7	3:30	0.0342	23.8	3:30	0.1197	83.1
3:45	0.3053	212.0	3:45	0.0333	23.1	3:45	0.1166	80.9
4:00	0.2970	206.3	4:00	0.0324	22.5	4:00	0.1134	78.8
4:15	0.2888	200.5	4:15	0.0315	21.9	4:15	0.1103	76.6
4:30	0.2805	194.8	4:30	0.0306	21.3	4:30	0.1071	74.4
4:45	0.2723	189.1	4:45	0.0297	20.6	4:45	0.1040	72.2
5:00	0.2640	183.3	5:00	0.0288	20.0	5:00	0.1008	70.0
5:15	0.2558	177.6	5:15	0.0279	19.4	5:15	0.0977	67.8
5:30	0.2475	171.9	5:30	0.0270	18.8	5:30	0.0945	65.6
5:45	0.2393	166.1	5:45	0.0261	18.1	5:45	0.0914	63.4
6:00	0.2310	160.4	6:00	0.0252	17.5	6:00	0.0882	61.3
6:15	0.2228	154.7	6:15	0.0243	16.9	6:15	0.0851	59.1
6:30	0.2145	149.0	6:30	0.0234	16.3	6:30	0.0819	56.9
6:45	0.2063	143.2	6:45	0.0225	15.6	6:45	0.0788	54.7
7:00	0.1980	137.5	7:00	0.0216	15.0	7:00	0.0756	52.5
7:15	0.1898	131.8	7:15	0.0207	14.4	7:15	0.0725	50.3
7:30	0.1815	126.0	7:30	0.0198	13.8	7:30	0.0693	48.1
7:45	0.1733	120.3	7:45	0.0189	13.1	7:45	0.0662	45.9
8:00	0.1650	114.6	8:00	0.0180	12.5	8:00	0.0630	43.8
8:15	0.1568	108.9	8:15	0.0171	11.9	8:15	0.0599	41.6
8:30	0.1485	103.1	8:30	0.0162	11.3	8:30	0.0567	39.4
8:45	0.1403	97.4	8:45	0.0153	10.6	8:45	0.0536	37.2
9:00	0.1320	91.7	9:00	0.0144	10.0	9:00	0.0504	35.0
9:15	0.1238	85.9	9:15	0.0135	9.4	9:15	0.0473	32.8
9:30	0.1155	80.2	9:30	0.0126	8.8	9:30	0.0441	30.6
9:45	0.1073	74.5	9:45	0.0117	8.1	9:45	0.0410	28.4
10:00	0.0990	68.8	10:00	0.0108	7.5	10:00	0.0378	26.3
10:15	0.0908	63.0	10:15	0.0099	6.9	10:15	0.0347	24.1
10:30	0.0825	57.3	10:30	0.0090	6.3	10:30	0.0315	21.9
10:45	0.0743	51.6	10:45	0.0081	5.6	10:45	0.0284	19.7
11:00	0.0660	45.8	11:00	0.0072	5.0	11:00	0.0252	17.5
11:15	0.0578	40.1	11:15	0.0063	4.4	11:15	0.0221	15.3
11:30	0.0495	34.4	11:30	0.0054	3.8	11:30	0.0189	13.1
11:45	0.0413	28.6	11:45	0.0045	3.1	11:45	0.0158	10.9
12:00	0.0330	22.9	12:00	0.0036	2.5	12:00	0.0126	8.8
12:15	0.0248	17.2	12:15	0.0027	1.9	12:15	0.0095	6.6
12:30	0.0165	11.5	12:30	0.0018	1.3	12:30	0.0063	4.4
12:45	0.0083	5.7	12:45	0.0009	0.6	12:45	0.0032	2.2
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

South Booster			Gerber Collision			Owens Branch Segment 7		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.4320	300.0	0:15	0.0040	2.8	0:15	0.2033	141.2
0:30	0.8640	600.0	0:30	0.0080	5.6	0:30	0.4067	282.4
0:45	1.2960	900.0	0:45	0.0120	8.3	0:45	0.6100	423.6
1:00	1.7280	1200.0	**1:00**	0.0160	11.1	**1:00**	0.8133	564.8
1:15	1.6920	1175.0	1:15	0.0157	10.9	1:15	0.7964	553.0
1:30	1.6560	1150.0	1:30	0.0153	10.6	1:30	0.7794	541.3
1:45	1.6200	1125.0	1:45	0.0150	10.4	1:45	0.7625	529.5
2:00	1.5840	1100.0	2:00	0.0147	10.2	2:00	0.7455	517.7
2:15	1.5480	1075.0	2:15	0.0143	10.0	2:15	0.7286	506.0
2:30	1.5120	1050.0	2:30	0.0140	9.7	2:30	0.7117	494.2
2:45	1.4760	1025.0	2:45	0.0137	9.5	2:45	0.6947	482.4
3:00	1.4400	1000.0	3:00	0.0133	9.3	3:00	0.6778	470.7
3:15	1.4040	975.0	3:15	0.0130	9.0	3:15	0.6608	458.9
3:30	1.3680	950.0	3:30	0.0127	8.8	3:30	0.6439	447.1
3:45	1.3320	925.0	3:45	0.0123	8.6	3:45	0.6269	435.4
4:00	1.2960	900.0	4:00	0.0120	8.3	4:00	0.6100	423.6
4:15	1.2600	875.0	4:15	0.0117	8.1	4:15	0.5930	411.8
4:30	1.2240	850.0	4:30	0.0113	7.9	4:30	0.5761	400.1
4:45	1.1880	825.0	4:45	0.0110	7.6	4:45	0.5592	388.3
5:00	1.1520	800.0	5:00	0.0107	7.4	5:00	0.5422	376.5
5:15	1.1160	775.0	5:15	0.0103	7.2	5:15	0.5253	364.8
5:30	1.0800	750.0	5:30	0.0100	6.9	5:30	0.5083	353.0
5:45	1.0440	725.0	5:45	0.0097	6.7	5:45	0.4914	341.2
6:00	1.0080	700.0	6:00	0.0093	6.5	6:00	0.4744	329.5
6:15	0.9720	675.0	6:15	0.0090	6.3	6:15	0.4575	317.7
6:30	0.9360	650.0	6:30	0.0087	6.0	6:30	0.4405	305.9
6:45	0.9000	625.0	6:45	0.0083	5.8	6:45	0.4236	294.2
7:00	0.8640	600.0	7:00	0.0080	5.6	7:00	0.4067	282.4
7:15	0.8280	575.0	7:15	0.0077	5.3	7:15	0.3897	270.6
7:30	0.7920	550.0	7:30	0.0073	5.1	7:30	0.3728	258.9
7:45	0.7560	525.0	7:45	0.0070	4.9	7:45	0.3558	247.1
8:00	0.7200	500.0	8:00	0.0067	4.6	8:00	0.3389	235.3
8:15	0.6840	475.0	8:15	0.0063	4.4	8:15	0.3219	223.6
8:30	0.6480	450.0	8:30	0.0060	4.2	8:30	0.3050	211.8
8:45	0.6120	425.0	8:45	0.0057	3.9	8:45	0.2880	200.0
9:00	0.5760	400.0	9:00	0.0053	3.7	9:00	0.2711	188.3
9:15	0.5400	375.0	9:15	0.0050	3.5	9:15	0.2542	176.5
9:30	0.5040	350.0	9:30	0.0047	3.2	9:30	0.2372	164.7
9:45	0.4680	325.0	9:45	0.0043	3.0	9:45	0.2203	153.0
10:00	0.4320	300.0	10:00	0.0040	2.8	10:00	0.2033	141.2
10:15	0.3960	275.0	10:15	0.0037	2.5	10:15	0.1864	129.4
10:30	0.3600	250.0	10:30	0.0033	2.3	10:30	0.1694	117.7
10:45	0.3240	225.0	10:45	0.0030	2.1	10:45	0.1525	105.9
11:00	0.2880	200.0	11:00	0.0027	1.9	11:00	0.1356	94.1
11:15	0.2520	175.0	11:15	0.0023	1.6	11:15	0.1186	82.4
11:30	0.2160	150.0	11:30	0.0020	1.4	11:30	0.1017	70.6
11:45	0.1800	125.0	11:45	0.0017	1.2	11:45	0.0847	58.8
12:00	0.1440	100.0	12:00	0.0013	0.9	12:00	0.0678	47.1
12:15	0.1080	75.0	12:15	0.0010	0.7	12:15	0.0508	35.3
12:30	0.0720	50.0	12:30	0.0007	0.5	12:30	0.0339	23.5
12:45	0.0360	25.0	12:45	0.0003	0.2	12:45	0.0169	11.8
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Owens Branch Segment 6			Owens Branch Segment 5		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.8827	613.0	0:15	0.3939	273.5
0:30	1.7654	1226.0	0:30	0.7877	547.0
0:45	2.6482	1839.0	0:45	1.1816	820.5
1:00	3.5309	2452.0	**1:00**	1.5754	1094.0
1:15	3.4573	2400.9	1:15	1.5426	1071.3
1:30	3.3838	2349.8	1:30	1.5098	1048.5
1:45	3.3102	2298.8	1:45	1.4770	1025.7
2:00	3.2367	2247.7	2:00	1.4441	1002.9
2:15	3.1631	2196.6	2:15	1.4113	980.1
2:30	3.0895	2145.5	2:30	1.3785	957.3
2:45	3.0160	2094.4	2:45	1.3457	934.5
3:00	2.9424	2043.3	3:00	1.3129	911.7
3:15	2.8689	1992.3	3:15	1.2800	888.9
3:30	2.7953	1941.2	3:30	1.2472	866.1
3:45	2.7217	1890.1	3:45	1.2144	843.3
4:00	2.6482	1839.0	4:00	1.1816	820.5
4:15	2.5746	1787.9	4:15	1.1487	797.7
4:30	2.5011	1736.8	4:30	1.1159	774.9
4:45	2.4275	1685.8	4:45	1.0831	752.2
5:00	2.3539	1634.7	5:00	1.0503	729.4
5:15	2.2804	1583.6	5:15	1.0175	706.6
5:30	2.2068	1532.5	5:30	0.9846	683.8
5:45	2.1333	1481.4	5:45	0.9518	661.0
6:00	2.0597	1430.3	6:00	0.9190	638.2
6:15	1.9861	1379.3	6:15	0.8862	615.4
6:30	1.9126	1328.2	6:30	0.8534	592.6
6:45	1.8390	1277.1	6:45	0.8205	569.8
7:00	1.7654	1226.0	7:00	0.7877	547.0
7:15	1.6919	1174.9	7:15	0.7549	524.2
7:30	1.6183	1123.8	7:30	0.7221	501.4
7:45	1.5448	1072.8	7:45	0.6892	478.6
8:00	1.4712	1021.7	8:00	0.6564	455.9
8:15	1.3976	970.6	8:15	0.6236	433.1
8:30	1.3241	919.5	8:30	0.5908	410.3
8:45	1.2505	868.4	8:45	0.5580	387.5
9:00	1.1770	817.3	9:00	0.5251	364.7
9:15	1.1034	766.3	9:15	0.4923	341.9
9:30	1.0298	715.2	9:30	0.4595	319.1
9:45	0.9563	664.1	9:45	0.4267	296.3
10:00	0.8827	613.0	10:00	0.3939	273.5
10:15	0.8092	561.9	10:15	0.3610	250.7
10:30	0.7356	510.8	10:30	0.3282	227.9
10:45	0.6620	459.8	10:45	0.2954	205.1
11:00	0.5885	408.7	11:00	0.2626	182.3
11:15	0.5149	357.6	11:15	0.2297	159.5
11:30	0.4414	306.5	11:30	0.1969	136.8
11:45	0.3678	255.4	11:45	0.1641	114.0
12:00	0.2942	204.3	12:00	0.1313	91.2
12:15	0.2207	153.3	12:15	0.0985	68.4
12:30	0.1471	102.2	12:30	0.0656	45.6
12:45	0.0736	51.1	12:45	0.0328	22.8
13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - ULTIMATE BUILD OUT FLOWS

Owens Branch Trib 4			Owens Branch Segment 4			Owens Branch Trib 2		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.3161	219.5	0:15	0.0575	39.9	0:15	0.1915	133.0
0:30	0.6322	439.0	0:30	0.1149	79.8	0:30	0.3831	266.0
0:45	0.9482	658.5	0:45	0.1724	119.7	0:45	0.5746	399.0
1:00	1.2643	878.0	**1:00**	0.2298	159.6	**1:00**	0.7662	532.0
1:15	1.2380	859.7	1:15	0.2250	156.3	1:15	0.7502	521.0
1:30	1.2116	841.4	1:30	0.2203	153.0	1:30	0.7342	509.9
1:45	1.1853	823.1	1:45	0.2155	149.6	1:45	0.7183	498.8
2:00	1.1590	804.8	2:00	0.2107	146.3	2:00	0.7023	487.7
2:15	1.1326	786.5	2:15	0.2059	143.0	2:15	0.6863	476.6
2:30	1.1063	768.3	2:30	0.2011	139.7	2:30	0.6704	465.5
2:45	1.0799	750.0	2:45	0.1963	136.3	2:45	0.6544	454.5
3:00	1.0536	731.7	3:00	0.1915	133.0	3:00	0.6385	443.4
3:15	1.0273	713.4	3:15	0.1867	129.7	3:15	0.6225	432.3
3:30	1.0009	695.1	3:30	0.1819	126.4	3:30	0.6065	421.2
3:45	0.9746	676.8	3:45	0.1772	123.0	3:45	0.5906	410.1
4:00	0.9482	658.5	4:00	0.1724	119.7	4:00	0.5746	399.0
4:15	0.9219	640.2	4:15	0.1676	116.4	4:15	0.5587	388.0
4:30	0.8956	621.9	4:30	0.1628	113.1	4:30	0.5427	376.9
4:45	0.8692	603.6	4:45	0.1580	109.7	4:45	0.5267	365.8
5:00	0.8429	585.3	5:00	0.1532	106.4	5:00	0.5108	354.7
5:15	0.8165	567.0	5:15	0.1484	103.1	5:15	0.4948	343.6
5:30	0.7902	548.8	5:30	0.1436	99.8	5:30	0.4788	332.5
5:45	0.7639	530.5	5:45	0.1389	96.4	5:45	0.4629	321.4
6:00	0.7375	512.2	6:00	0.1341	93.1	6:00	0.4469	310.4
6:15	0.7112	493.9	6:15	0.1293	89.8	6:15	0.4310	299.3
6:30	0.6848	475.6	6:30	0.1245	86.5	6:30	0.4150	288.2
6:45	0.6585	457.3	6:45	0.1197	83.1	6:45	0.3990	277.1
7:00	0.6322	439.0	7:00	0.1149	79.8	7:00	0.3831	266.0
7:15	0.6058	420.7	7:15	0.1101	76.5	7:15	0.3671	254.9
7:30	0.5795	402.4	7:30	0.1053	73.2	7:30	0.3512	243.9
7:45	0.5531	384.1	7:45	0.1006	69.8	7:45	0.3352	232.8
8:00	0.5268	365.8	8:00	0.0958	66.5	8:00	0.3192	221.7
8:15	0.5005	347.5	8:15	0.0910	63.2	8:15	0.3033	210.6
8:30	0.4741	329.3	8:30	0.0862	59.9	8:30	0.2873	199.5
8:45	0.4478	311.0	8:45	0.0814	56.5	8:45	0.2713	188.4
9:00	0.4214	292.7	9:00	0.0766	53.2	9:00	0.2554	177.3
9:15	0.3951	274.4	9:15	0.0718	49.9	9:15	0.2394	166.3
9:30	0.3688	256.1	9:30	0.0670	46.6	9:30	0.2235	155.2
9:45	0.3424	237.8	9:45	0.0622	43.2	9:45	0.2075	144.1
10:00	0.3161	219.5	10:00	0.0575	39.9	10:00	0.1915	133.0
10:15	0.2897	201.2	10:15	0.0527	36.6	10:15	0.1756	121.9
10:30	0.2634	182.9	10:30	0.0479	33.3	10:30	0.1596	110.8
10:45	0.2371	164.6	10:45	0.0431	29.9	10:45	0.1437	99.8
11:00	0.2107	146.3	11:00	0.0383	26.6	11:00	0.1277	88.7
11:15	0.1844	128.0	11:15	0.0335	23.3	11:15	0.1117	77.6
11:30	0.1580	109.8	11:30	0.0287	20.0	11:30	0.0958	66.5
11:45	0.1317	91.5	11:45	0.0239	16.6	11:45	0.0798	55.4
12:00	0.1054	73.2	12:00	0.0192	13.3	12:00	0.0638	44.3
12:15	0.0790	54.9	12:15	0.0144	10.0	12:15	0.0479	33.3
12:30	0.0527	36.6	12:30	0.0096	6.7	12:30	0.0319	22.2
12:45	0.0263	18.3	12:45	0.0048	3.3	12:45	0.0160	11.1
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Owens Branch Trib 3			Owens Branch Segment 3			Owens Branch Trib 1		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0648	45.0	0:15	0.3010	209.0	0:15	0.0658	45.7
0:30	0.1296	90.0	0:30	0.6019	418.0	0:30	0.1316	91.4
0:45	0.1944	135.0	0:45	0.9029	627.0	0:45	0.1975	137.1
1:00	0.2592	180.0	**1:00**	1.2038	836.0	**1:00**	0.2633	182.8
1:15	0.2538	176.3	1:15	1.1788	818.6	1:15	0.2578	179.0
1:30	0.2484	172.5	1:30	1.1537	801.2	1:30	0.2523	175.2
1:45	0.2430	168.8	1:45	1.1286	783.8	1:45	0.2468	171.4
2:00	0.2376	165.0	2:00	1.1035	766.3	2:00	0.2414	167.6
2:15	0.2322	161.3	2:15	1.0784	748.9	2:15	0.2359	163.8
2:30	0.2268	157.5	2:30	1.0534	731.5	2:30	0.2304	160.0
2:45	0.2214	153.8	2:45	1.0283	714.1	2:45	0.2249	156.2
3:00	0.2160	150.0	3:00	1.0032	696.7	3:00	0.2194	152.4
3:15	0.2106	146.3	3:15	0.9781	679.3	3:15	0.2139	148.6
3:30	0.2052	142.5	3:30	0.9530	661.8	3:30	0.2084	144.8
3:45	0.1998	138.8	3:45	0.9280	644.4	3:45	0.2030	140.9
4:00	0.1944	135.0	4:00	0.9029	627.0	4:00	0.1975	137.1
4:15	0.1890	131.3	4:15	0.8778	609.6	4:15	0.1920	133.3
4:30	0.1836	127.5	4:30	0.8527	592.2	4:30	0.1865	129.5
4:45	0.1782	123.8	4:45	0.8276	574.8	4:45	0.1810	125.7
5:00	0.1728	120.0	5:00	0.8026	557.3	5:00	0.1755	121.9
5:15	0.1674	116.3	5:15	0.7775	539.9	5:15	0.1700	118.1
5:30	0.1620	112.5	5:30	0.7524	522.5	5:30	0.1646	114.3
5:45	0.1566	108.8	5:45	0.7273	505.1	5:45	0.1591	110.5
6:00	0.1512	105.0	6:00	0.7022	487.7	6:00	0.1536	106.7
6:15	0.1458	101.3	6:15	0.6772	470.3	6:15	0.1481	102.8
6:30	0.1404	97.5	6:30	0.6521	452.8	6:30	0.1426	99.0
6:45	0.1350	93.8	6:45	0.6270	435.4	6:45	0.1371	95.2
7:00	0.1296	90.0	7:00	0.6019	418.0	7:00	0.1316	91.4
7:15	0.1242	86.3	7:15	0.5768	400.6	7:15	0.1262	87.6
7:30	0.1188	82.5	7:30	0.5518	383.2	7:30	0.1207	83.8
7:45	0.1134	78.8	7:45	0.5267	365.8	7:45	0.1152	80.0
8:00	0.1080	75.0	8:00	0.5016	348.3	8:00	0.1097	76.2
8:15	0.1026	71.3	8:15	0.4765	330.9	8:15	0.1042	72.4
8:30	0.0972	67.5	8:30	0.4514	313.5	8:30	0.0987	68.6
8:45	0.0918	63.8	8:45	0.4264	296.1	8:45	0.0932	64.8
9:00	0.0864	60.0	9:00	0.4013	278.7	9:00	0.0878	60.9
9:15	0.0810	56.3	9:15	0.3762	261.3	9:15	0.0823	57.1
9:30	0.0756	52.5	9:30	0.3511	243.8	9:30	0.0768	53.3
9:45	0.0702	48.8	9:45	0.3260	226.4	9:45	0.0713	49.5
10:00	0.0648	45.0	10:00	0.3010	209.0	10:00	0.0658	45.7
10:15	0.0594	41.3	10:15	0.2759	191.6	10:15	0.0603	41.9
10:30	0.0540	37.5	10:30	0.2508	174.2	10:30	0.0549	38.1
10:45	0.0486	33.8	10:45	0.2257	156.8	10:45	0.0494	34.3
11:00	0.0432	30.0	11:00	0.2006	139.3	11:00	0.0439	30.5
11:15	0.0378	26.3	11:15	0.1756	121.9	11:15	0.0384	26.7
11:30	0.0324	22.5	11:30	0.1505	104.5	11:30	0.0329	22.9
11:45	0.0270	18.8	11:45	0.1254	87.1	11:45	0.0274	19.0
12:00	0.0216	15.0	12:00	0.1003	69.7	12:00	0.0219	15.2
12:15	0.0162	11.3	12:15	0.0752	52.3	12:15	0.0165	11.4
12:30	0.0108	7.5	12:30	0.0502	34.8	12:30	0.0110	7.6
12:45	0.0054	3.8	12:45	0.0251	17.4	12:45	0.0055	3.8
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

Owens Branch Segment 2			Owens Branch Segment 1			Campground Interceptor		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.0000	0.0	0:15	0.2159	149.9	0:15	0.0903	62.7
0:30	0.0000	0.0	0:30	0.4318	299.9	0:30	0.1806	125.4
0:45	0.0000	0.0	0:45	0.6477	449.8	0:45	0.2710	188.2
1:00	0.0000	0.0	**1:00**	0.8636	599.7	**1:00**	0.3613	250.9
1:15	0.0000	0.0	1:15	0.8456	587.3	1:15	0.3538	245.7
1:30	0.0000	0.0	1:30	0.8277	574.8	1:30	0.3462	240.4
1:45	0.0000	0.0	1:45	0.8097	562.3	1:45	0.3387	235.2
2:00	0.0000	0.0	2:00	0.7917	549.8	2:00	0.3312	230.0
2:15	0.0000	0.0	2:15	0.7737	537.3	2:15	0.3236	224.8
2:30	0.0000	0.0	2:30	0.7557	524.8	2:30	0.3161	219.5
2:45	0.0000	0.0	2:45	0.7377	512.3	2:45	0.3086	214.3
3:00	0.0000	0.0	3:00	0.7197	499.8	3:00	0.3011	209.1
3:15	0.0000	0.0	3:15	0.7017	487.3	3:15	0.2935	203.8
3:30	0.0000	0.0	3:30	0.6837	474.8	3:30	0.2860	198.6
3:45	0.0000	0.0	3:45	0.6657	462.3	3:45	0.2785	193.4
4:00	0.0000	0.0	4:00	0.6477	449.8	4:00	0.2710	188.2
4:15	0.0000	0.0	4:15	0.6297	437.3	4:15	0.2634	182.9
4:30	0.0000	0.0	4:30	0.6117	424.8	4:30	0.2559	177.7
4:45	0.0000	0.0	4:45	0.5938	412.3	4:45	0.2484	172.5
5:00	0.0000	0.0	5:00	0.5758	399.8	5:00	0.2409	167.3
5:15	0.0000	0.0	5:15	0.5578	387.3	5:15	0.2333	162.0
5:30	0.0000	0.0	5:30	0.5398	374.8	5:30	0.2258	156.8
5:45	0.0000	0.0	5:45	0.5218	362.3	5:45	0.2183	151.6
6:00	0.0000	0.0	6:00	0.5038	349.9	6:00	0.2107	146.4
6:15	0.0000	0.0	6:15	0.4858	337.4	6:15	0.2032	141.1
6:30	0.0000	0.0	6:30	0.4678	324.9	6:30	0.1957	135.9
6:45	0.0000	0.0	6:45	0.4498	312.4	6:45	0.1882	130.7
7:00	0.0000	0.0	7:00	0.4318	299.9	7:00	0.1806	125.4
7:15	0.0000	0.0	7:15	0.4138	287.4	7:15	0.1731	120.2
7:30	0.0000	0.0	7:30	0.3958	274.9	7:30	0.1656	115.0
7:45	0.0000	0.0	7:45	0.3778	262.4	7:45	0.1581	109.8
8:00	0.0000	0.0	8:00	0.3598	249.9	8:00	0.1505	104.5
8:15	0.0000	0.0	8:15	0.3419	237.4	8:15	0.1430	99.3
8:30	0.0000	0.0	8:30	0.3239	224.9	8:30	0.1355	94.1
8:45	0.0000	0.0	8:45	0.3059	212.4	8:45	0.1280	88.9
9:00	0.0000	0.0	9:00	0.2879	199.9	9:00	0.1204	83.6
9:15	0.0000	0.0	9:15	0.2699	187.4	9:15	0.1129	78.4
9:30	0.0000	0.0	9:30	0.2519	174.9	9:30	0.1054	73.2
9:45	0.0000	0.0	9:45	0.2339	162.4	9:45	0.0978	67.9
10:00	0.0000	0.0	10:00	0.2159	149.9	10:00	0.0903	62.7
10:15	0.0000	0.0	10:15	0.1979	137.4	10:15	0.0828	57.5
10:30	0.0000	0.0	10:30	0.1799	124.9	10:30	0.0753	52.3
10:45	0.0000	0.0	10:45	0.1619	112.5	10:45	0.0677	47.0
11:00	0.0000	0.0	11:00	0.1439	100.0	11:00	0.0602	41.8
11:15	0.0000	0.0	11:15	0.1259	87.5	11:15	0.0527	36.6
11:30	0.0000	0.0	11:30	0.1080	75.0	11:30	0.0452	31.4
11:45	0.0000	0.0	11:45	0.0900	62.5	11:45	0.0376	26.1
12:00	0.0000	0.0	12:00	0.0720	50.0	12:00	0.0301	20.9
12:15	0.0000	0.0	12:15	0.0540	37.5	12:15	0.0226	15.7
12:30	0.0000	0.0	12:30	0.0360	25.0	12:30	0.0151	10.5
12:45	0.0000	0.0	12:45	0.0180	12.5	12:45	0.0075	5.2
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

First Creek Segment 4			First Creek Segment 3			First Creek Segment 2		
Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)	Time	MGD	Flow (gpm)
0:00	0.0000	0.0	0:00	0.0000	0.0	0:00	0.0000	0.0
0:15	0.4184	290.6	0:15	0.1549	107.6	0:15	0.3771	261.9
0:30	0.8369	581.2	0:30	0.3098	215.2	0:30	0.7542	523.8
0:45	1.2553	871.8	0:45	0.4647	322.7	0:45	1.1313	785.6
1:00	1.6738	1162.3	**1:00**	0.6197	430.3	**1:00**	1.5084	1047.5
1:15	1.6389	1138.1	1:15	0.6068	421.4	1:15	1.4770	1025.7
1:30	1.6040	1113.9	1:30	0.5938	412.4	1:30	1.4456	1003.9
1:45	1.5692	1089.7	1:45	0.5809	403.4	1:45	1.4142	982.1
2:00	1.5343	1065.5	2:00	0.5680	394.5	2:00	1.3827	960.2
2:15	1.4994	1041.3	2:15	0.5551	385.5	2:15	1.3513	938.4
2:30	1.4646	1017.1	2:30	0.5422	376.5	2:30	1.3199	916.6
2:45	1.4297	992.8	2:45	0.5293	367.6	2:45	1.2885	894.8
3:00	1.3948	968.6	3:00	0.5164	358.6	3:00	1.2570	872.9
3:15	1.3599	944.4	3:15	0.5035	349.6	3:15	1.2256	851.1
3:30	1.3251	920.2	3:30	0.4906	340.7	3:30	1.1942	829.3
3:45	1.2902	896.0	3:45	0.4777	331.7	3:45	1.1628	807.5
4:00	1.2553	871.8	4:00	0.4647	322.7	4:00	1.1313	785.6
4:15	1.2205	847.5	4:15	0.4518	313.8	4:15	1.0999	763.8
4:30	1.1856	823.3	4:30	0.4389	304.8	4:30	1.0685	742.0
4:45	1.1507	799.1	4:45	0.4260	295.8	4:45	1.0371	720.2
5:00	1.1159	774.9	5:00	0.4131	286.9	5:00	1.0056	698.4
5:15	1.0810	750.7	5:15	0.4002	277.9	5:15	0.9742	676.5
5:30	1.0461	726.5	5:30	0.3873	269.0	5:30	0.9428	654.7
5:45	1.0112	702.2	5:45	0.3744	260.0	5:45	0.9113	632.9
6:00	0.9764	678.0	6:00	0.3615	251.0	6:00	0.8799	611.1
6:15	0.9415	653.8	6:15	0.3486	242.1	6:15	0.8485	589.2
6:30	0.9066	629.6	6:30	0.3357	233.1	6:30	0.8171	567.4
6:45	0.8718	605.4	6:45	0.3227	224.1	6:45	0.7856	545.6
7:00	0.8369	581.2	7:00	0.3098	215.2	7:00	0.7542	523.8
7:15	0.8020	557.0	7:15	0.2969	206.2	7:15	0.7228	501.9
7:30	0.7671	532.7	7:30	0.2840	197.2	7:30	0.6914	480.1
7:45	0.7323	508.5	7:45	0.2711	188.3	7:45	0.6599	458.3
8:00	0.6974	484.3	8:00	0.2582	179.3	8:00	0.6285	436.5
8:15	0.6625	460.1	8:15	0.2453	170.3	8:15	0.5971	414.6
8:30	0.6277	435.9	8:30	0.2324	161.4	8:30	0.5657	392.8
8:45	0.5928	411.7	8:45	0.2195	152.4	8:45	0.5342	371.0
9:00	0.5579	387.4	9:00	0.2066	143.4	9:00	0.5028	349.2
9:15	0.5231	363.2	9:15	0.1936	134.5	9:15	0.4714	327.4
9:30	0.4882	339.0	9:30	0.1807	125.5	9:30	0.4400	305.5
9:45	0.4533	314.8	9:45	0.1678	116.5	9:45	0.4085	283.7
10:00	0.4184	290.6	10:00	0.1549	107.6	10:00	0.3771	261.9
10:15	0.3836	266.4	10:15	0.1420	98.6	10:15	0.3457	240.1
10:30	0.3487	242.2	10:30	0.1291	89.7	10:30	0.3143	218.2
10:45	0.3138	217.9	10:45	0.1162	80.7	10:45	0.2828	196.4
11:00	0.2790	193.7	11:00	0.1033	71.7	11:00	0.2514	174.6
11:15	0.2441	169.5	11:15	0.0904	62.8	11:15	0.2200	152.8
11:30	0.2092	145.3	11:30	0.0775	53.8	11:30	0.1886	130.9
11:45	0.1744	121.1	11:45	0.0645	44.8	11:45	0.1571	109.1
12:00	0.1395	96.9	12:00	0.0516	35.9	12:00	0.1257	87.3
12:15	0.1046	72.6	12:15	0.0387	26.9	12:15	0.0943	65.5
12:30	0.0697	48.4	12:30	0.0258	17.9	12:30	0.0629	43.6
12:45	0.0349	24.2	12:45	0.0129	9.0	12:45	0.0314	21.8
13:00	0.0000	0.0	13:00	0.0000	0.0	13:00	0.0000	0.0

UNIT HYDROGRAPH - ULTIMATE BUILD OUT FLOWS

First Creek Segment 1

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0015	1.0
0:30	0.0030	2.1
0:45	0.0045	3.1
1:00	0.0059	4.1
1:15	0.0058	4.0
1:30	0.0057	4.0
1:45	0.0056	3.9
2:00	0.0054	3.8
2:15	0.0053	3.7
2:30	0.0052	3.6
2:45	0.0051	3.5
3:00	0.0050	3.4
3:15	0.0048	3.4
3:30	0.0047	3.3
3:45	0.0046	3.2
4:00	0.0045	3.1
4:15	0.0043	3.0
4:30	0.0042	2.9
4:45	0.0041	2.8
5:00	0.0040	2.8
5:15	0.0038	2.7
5:30	0.0037	2.6
5:45	0.0036	2.5
6:00	0.0035	2.4
6:15	0.0033	2.3
6:30	0.0032	2.2
6:45	0.0031	2.1
7:00	0.0030	2.1
7:15	0.0028	2.0
7:30	0.0027	1.9
7:45	0.0026	1.8
8:00	0.0025	1.7
8:15	0.0024	1.6
8:30	0.0022	1.5
8:45	0.0021	1.5
9:00	0.0020	1.4
9:15	0.0019	1.3
9:30	0.0017	1.2
9:45	0.0016	1.1
10:00	0.0015	1.0
10:15	0.0014	0.9
10:30	0.0012	0.9
10:45	0.0011	0.8
11:00	0.0010	0.7
11:15	0.0009	0.6
11:30	0.0007	0.5
11:45	0.0006	0.4
12:00	0.0005	0.3
12:15	0.0004	0.3
12:30	0.0002	0.2
12:45	0.0001	0.1
13:00	0.0000	0.0

Rocky Branch

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.5834	405.2
0:30	1.1669	810.3
0:45	1.7503	1215.5
1:00	2.3337	1620.6
1:15	2.2851	1586.9
1:30	2.2365	1553.1
1:45	2.1878	1519.3
2:00	2.1392	1485.6
2:15	2.0906	1451.8
2:30	2.0420	1418.0
2:45	1.9934	1384.3
3:00	1.9448	1350.5
3:15	1.8961	1316.8
3:30	1.8475	1283.0
3:45	1.7989	1249.2
4:00	1.7503	1215.5
4:15	1.7017	1181.7
4:30	1.6530	1147.9
4:45	1.6044	1114.2
5:00	1.5558	1080.4
5:15	1.5072	1046.7
5:30	1.4586	1012.9
5:45	1.4099	979.1
6:00	1.3613	945.4
6:15	1.3127	911.6
6:30	1.2641	877.8
6:45	1.2155	844.1
7:00	1.1669	810.3
7:15	1.1182	776.6
7:30	1.0696	742.8
7:45	1.0210	709.0
8:00	0.9724	675.3
8:15	0.9238	641.5
8:30	0.8751	607.7
8:45	0.8265	574.0
9:00	0.7779	540.2
9:15	0.7293	506.4
9:30	0.6807	472.7
9:45	0.6320	438.9
10:00	0.5834	405.2
10:15	0.5348	371.4
10:30	0.4862	337.6
10:45	0.4376	303.9
11:00	0.3890	270.1
11:15	0.3403	236.3
11:30	0.2917	202.6
11:45	0.2431	168.8
12:00	0.1945	135.1
12:15	0.1459	101.3
12:30	0.0972	67.5
12:45	0.0486	33.8
13:00	0.0000	0.0

Rocky Branch Segment 1

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.5010	347.9
0:30	1.0019	695.8
0:45	1.5029	1043.6
1:00	2.0038	1391.5
1:15	1.9621	1362.5
1:30	1.9203	1333.6
1:45	1.8786	1304.6
2:00	1.8368	1275.6
2:15	1.7951	1246.6
2:30	1.7533	1217.6
2:45	1.7116	1188.6
3:00	1.6698	1159.6
3:15	1.6281	1130.6
3:30	1.5863	1101.6
3:45	1.5446	1072.6
4:00	1.5029	1043.6
4:15	1.4611	1014.7
4:30	1.4194	985.7
4:45	1.3776	956.7
5:00	1.3359	927.7
5:15	1.2941	898.7
5:30	1.2524	869.7
5:45	1.2106	840.7
6:00	1.1689	811.7
6:15	1.1271	782.7
6:30	1.0854	753.7
6:45	1.0436	724.8
7:00	1.0019	695.8
7:15	0.9602	666.8
7:30	0.9184	637.8
7:45	0.8767	608.8
8:00	0.8349	579.8
8:15	0.7932	550.8
8:30	0.7514	521.8
8:45	0.7097	492.8
9:00	0.6679	463.8
9:15	0.6262	434.9
9:30	0.5844	405.9
9:45	0.5427	376.9
10:00	0.5010	347.9
10:15	0.4592	318.9
10:30	0.4175	289.9
10:45	0.3757	260.9
11:00	0.3340	231.9
11:15	0.2922	202.9
11:30	0.2505	173.9
11:45	0.2087	145.0
12:00	0.1670	116.0
12:15	0.1252	87.0
12:30	0.0835	58.0
12:45	0.0417	29.0
13:00	0.0000	0.0

Wilkerson Creek Trib 3

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	1.2677	880.3
0:30	2.5353	1760.7
0:45	3.8030	2641.0
1:00	5.0707	3521.3
1:15	4.9650	3447.9
1:30	4.8594	3374.6
1:45	4.7538	3301.2
2:00	4.6481	3227.9
2:15	4.5425	3154.5
2:30	4.4368	3081.1
2:45	4.3312	3007.8
3:00	4.2256	2934.4
3:15	4.1199	2861.1
3:30	4.0143	2787.7
3:45	3.9086	2714.3
4:00	3.8030	2641.0
4:15	3.6974	2567.6
4:30	3.5917	2494.3
4:45	3.4861	2420.9
5:00	3.3805	2347.5
5:15	3.2748	2274.2
5:30	3.1692	2200.8
5:45	3.0635	2127.5
6:00	2.9579	2054.1
6:15	2.8523	1980.7
6:30	2.7466	1907.4
6:45	2.6410	1834.0
7:00	2.5353	1760.7
7:15	2.4297	1687.3
7:30	2.3241	1613.9
7:45	2.2184	1540.6
8:00	2.1128	1467.2
8:15	2.0071	1393.9
8:30	1.9015	1320.5
8:45	1.7959	1247.1
9:00	1.6902	1173.8
9:15	1.5846	1100.4
9:30	1.4789	1027.0
9:45	1.3733	953.7
10:00	1.2677	880.3
10:15	1.1620	807.0
10:30	1.0564	733.6
10:45	0.9508	660.2
11:00	0.8451	586.9
11:15	0.7395	513.5
11:30	0.6338	440.2
11:45	0.5282	366.8
12:00	0.4226	293.4
12:15	0.3169	220.1
12:30	0.2113	146.7
12:45	0.1056	73.4
13:00	0.0000	0.0

Wilkerson Creek Segment 5

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1522	105.7
0:30	0.3044	211.4
0:45	0.4565	317.0
1:00	0.6087	422.7
1:15	0.5960	413.9
1:30	0.5833	405.1
1:45	0.5707	396.3
2:00	0.5580	387.5
2:15	0.5453	378.7
2:30	0.5326	369.9
2:45	0.5199	361.1
3:00	0.5073	352.3
3:15	0.4946	343.5
3:30	0.4819	334.7
3:45	0.4692	325.8
4:00	0.4565	317.0
4:15	0.4439	308.2
4:30	0.4312	299.4
4:45	0.4185	290.6
5:00	0.4058	281.8
5:15	0.3931	273.0
5:30	0.3804	264.2
5:45	0.3678	255.4
6:00	0.3551	246.6
6:15	0.3424	237.8
6:30	0.3297	229.0
6:45	0.3170	220.2
7:00	0.3044	211.4
7:15	0.2917	202.6
7:30	0.2790	193.7
7:45	0.2663	184.9
8:00	0.2536	176.1
8:15	0.2409	167.3
8:30	0.2283	158.5
8:45	0.2156	149.7
9:00	0.2029	140.9
9:15	0.1902	132.1
9:30	0.1775	123.3
9:45	0.1649	114.5
10:00	0.1522	105.7
10:15	0.1395	96.9
10:30	0.1268	88.1
10:45	0.1141	79.3
11:00	0.1015	70.5
11:15	0.0888	61.6
11:30	0.0761	52.8
11:45	0.0634	44.0
12:00	0.0507	35.2
12:15	0.0380	26.4
12:30	0.0254	17.6
12:45	0.0127	8.8
13:00	0.0000	0.0

Wilkerson Creek Trib 2

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.2772	192.5
0:30	0.5543	385.0
0:45	0.8315	577.4
1:00	1.1087	769.9
1:15	1.0856	753.9
1:30	1.0625	737.8
1:45	1.0394	721.8
2:00	1.0163	705.8
2:15	0.9932	689.7
2:30	0.9701	673.7
2:45	0.9470	657.6
3:00	0.9239	641.6
3:15	0.9008	625.6
3:30	0.8777	609.5
3:45	0.8546	593.5
4:00	0.8315	577.4
4:15	0.8084	561.4
4:30	0.7853	545.4
4:45	0.7622	529.3
5:00	0.7391	513.3
5:15	0.7160	497.2
5:30	0.6929	481.2
5:45	0.6698	465.2
6:00	0.6467	449.1
6:15	0.6236	433.1
6:30	0.6005	417.0
6:45	0.5774	401.0
7:00	0.5543	385.0
7:15	0.5312	368.9
7:30	0.5081	352.9
7:45	0.4850	336.8
8:00	0.4620	320.8
8:15	0.4389	304.8
8:30	0.4158	288.7
8:45	0.3927	272.7
9:00	0.3696	256.6
9:15	0.3465	240.6
9:30	0.3234	224.6
9:45	0.3003	208.5
10:00	0.2772	192.5
10:15	0.2541	176.4
10:30	0.2310	160.4
10:45	0.2079	144.4
11:00	0.1848	128.3
11:15	0.1617	112.3
11:30	0.1386	96.2
11:45	0.1155	80.2
12:00	0.0924	64.2
12:15	0.0693	48.1
12:30	0.0462	32.1
12:45	0.0231	16.0
13:00	0.0000	0.0

Wilkerson Creek Segment 4

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.2379	165.2
0:30	0.4759	330.5
0:45	0.7138	495.7
1:00	0.9518	661.0
1:15	0.9319	647.2
1:30	0.9121	633.4
1:45	0.8923	619.6
2:00	0.8725	605.9
2:15	0.8526	592.1
2:30	0.8328	578.3
2:45	0.8130	564.6
3:00	0.7931	550.8
3:15	0.7733	537.0
3:30	0.7535	523.3
3:45	0.7337	509.5
4:00	0.7138	495.7
4:15	0.6940	481.9
4:30	0.6742	468.2
4:45	0.6543	454.4
5:00	0.6345	440.6
5:15	0.6147	426.9
5:30	0.5949	413.1
5:45	0.5750	399.3
6:00	0.5552	385.6
6:15	0.5354	371.8
6:30	0.5155	358.0
6:45	0.4957	344.2
7:00	0.4759	330.5
7:15	0.4561	316.7
7:30	0.4362	302.9
7:45	0.4164	289.2
8:00	0.3966	275.4
8:15	0.3767	261.6
8:30	0.3569	247.9
8:45	0.3371	234.1
9:00	0.3173	220.3
9:15	0.2974	206.5
9:30	0.2776	192.8
9:45	0.2578	179.0
10:00	0.2379	165.2
10:15	0.2181	151.5
10:30	0.1983	137.7
10:45	0.1785	123.9
11:00	0.1586	110.2
11:15	0.1388	96.4
11:30	0.1190	82.6
11:45	0.0991	68.8
12:00	0.0793	55.1
12:15	0.0595	41.3
12:30	0.0397	27.5
12:45	0.0198	13.8
13:00	0.0000	0.0

Wilkerson Creek Trib 1

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0300	20.8
0:30	0.0599	41.6
0:45	0.0899	62.4
1:00	0.1198	83.2
1:15	0.1173	81.5
1:30	0.1148	79.7
1:45	0.1123	78.0
2:00	0.1098	76.3
2:15	0.1073	74.5
2:30	0.1048	72.8
2:45	0.1024	71.1
3:00	0.0999	69.3
3:15	0.0974	67.6
3:30	0.0949	65.9
3:45	0.0924	64.1
4:00	0.0899	62.4
4:15	0.0874	60.7
4:30	0.0849	58.9
4:45	0.0824	57.2
5:00	0.0799	55.5
5:15	0.0774	53.7
5:30	0.0749	52.0
5:45	0.0724	50.3
6:00	0.0699	48.5
6:15	0.0674	46.8
6:30	0.0649	45.1
6:45	0.0624	43.3
7:00	0.0599	41.6
7:15	0.0574	39.9
7:30	0.0549	38.1
7:45	0.0524	36.4
8:00	0.0499	34.7
8:15	0.0474	32.9
8:30	0.0449	31.2
8:45	0.0424	29.5
9:00	0.0399	27.7
9:15	0.0374	26.0
9:30	0.0349	24.3
9:45	0.0325	22.5
10:00	0.0300	20.8
10:15	0.0275	19.1
10:30	0.0250	17.3
10:45	0.0225	15.6
11:00	0.0200	13.9
11:15	0.0175	12.1
11:30	0.0150	10.4
11:45	0.0125	8.7
12:00	0.0100	6.9
12:15	0.0075	5.2
12:30	0.0050	3.5
12:45	0.0025	1.7
13:00	0.0000	0.0

Wilkerson Creek Segment 3

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1925	133.7
0:30	0.3850	267.4
0:45	0.5775	401.1
1:00	0.7700	534.7
1:15	0.7540	523.6
1:30	0.7379	512.5
1:45	0.7219	501.3
2:00	0.7059	490.2
2:15	0.6898	479.0
2:30	0.6738	467.9
2:45	0.6577	456.8
3:00	0.6417	445.6
3:15	0.6256	434.5
3:30	0.6096	423.3
3:45	0.5936	412.2
4:00	0.5775	401.1
4:15	0.5615	389.9
4:30	0.5454	378.8
4:45	0.5294	367.6
5:00	0.5134	356.5
5:15	0.4973	345.4
5:30	0.4813	334.2
5:45	0.4652	323.1
6:00	0.4492	311.9
6:15	0.4331	300.8
6:30	0.4171	289.7
6:45	0.4011	278.5
7:00	0.3850	267.4
7:15	0.3690	256.2
7:30	0.3529	245.1
7:45	0.3369	234.0
8:00	0.3208	222.8
8:15	0.3048	211.7
8:30	0.2888	200.5
8:45	0.2727	189.4
9:00	0.2567	178.2
9:15	0.2406	167.1
9:30	0.2246	156.0
9:45	0.2085	144.8
10:00	0.1925	133.7
10:15	0.1765	122.5
10:30	0.1604	111.4
10:45	0.1444	100.3
11:00	0.1283	89.1
11:15	0.1123	78.0
11:30	0.0963	66.8
11:45	0.0802	55.7
12:00	0.0642	44.6
12:15	0.0481	33.4
12:30	0.0321	22.3
12:45	0.0160	11.1
13:00	0.0000	0.0

Wilkerson Creek Segment 2

Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.0835	58.0
0:30	0.1670	116.0
0:45	0.2505	173.9
1:00	0.3340	231.9
1:15	0.3270	227.1
1:30	0.3201	222.3
1:45	0.3131	217.4
2:00	0.3061	212.6
2:15	0.2992	207.8
2:30	0.2922	202.9
2:45	0.2853	198.1
3:00	0.2783	193.3
3:15	0.2713	188.4
3:30	0.2644	183.6
3:45	0.2574	178.8
4:00	0.2505	173.9
4:15	0.2435	169.1
4:30	0.2366	164.3
4:45	0.2296	159.4
5:00	0.2226	154.6
5:15	0.2157	149.8
5:30	0.2087	145.0
5:45	0.2018	140.1
6:00	0.1948	135.3
6:15	0.1879	130.5
6:30	0.1809	125.6
6:45	0.1739	120.8
7:00	0.1670	116.0
7:15	0.1600	111.1
7:30	0.1531	106.3
7:45	0.1461	101.5
8:00	0.1392	96.6
8:15	0.1322	91.8
8:30	0.1252	87.0
8:45	0.1183	82.1
9:00	0.1113	77.3
9:15	0.1044	72.5
9:30	0.0974	67.6
9:45	0.0904	62.8
10:00	0.0835	58.0
10:15	0.0765	53.1
10:30	0.0696	48.3
10:45	0.0626	43.5
11:00	0.0557	38.7
11:15	0.0487	33.8
11:30	0.0417	29.0
11:45	0.0348	24.2
12:00	0.0278	19.3
12:15	0.0209	14.5
12:30	0.0139	9.7
12:45	0.0070	4.8
13:00	0.0000	0.0

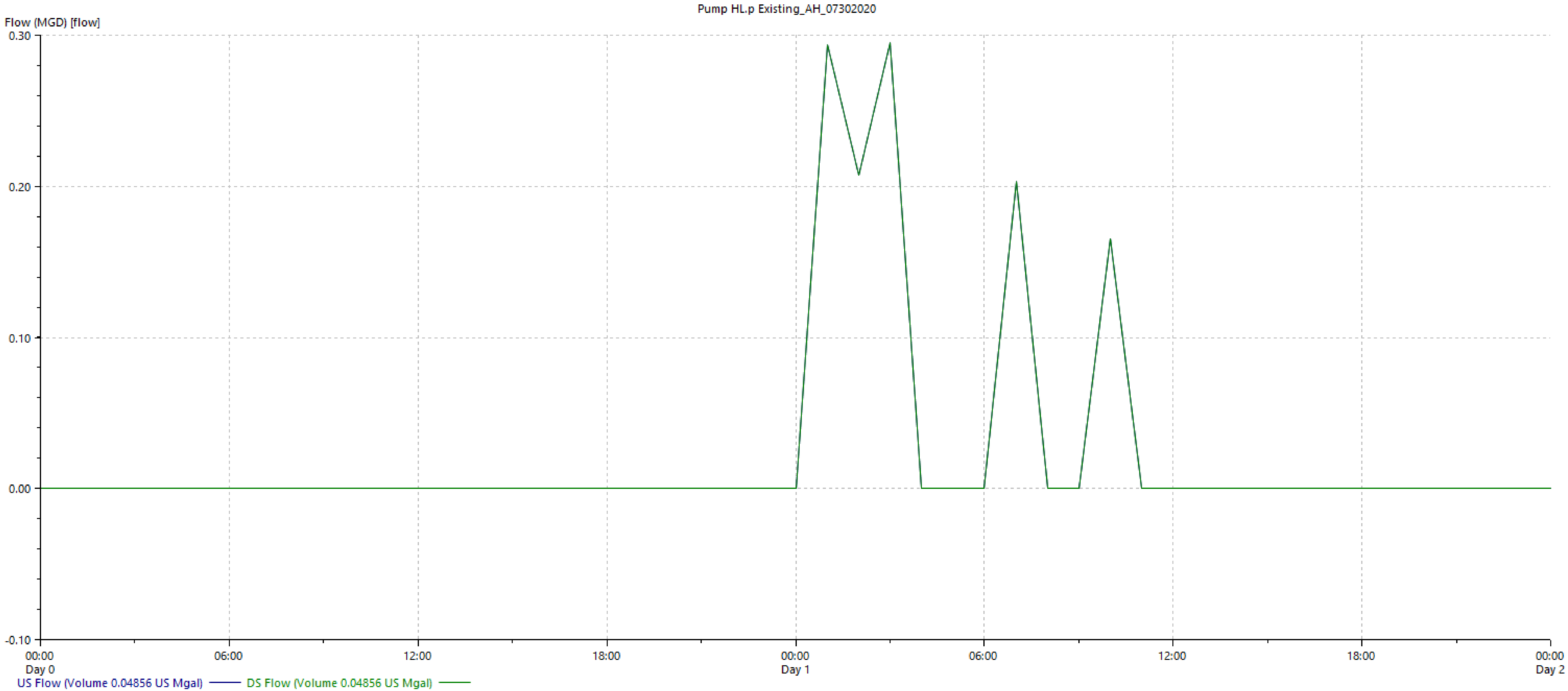
Wilkerson Creek Segment 1

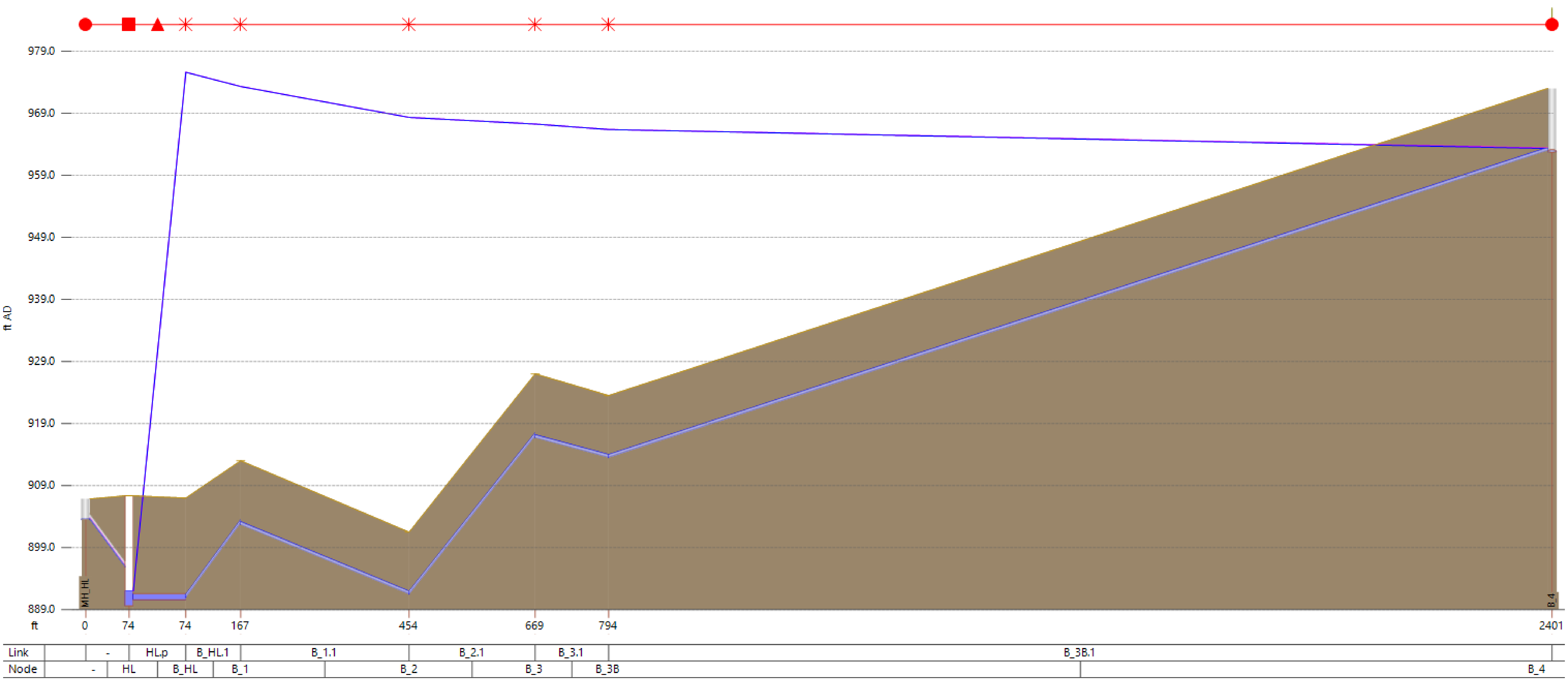
Time	MGD	Flow (gpm)
0:00	0.0000	0.0
0:15	0.1800	125.0
0:30	0.3600	250.0
0:45	0.5400	375.0
1:00	0.7200	500.0
1:15	0.7050	489.6
1:30	0.6900	479.2
1:45	0.6750	468.8
2:00	0.6600	458.3
2:15	0.6450	447.9
2:30	0.6300	437.5
2:45	0.6150	427.1
3:00	0.6000	416.7
3:15	0.5850	406.3
3:30	0.5700	395.8
3:45	0.5550	385.4
4:00	0.5400	375.0
4:15	0.5250	364.6
4:30	0.5100	354.2
4:45	0.4950	343.8
5:00	0.4800	333.3
5:15	0.4650	322.9
5:30	0.4500	312.5
5:45	0.4350	302.1
6:00	0.4200	291.7
6:15	0.4050	281.3
6:30	0.3900	270.8
6:45	0.3750	260.4
7:00	0.3600	250.0
7:15	0.3450	239.6
7:30	0.3300	229.2
7:45	0.3150	218.8
8:00	0.3000	208.3
8:15	0.2850	197.9
8:30	0.2700	187.5
8:45	0.2550	177.1
9:00	0.2400	166.7
9:15	0.2250	156.3
9:30	0.2100	145.8
9:45	0.1950	135.4
10:00	0.1800	125.0
10:15	0.1650	114.6
10:30	0.1500	104.2
10:45	0.1350	93.8
11:00	0.1200	83.3
11:15	0.1050	72.9
11:30	0.0900	62.5
11:45	0.0750	52.1
12:00	0.0600	41.7
12:15	0.0450	31.3
12:30	0.0300	20.8
12:45	0.0150	10.4
13:00	0.0000	0.0

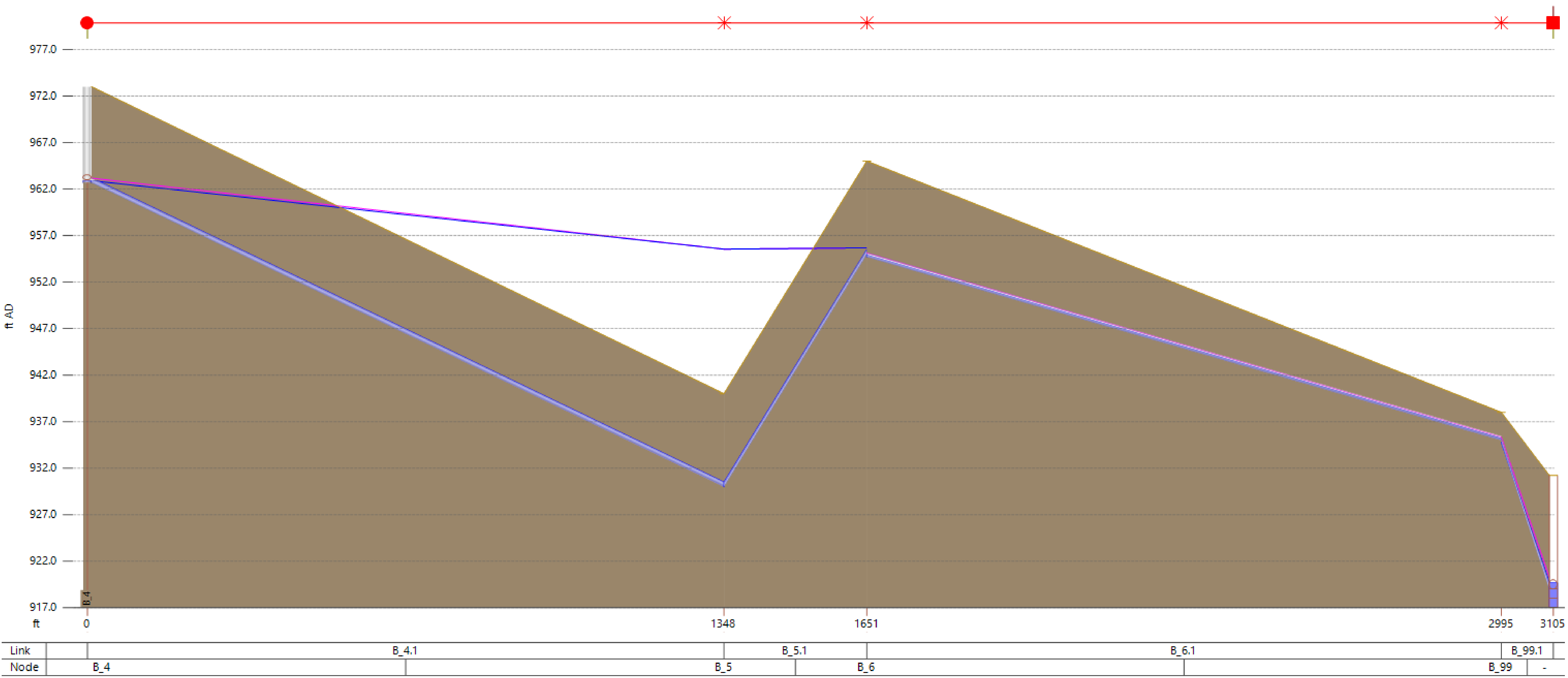
EXISTING SYSTEM MODEL RESULTS

NORTH FORCEMAIN

HARBOR LAKES PS

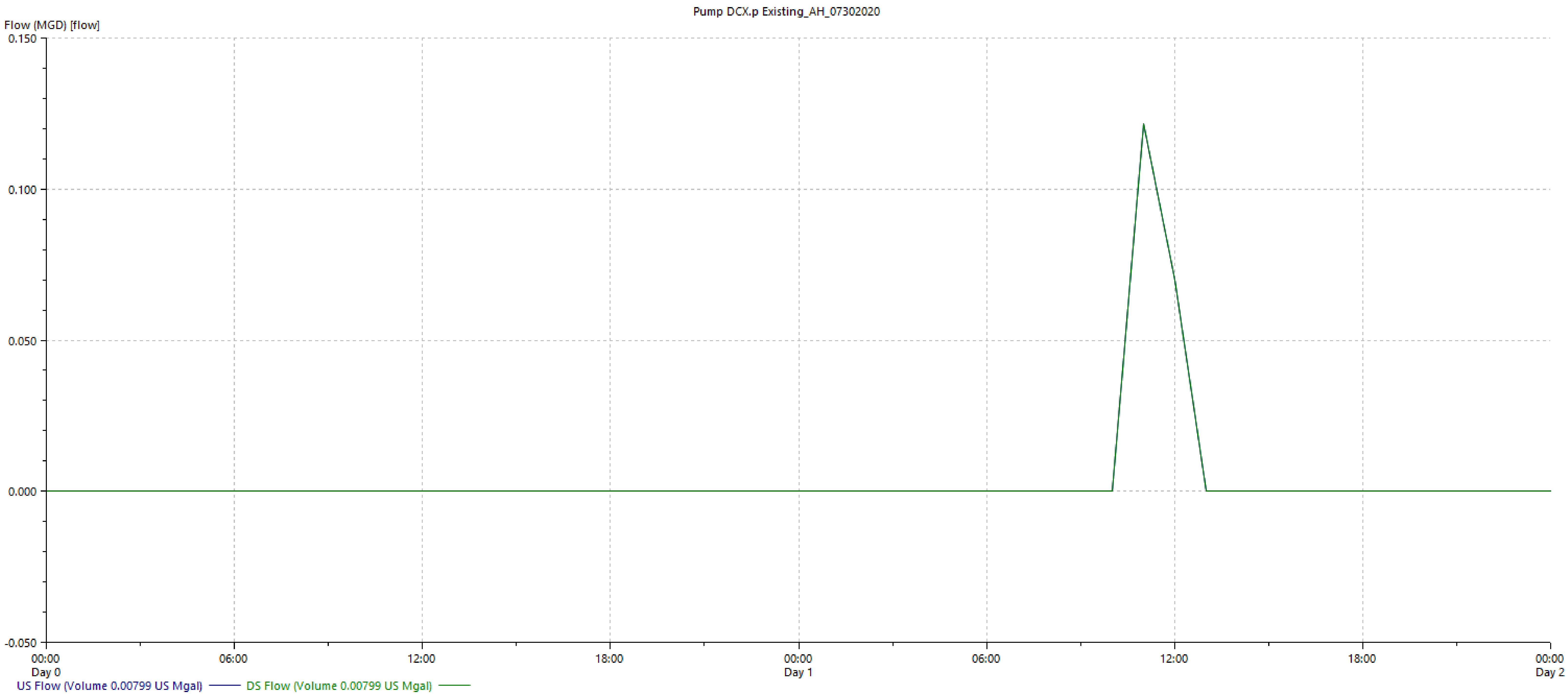


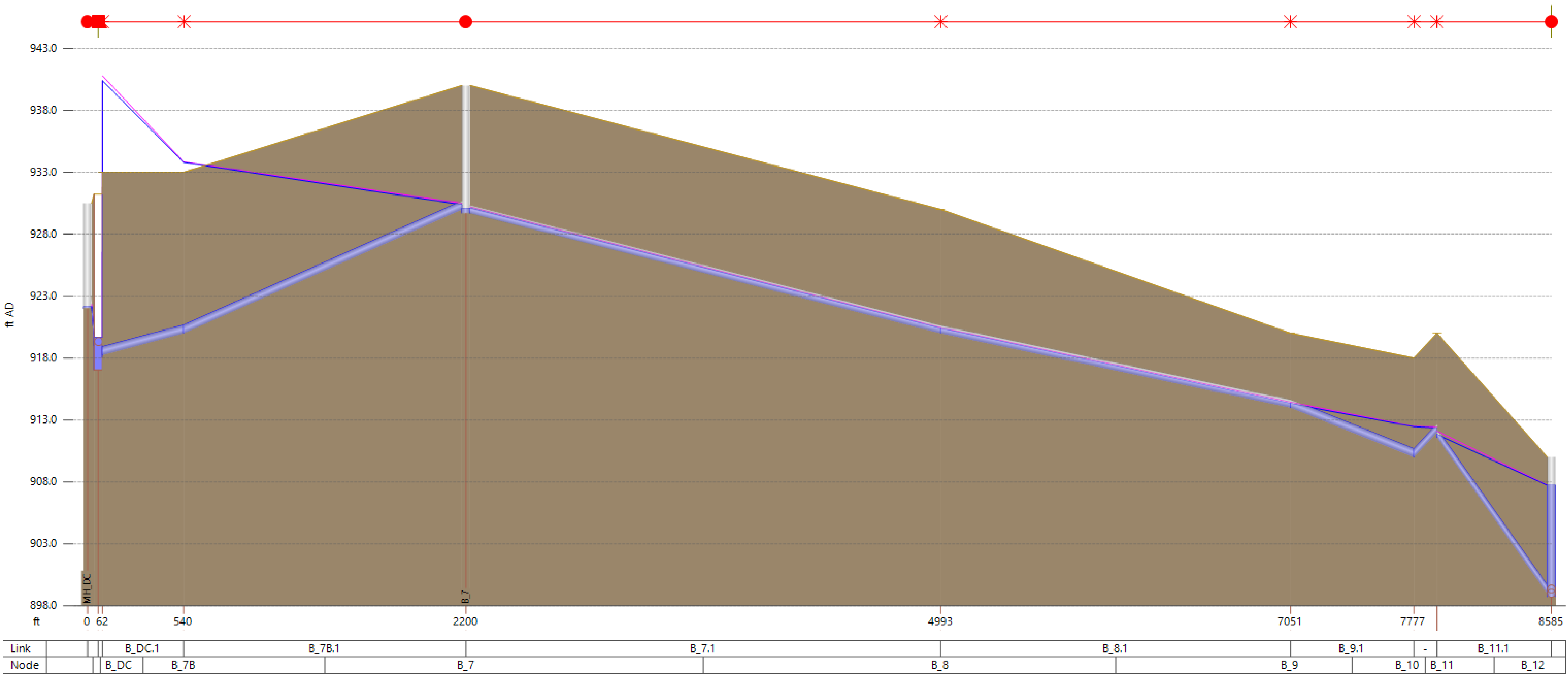

979.0
969.0
959.0
949.0
939.0
929.0
919.0
909.0
899.0
889.0
ft AD
MH_HL
B_4
ft
0
74
74
167
454
669
794
2401
Link
-
HLp
B_HL.1
B_1.1
B_2.1
B_3.1
B_3B.1
Node
-
HL
B_HL
B_1
B_2
B_3
B_3B
B_4



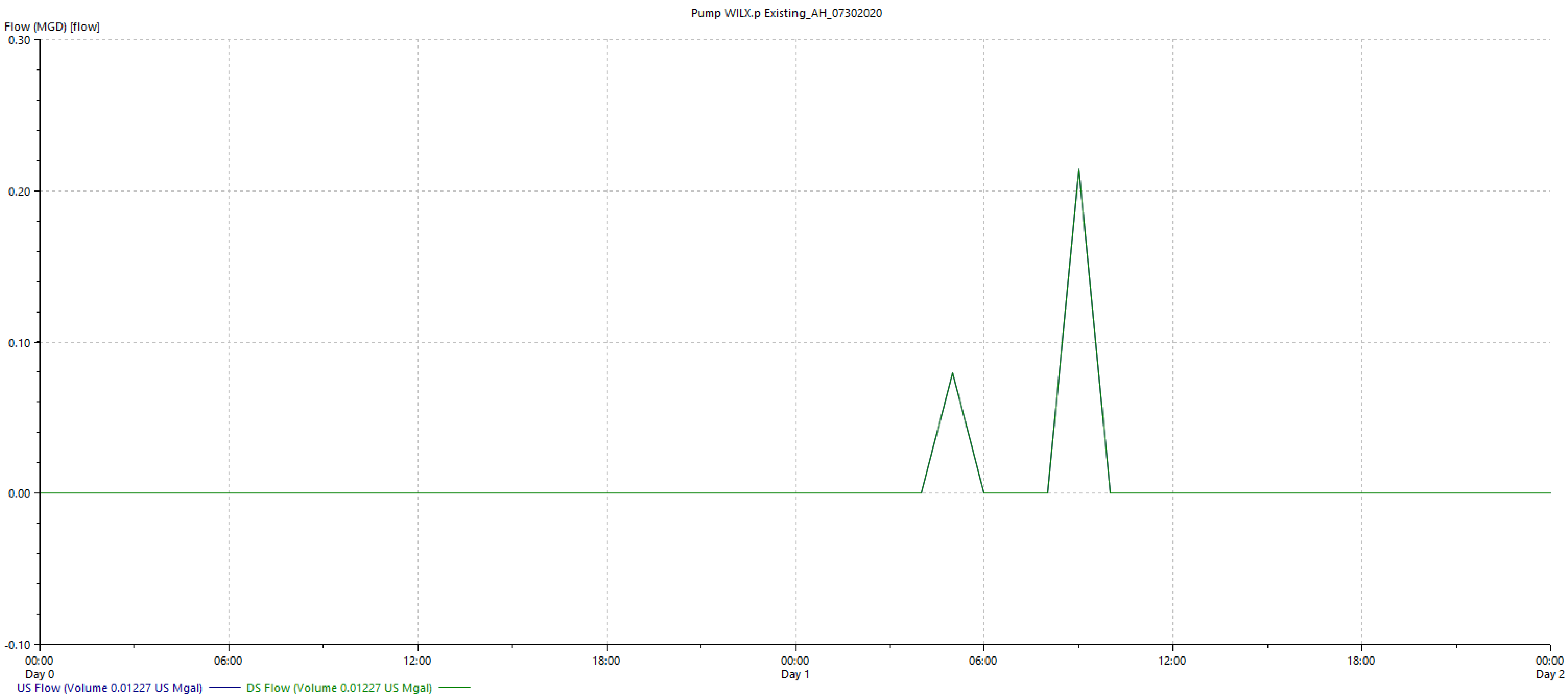
977.0
972.0
967.0
962.0
957.0
952.0
947.0
942.0
937.0
932.0
927.0
922.0
917.0
ft AD
ft
0
1348
1651
2995
3105
B_4
Link
B_4.1
B_5.1
B_6.1
B_99.1
Node
B_4
B_5
B_6
B_99
-

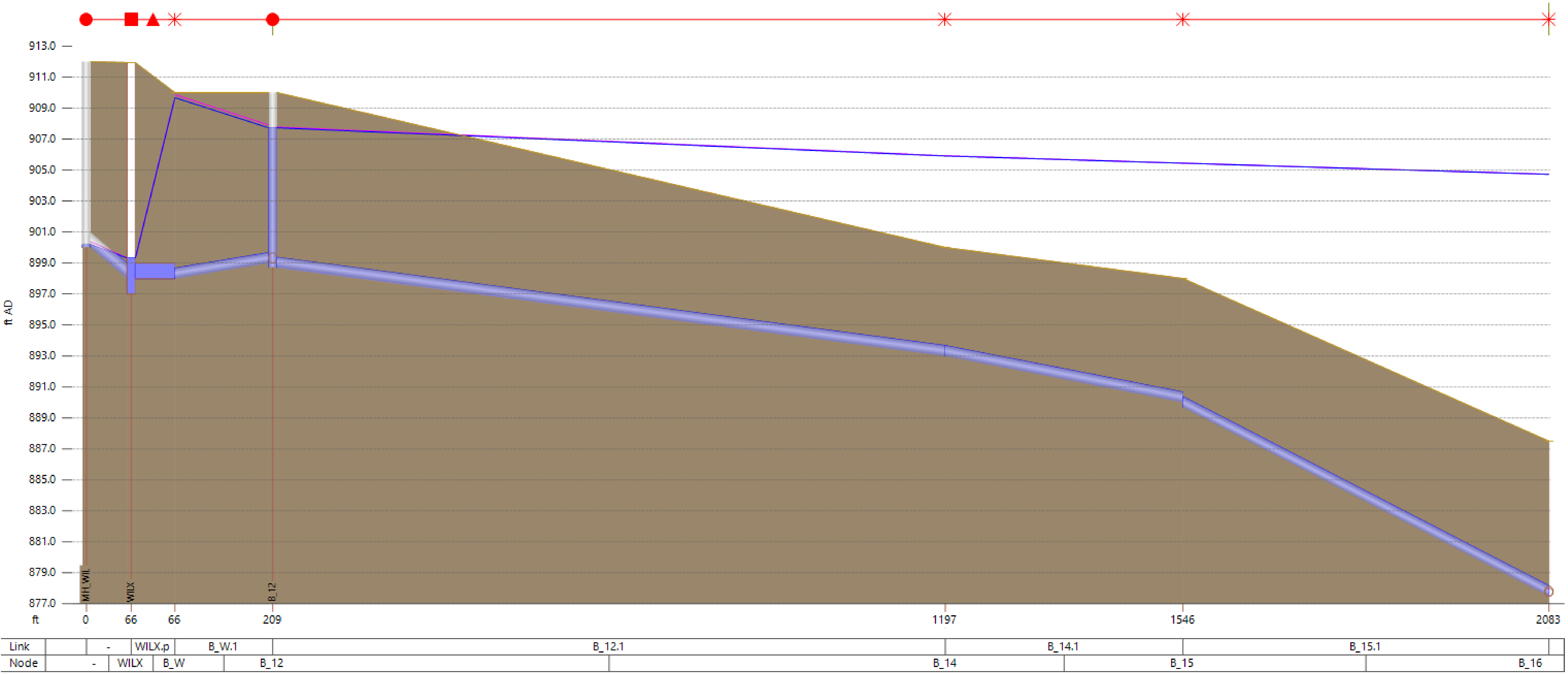
DIAMOND CREST PS



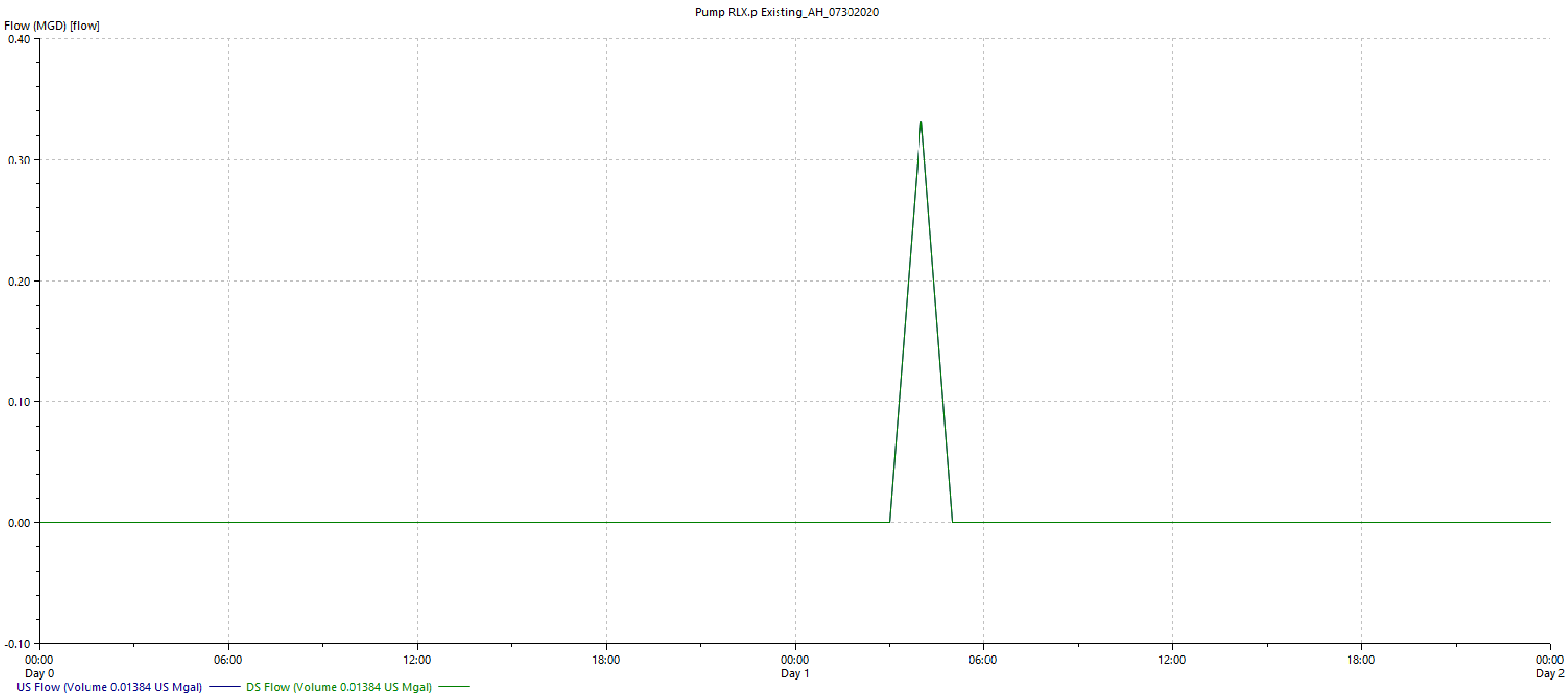


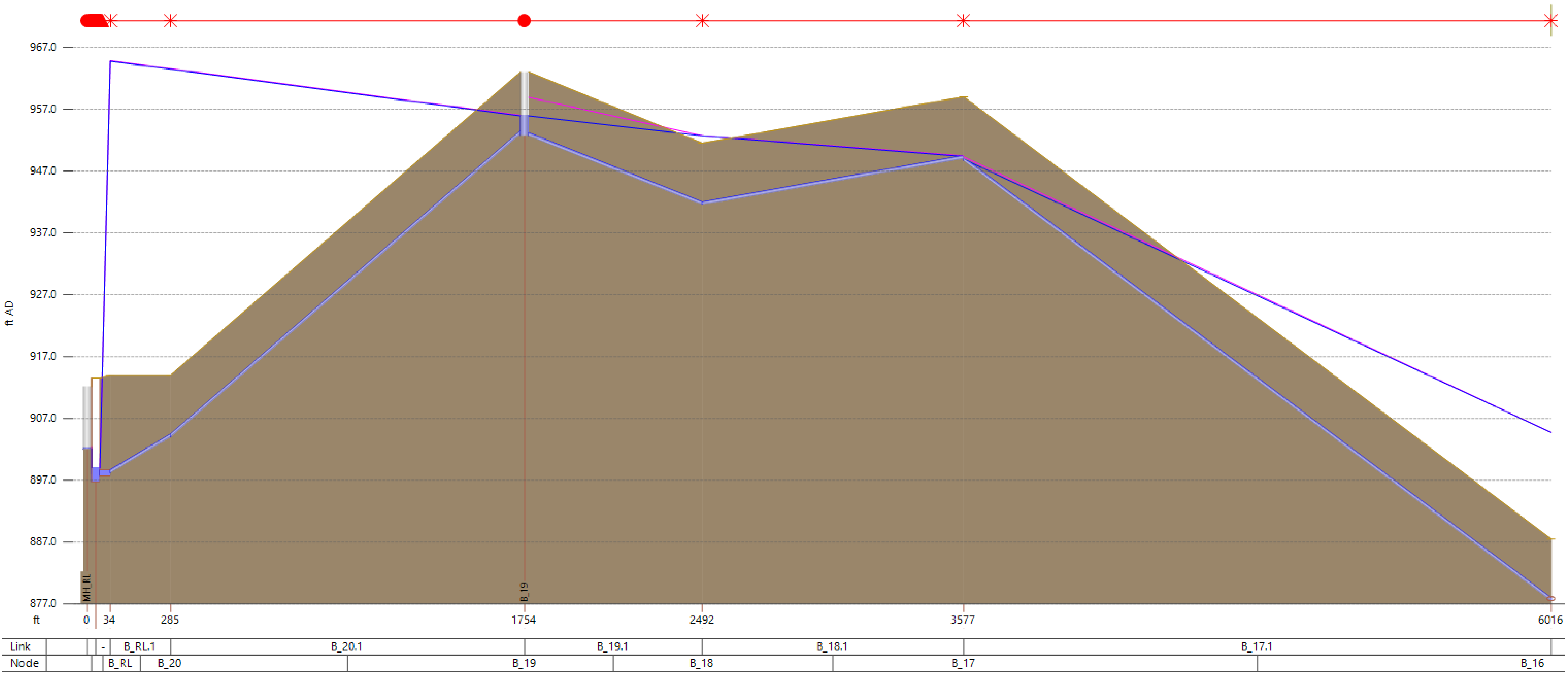
943.0
938.0
933.0
928.0
923.0
918.0
913.0
908.0
903.0
898.0
ft AD
MH_DC
B_7
ft
0
62
540
2200
4993
7051
7777
8585
Link
B_DC.1
B_7B.1
B_7.1
B_8.1
B_9.1
-
B_11.1
Node
B_DC
B_7B
B_7
B_8
B_9
B_10
B_11
B_12


Pump WILX.p Existing_AH_07302020
Flow (MGD) [flow]
0.30
0.20
0.10
0.00
-0.10
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.01227 US Mgal)
DS Flow (Volume 0.01227 US Mgal)

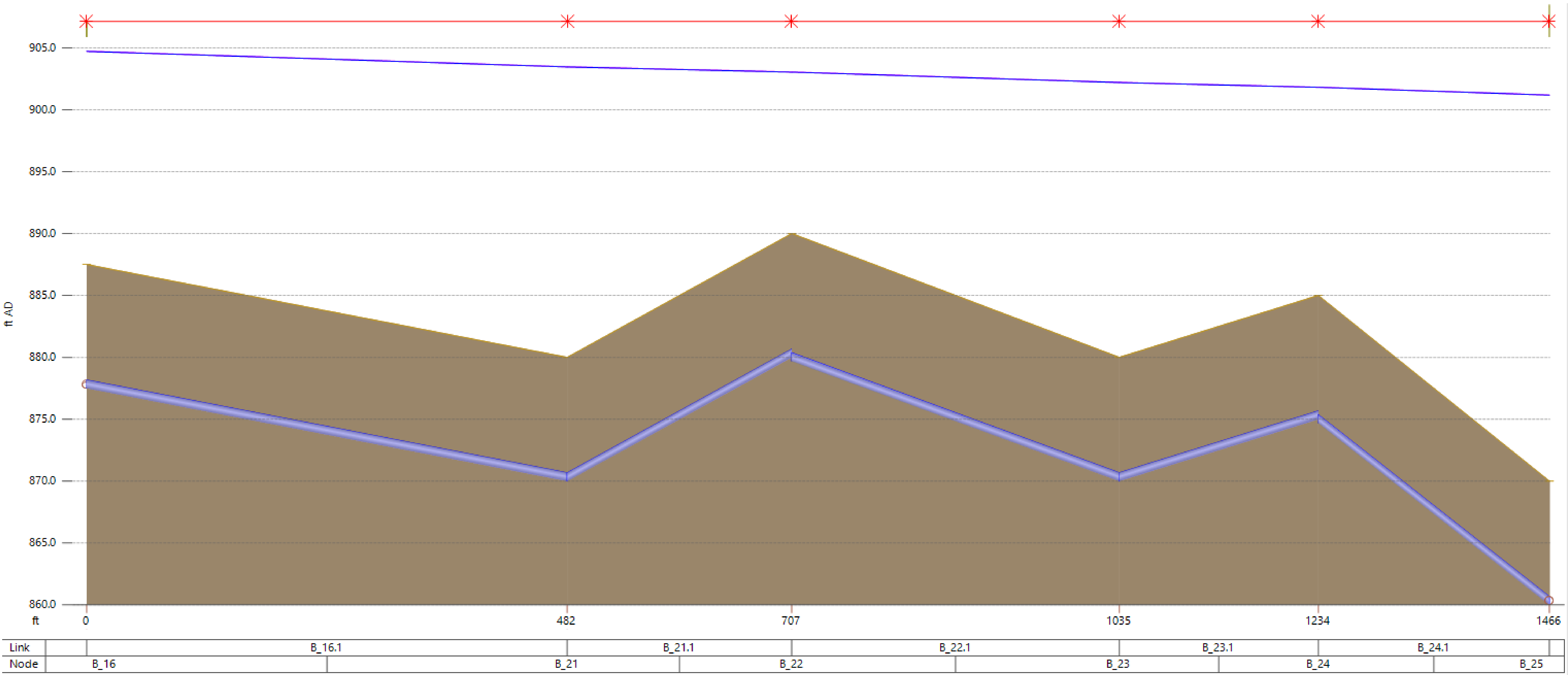


913.0
911.0
909.0
907.0
905.0
903.0
901.0
899.0
897.0
895.0
893.0
891.0
889.0
887.0
885.0
883.0
881.0
879.0
877.0
ft AD
MH_WIL
WILX
B_12
ft
0
66
66
209
1197
1546
2083
Link
-
WILX.p
B_W.1
B_12.1
B_14.1
B_15.1
Node
-
WILX
B_W
B_12
B_14
B_15
B_16

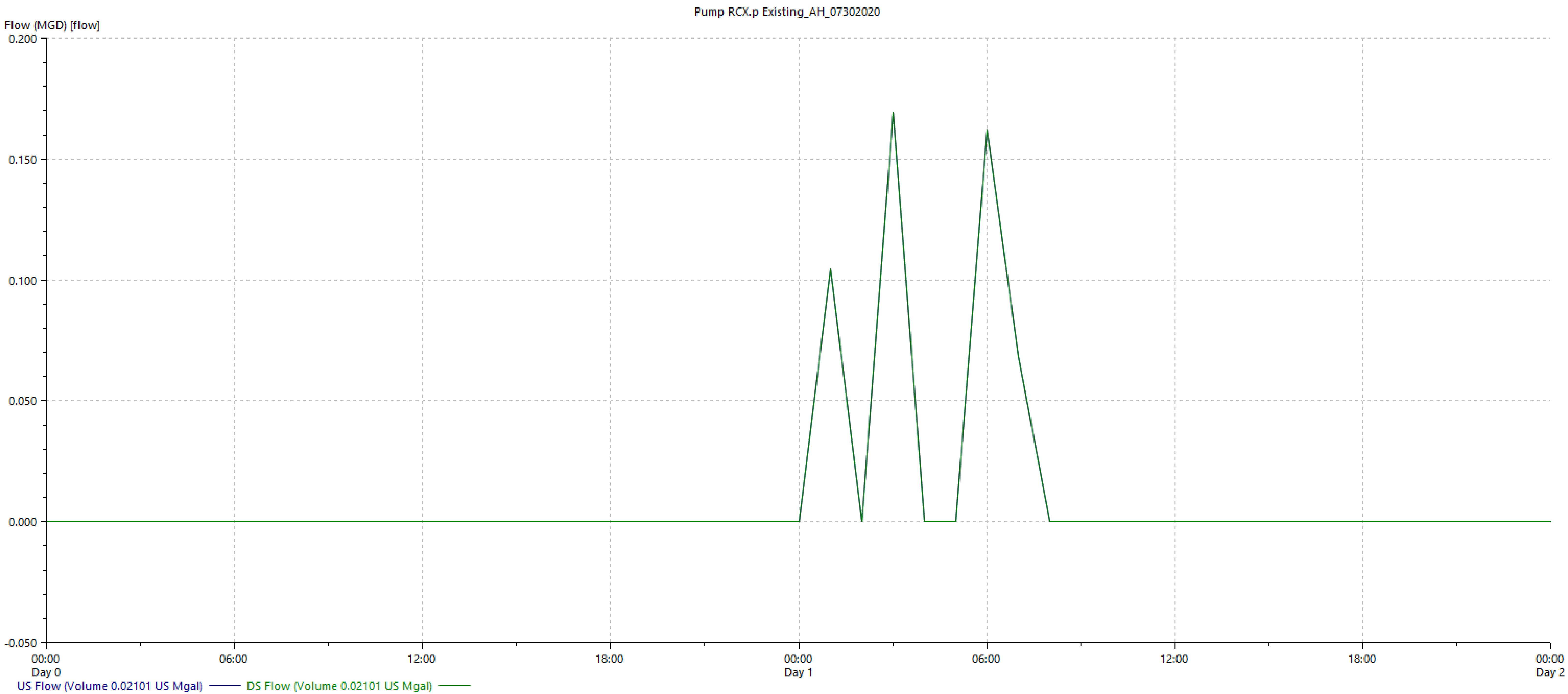

Pump RLX.p Existing_AH_07302020
Flow (MGD) [flow]
0.40
0.30
0.20
0.10
0.00
-0.10
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.01384 US Mgal)
DS Flow (Volume 0.01384 US Mgal)



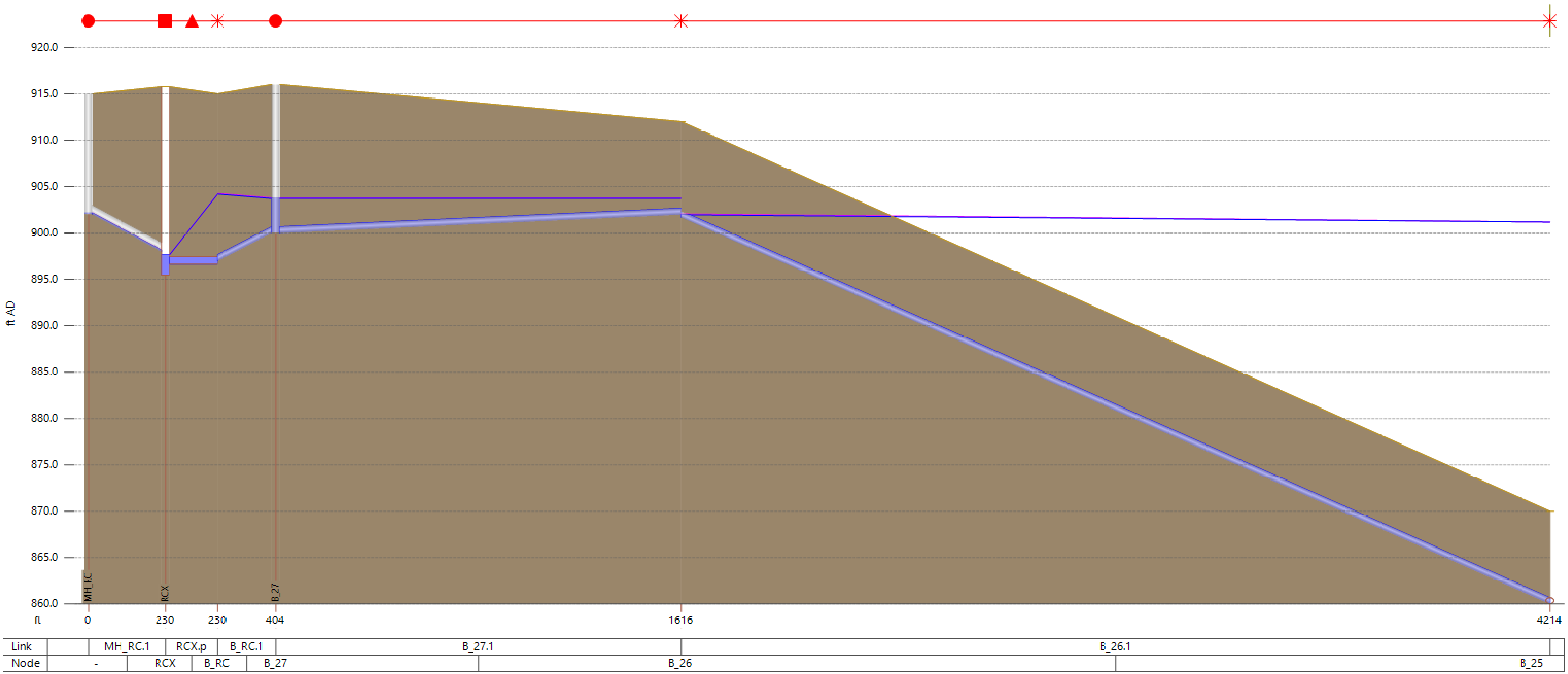
967.0
957.0
947.0
937.0
927.0
917.0
907.0
897.0
887.0
877.0
ft AD
MH_RL
B_19
ft
0
34
285
1754
2492
3577
6016
Link
-
B_RL.1
B_20.1
B_19.1
B_18.1
B_17.1
Node
B_RL
B_20
B_19
B_18
B_17
B_16



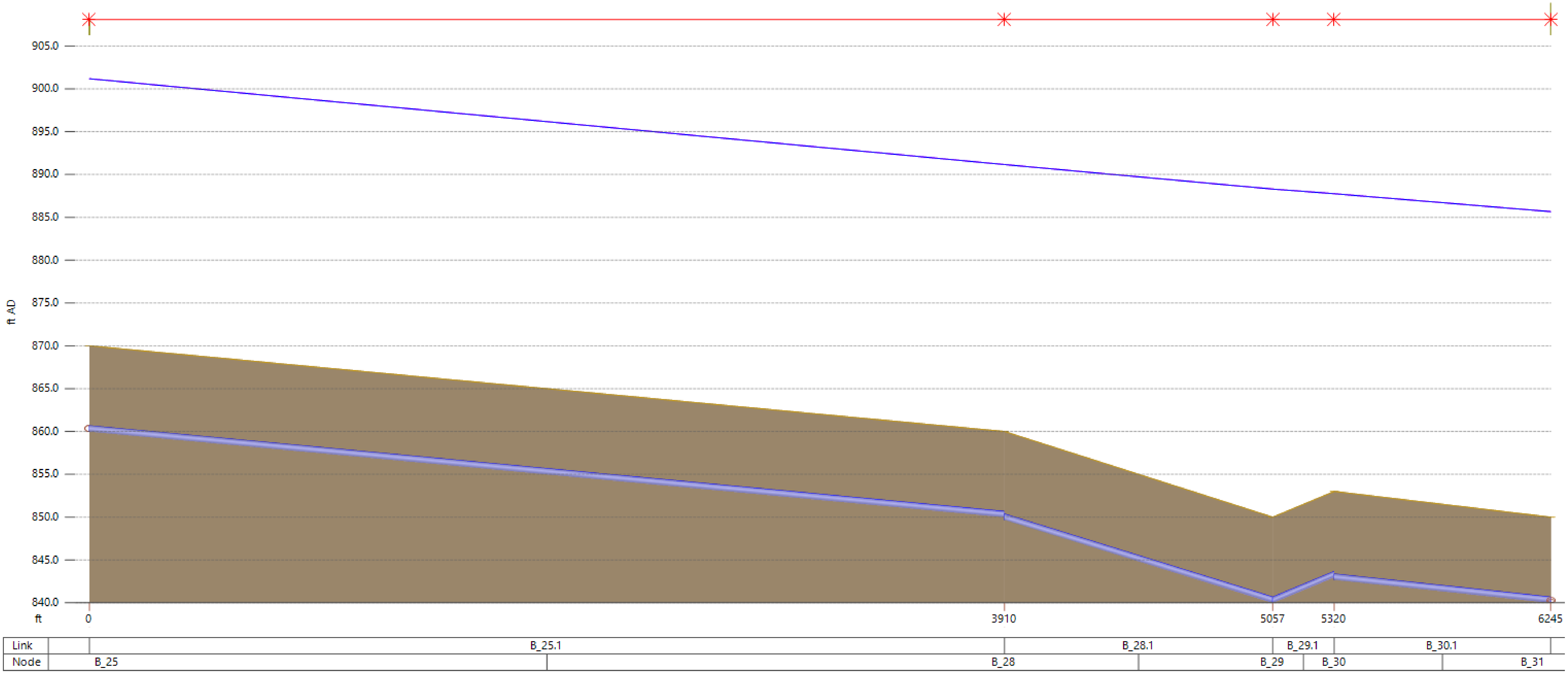
905.0
900.0
895.0
890.0
885.0
880.0
875.0
870.0
865.0
860.0
ft AD
ft
0
482
707
1035
1234
1466
Link
B_16.1
B_21.1
B_22.1
B_23.1
B_24.1
Node
B_16
B_21
B_22
B_23
B_24
B_25



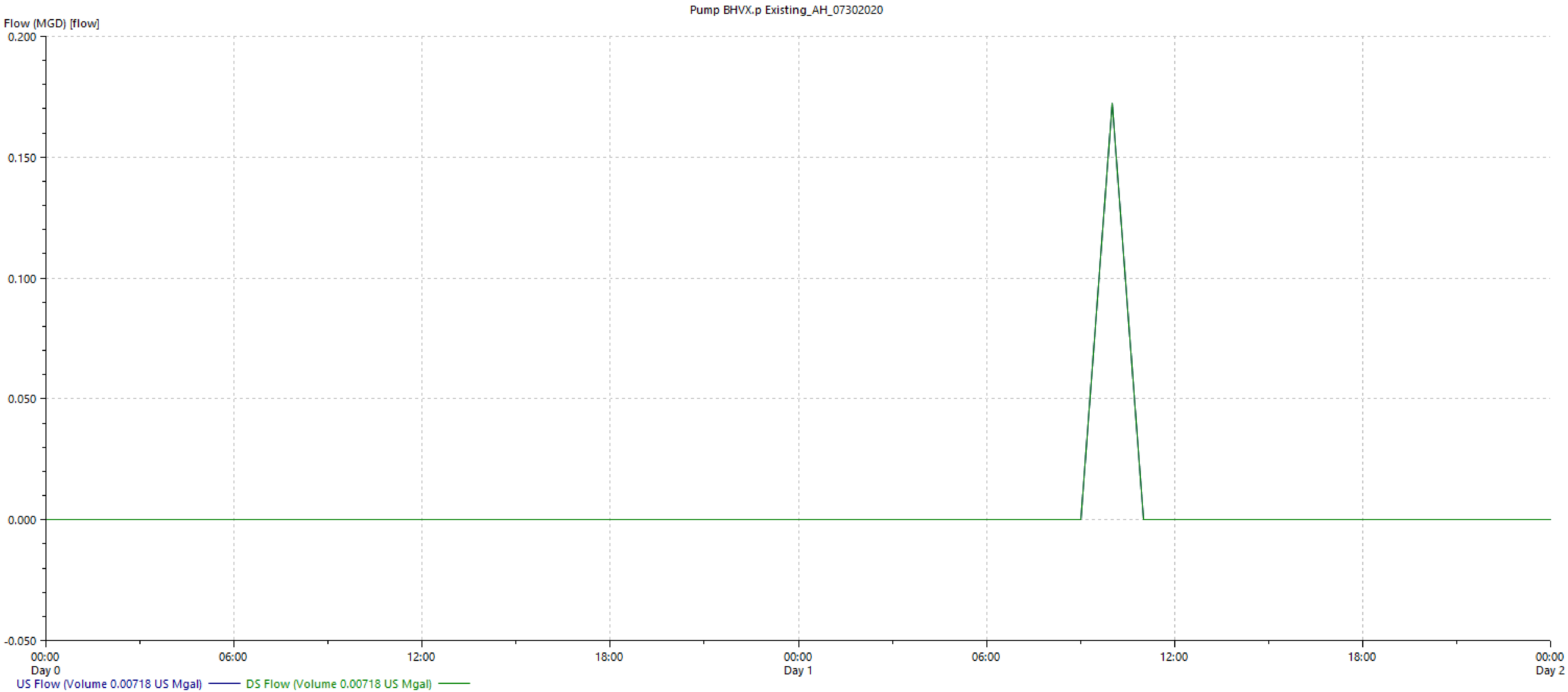
Pump RCX.p Existing_AH_07302020
Flow (MGD) [flow]
0.200
0.150
0.100
0.050
0.000
-0.050
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.02101 US Mgal)
DS Flow (Volume 0.02101 US Mgal)

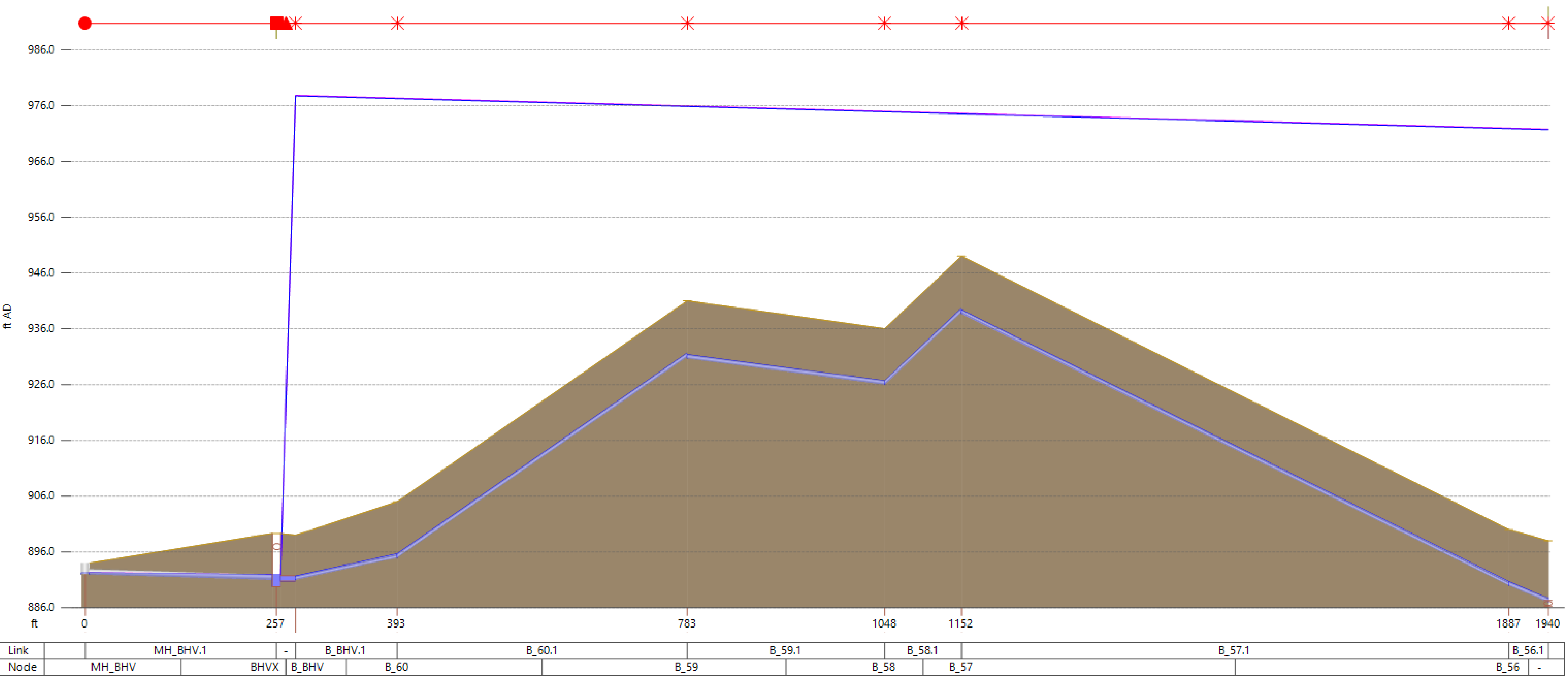


920.0
915.0
910.0
905.0
900.0
895.0
890.0
885.0
880.0
875.0
870.0
865.0
860.0
ft AD
MH_RC
RCX
B_27
ft
0
230
230
404
1616
4214
Link
MH_RC.1
RCX.p
B_RC.1
B_27.1
B_26.1
Node
-
RCX
B_RC
B_27
B_26
B_25

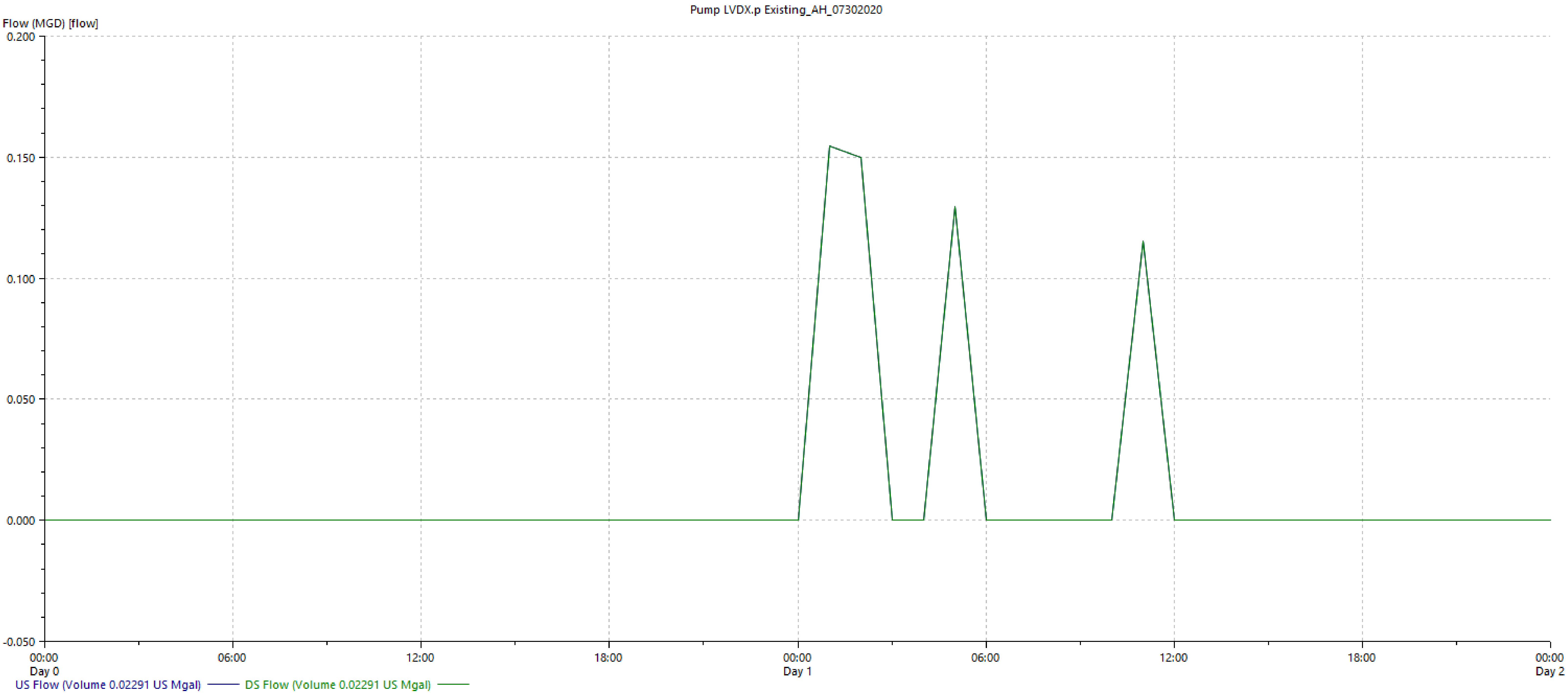


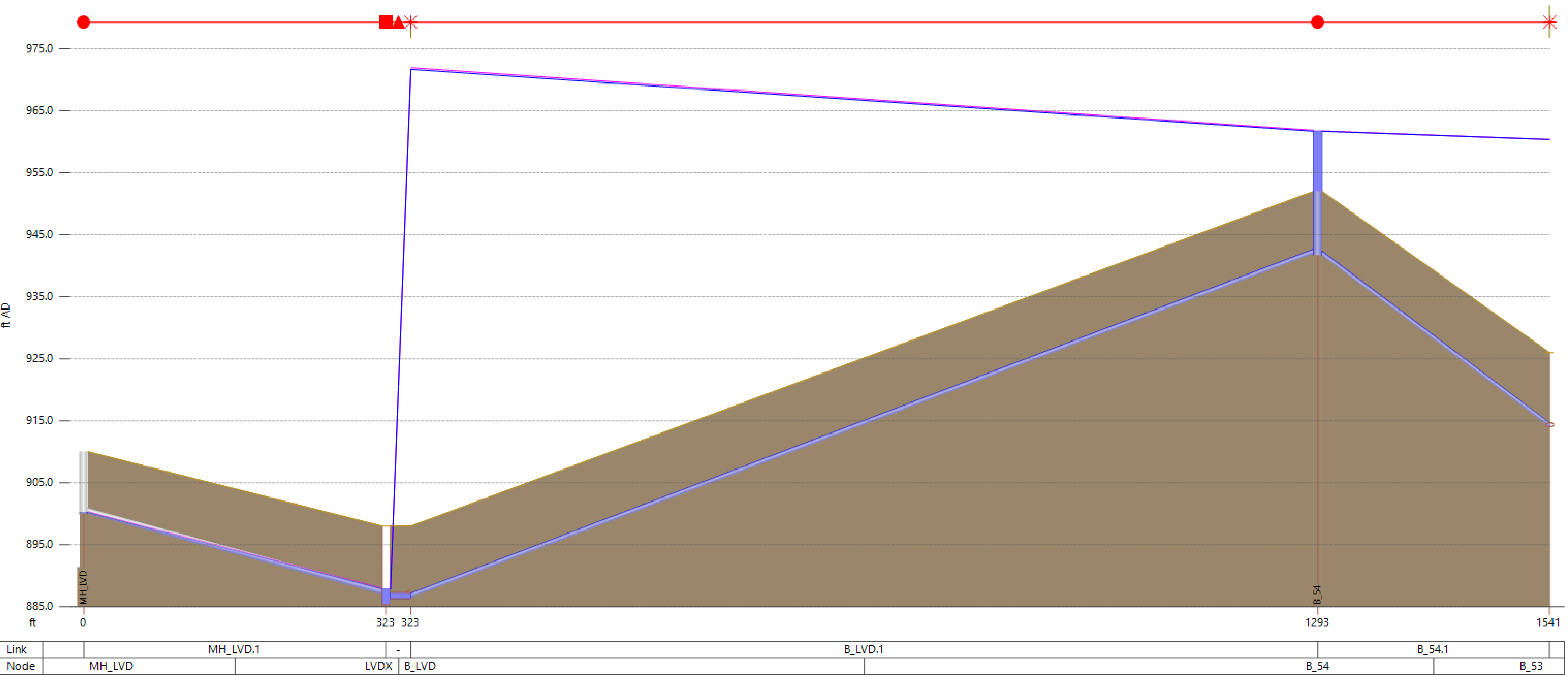
905.0
900.0
895.0
890.0
885.0
880.0
875.0
870.0
865.0
860.0
855.0
850.0
845.0
840.0
ft AD
ft
0
3910
5057
5320
6245
Link
B_25.1
B_28.1
B_29.1
B_30.1
Node
B_25
B_28
B_29
B_30
B_31

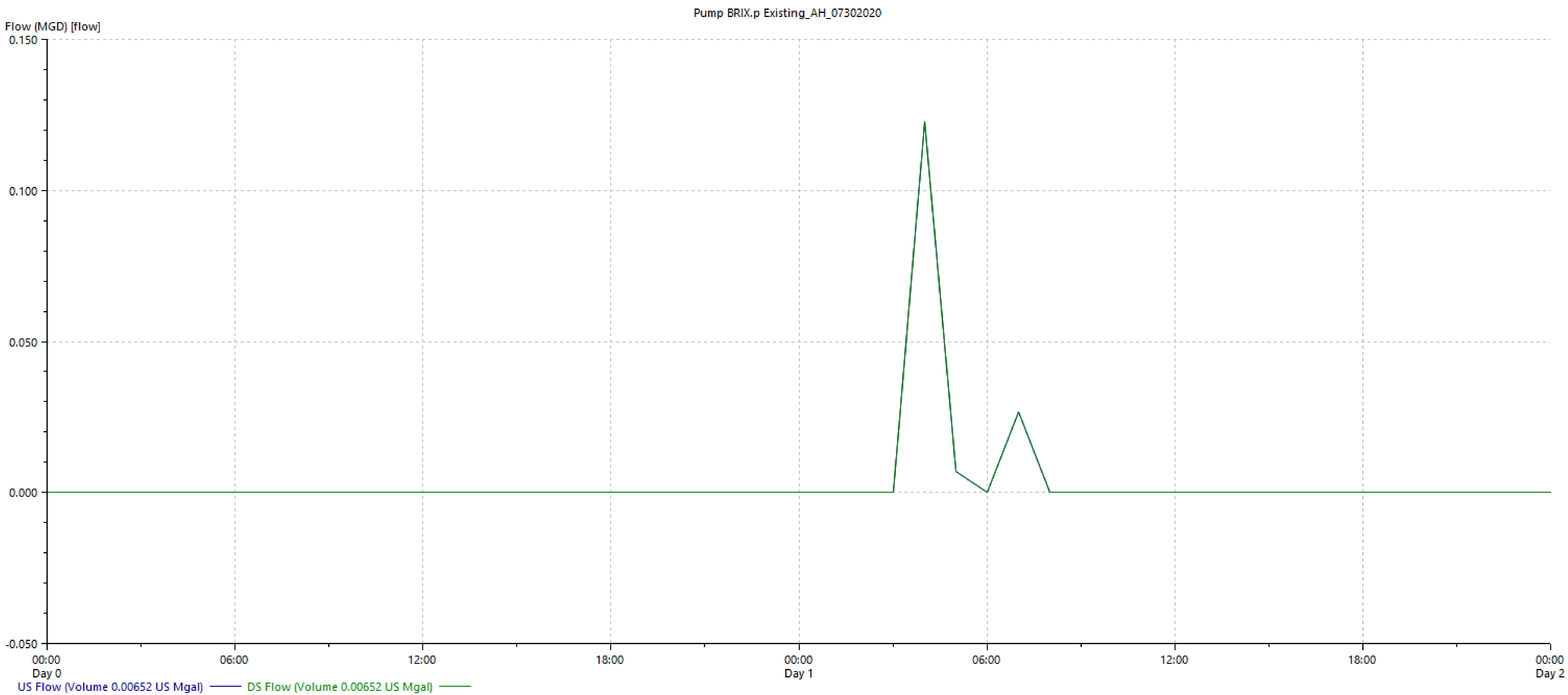

Pump BHVX.p Existing_AH_07302020
Flow (MGD) [flow]
0.200
0.150
0.100
0.050
0.000
-0.050
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.00718 US Mgal)
DS Flow (Volume 0.00718 US Mgal)

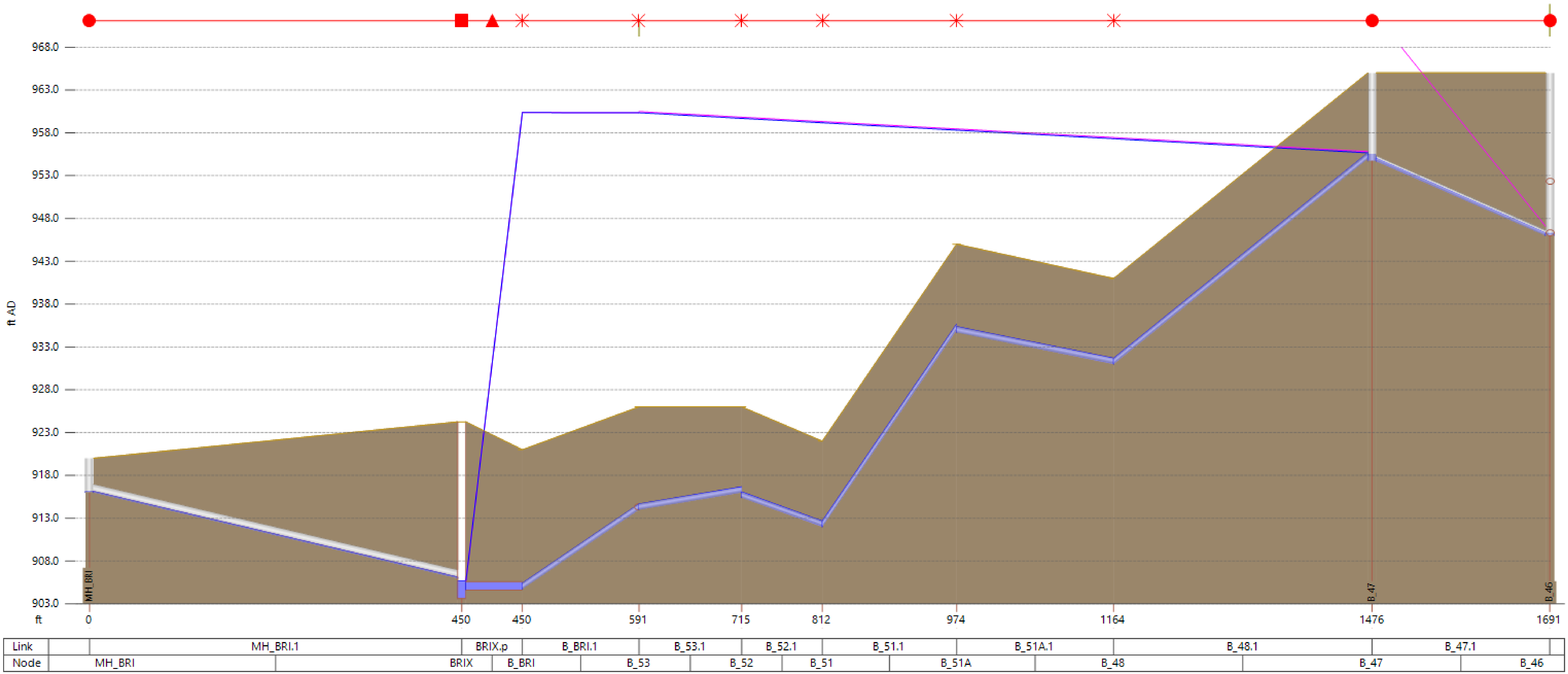


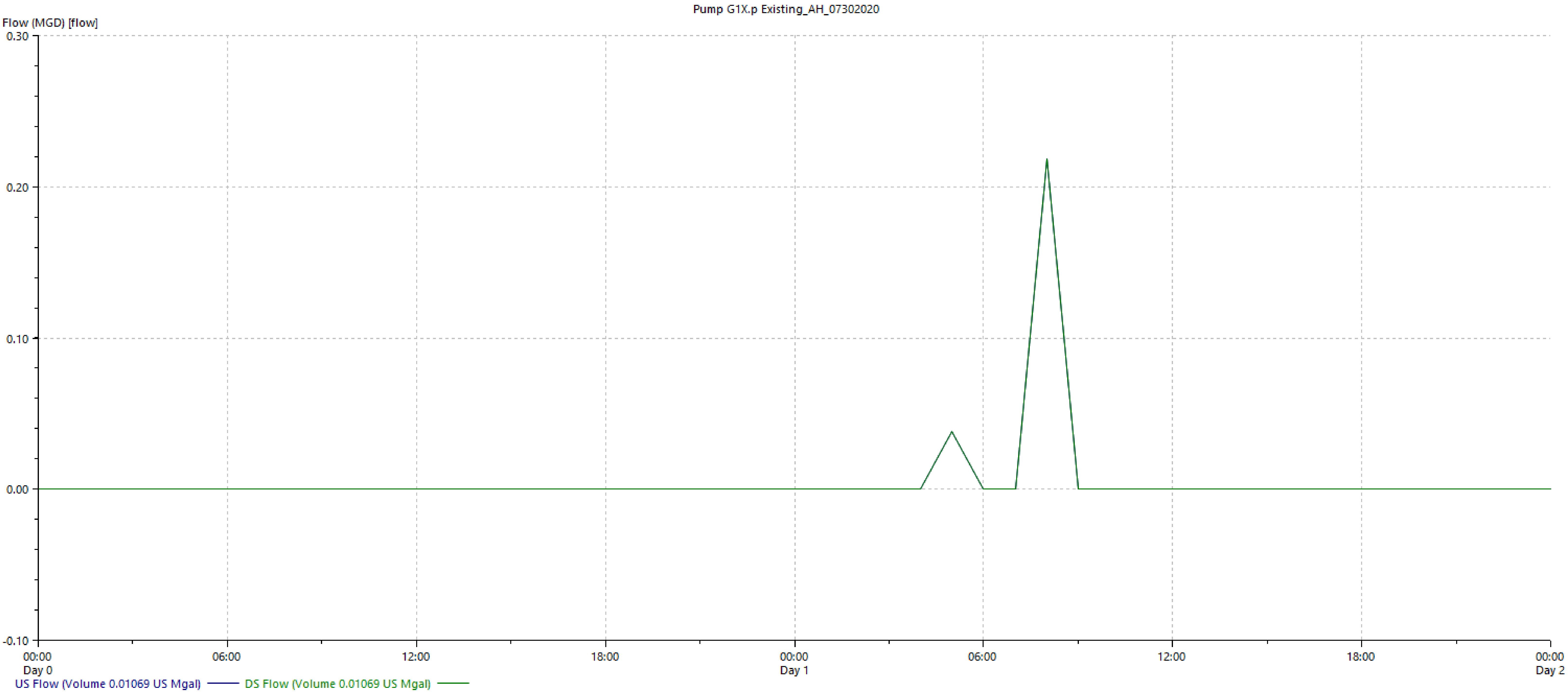
986.0
976.0
966.0
956.0
946.0
936.0
926.0
916.0
906.0
896.0
886.0
ft AD
ft
0
257
393
783
1048
1152
1887
1940
Link
MH_BHV.1
-
B_BHV.1
B_60.1
B_59.1
B_58.1
B_57.1
B_56.1
Node
MH_BHV
BHVX
B_BHV
B_60
B_59
B_58
B_57
B_56
-

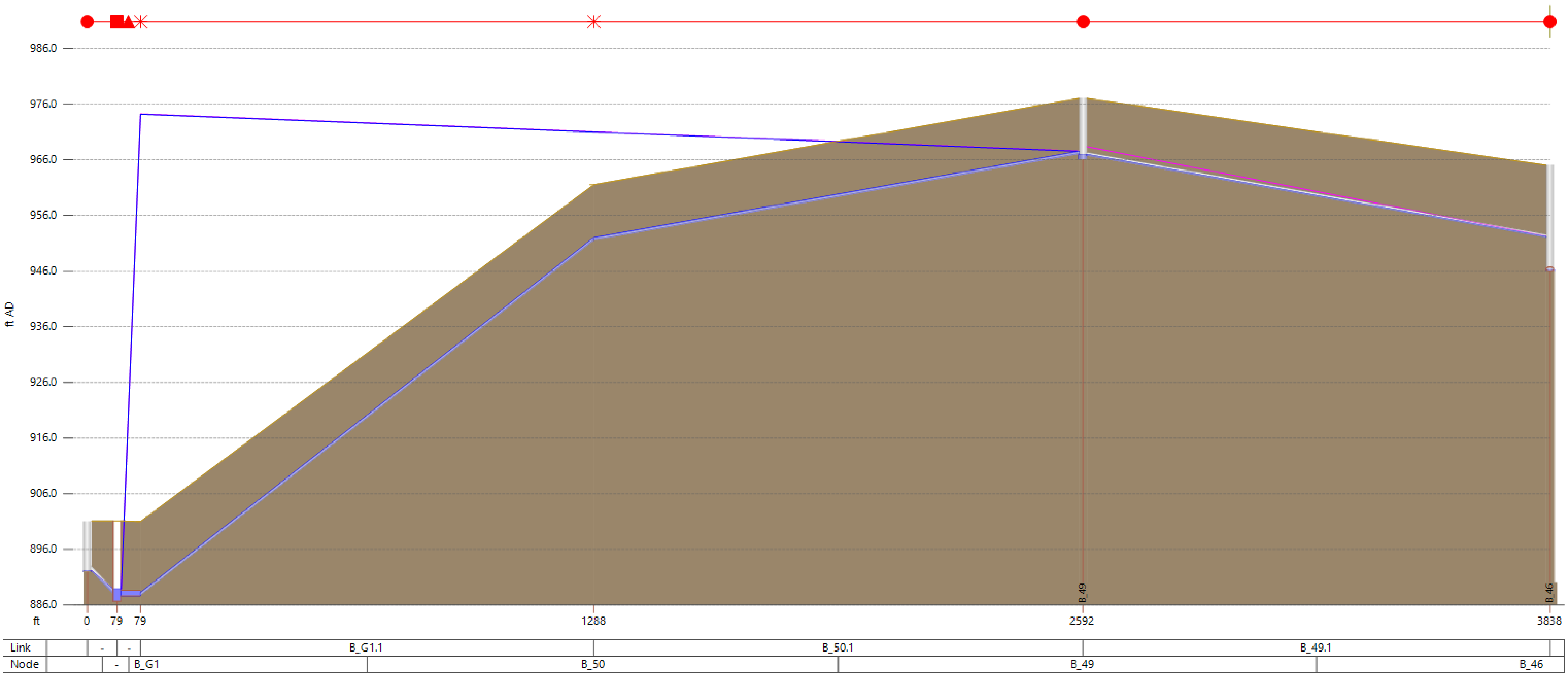

Pump LVDX.p Existing_AH_07302020
Flow (MGD) [flow]
0.200
0.150
0.100
0.050
0.000
-0.050
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.02291 US Mgal)
DS Flow (Volume 0.02291 US Mgal)


975.0
965.0
955.0
945.0
935.0
925.0
915.0
905.0
895.0
885.0
ft AD
ft
0
323
323
1293
1541
MH_LVD
B_54
Link
MH_LVD.1
-
B_LVD.1
B_54.1
Node
MH_LVD
LVDX
B_LVD
B_54
B_53

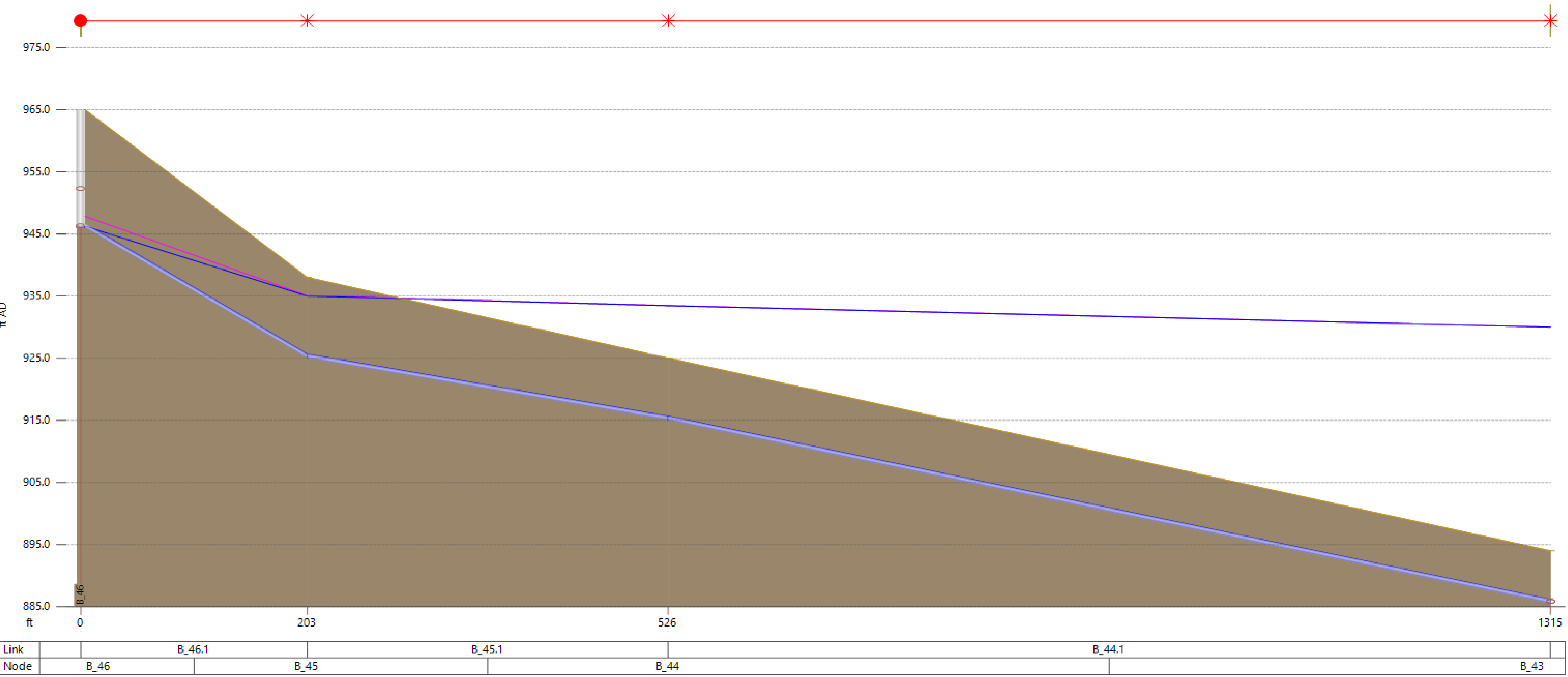

Pump BRIX.p Existing_AH_07302020
Flow (MGD) [flow]
0.150
0.100
0.050
0.000
-0.050
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.00652 US Mgal)
DS Flow (Volume 0.00652 US Mgal)

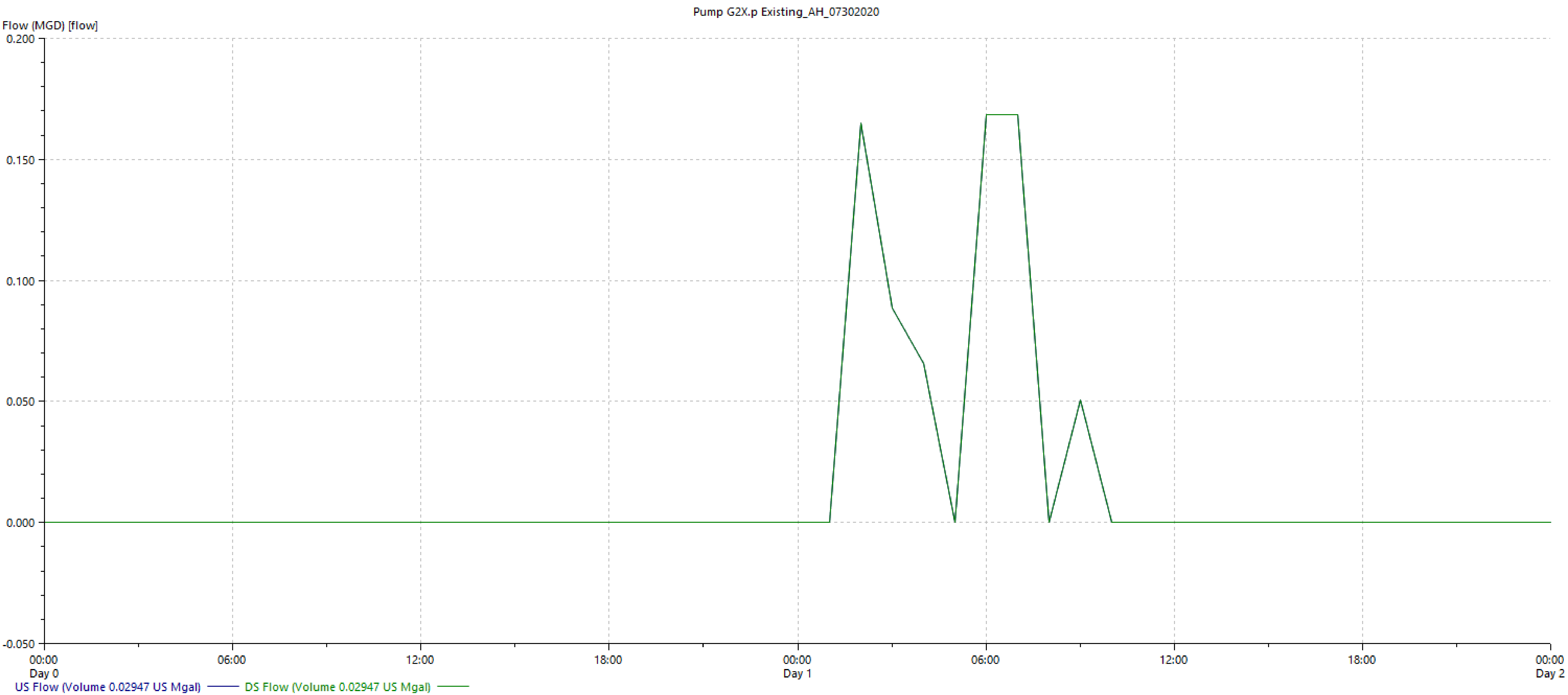

ft AD
968.0
963.0
958.0
953.0
948.0
943.0
938.0
933.0
928.0
923.0
918.0
913.0
908.0
903.0
MH_BRI
B_47
B_46
ft
0
450
450
591
715
812
974
1164
1476
1691
Link
MH_BRI.1
BRIX.p
B_BRI.1
B_53.1
B_52.1
B_51.1
B_51A.1
B_48.1
B_47.1
Node
MH_BRI
BRIX
B_BRI
B_53
B_52
B_51
B_51A
B_48
B_47
B_46

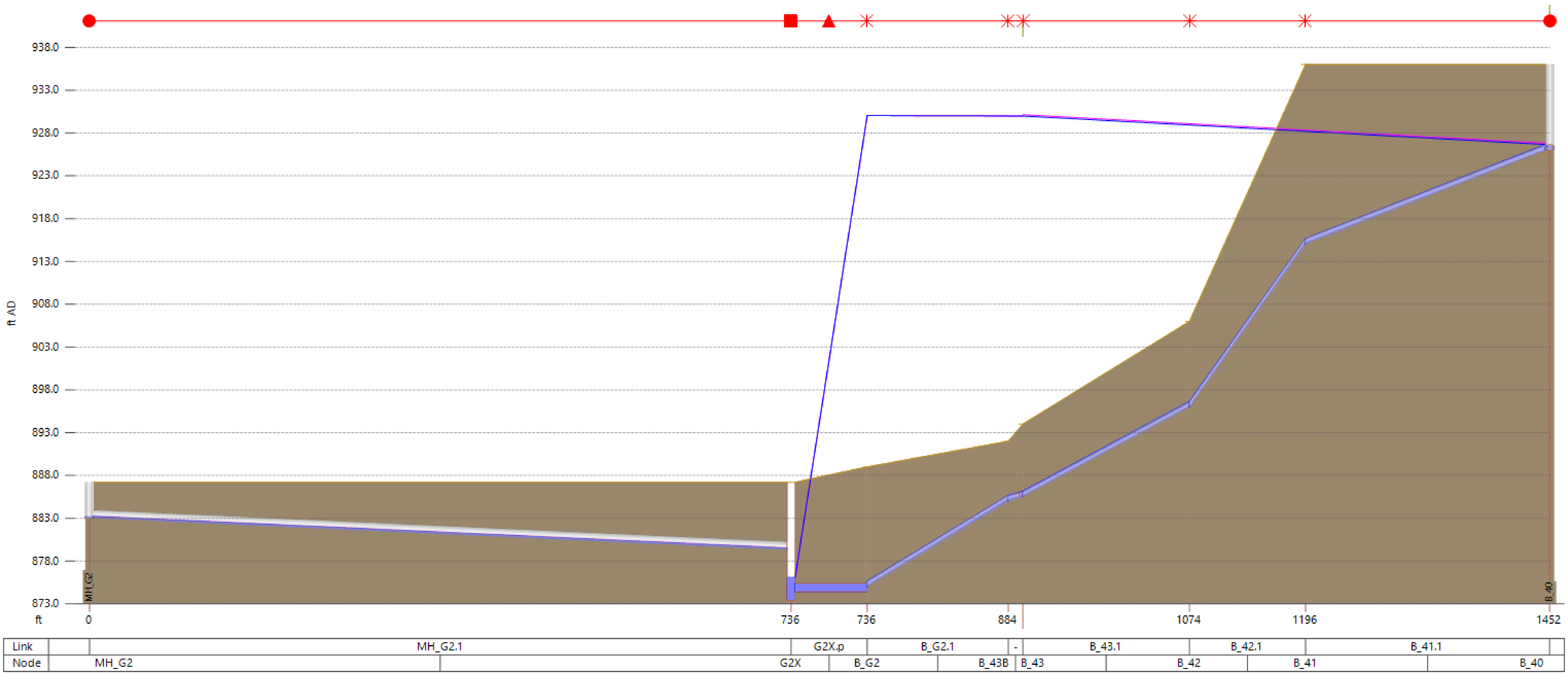

Pump G1X.p Existing_AH_07302020
Flow (MGD) [flow]
0.30
0.20
0.10
0.00
-0.10
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.01069 US Mgal)
DS Flow (Volume 0.01069 US Mgal)



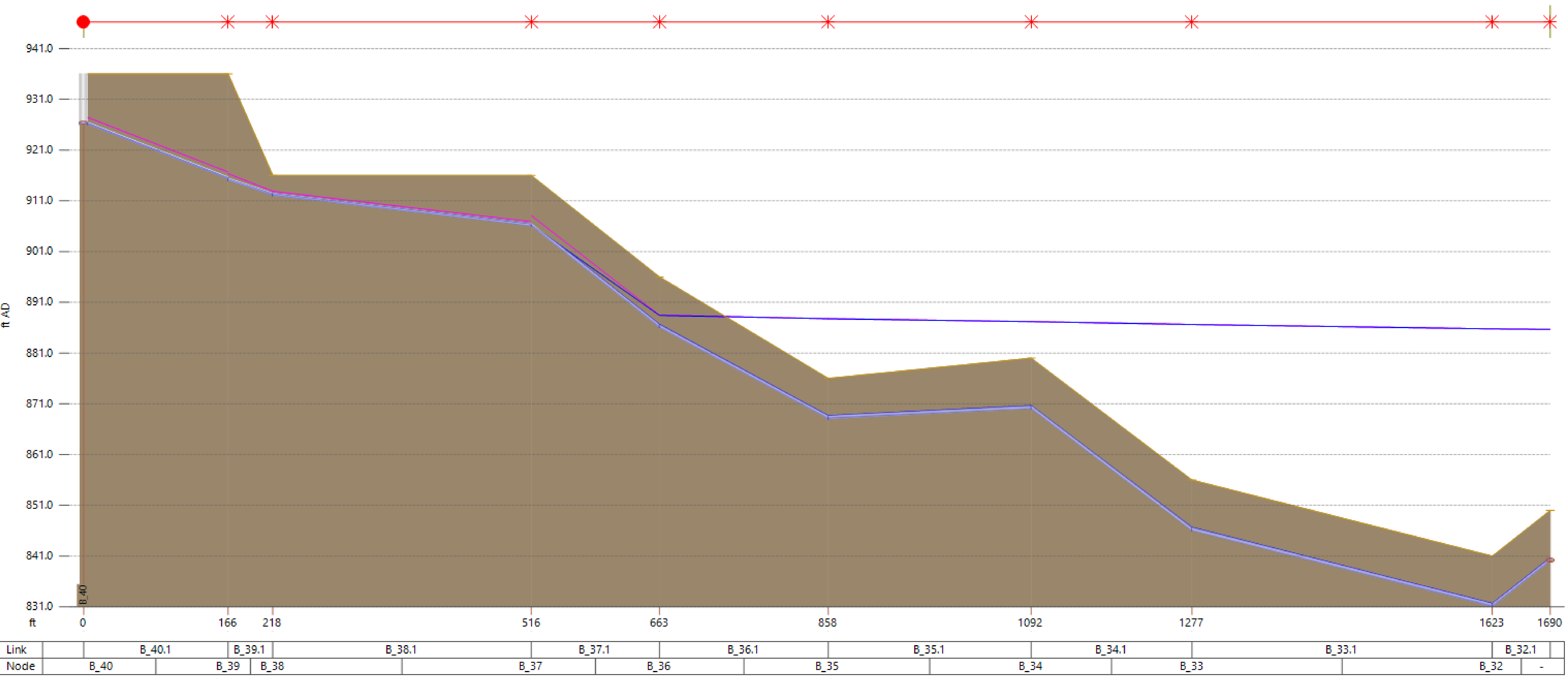
986.0
976.0
966.0
956.0
946.0
936.0
926.0
916.0
906.0
896.0
886.0
ft AD
ft
0
79
79
1288
2592
3838
B_49
B_46
Link
-
-
B_G1.1
B_50.1
B_49.1
Node
-
B_G1
B_50
B_49
B_46


975.0
965.0
955.0
945.0
935.0
925.0
915.0
905.0
895.0
885.0
ft AD
B_46
ft
0
203
526
1315
Link
B_46.1
B_45.1
B_44.1
Node
B_46
B_45
B_44
B_43

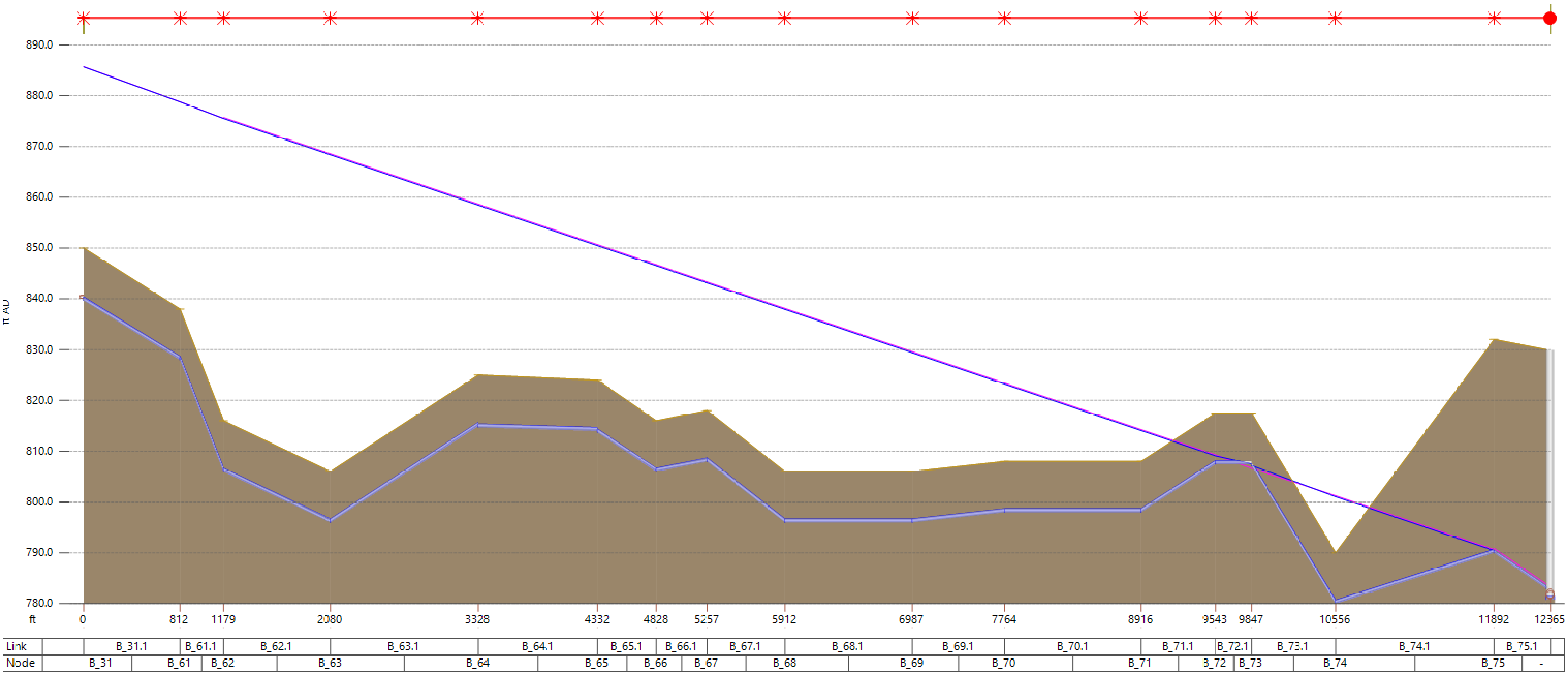

Pump G2X.p Existing_AH_07302020
Flow (MGD) [flow]
0.200
0.150
0.100
0.050
0.000
-0.050
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.02947 US Mgal)
DS Flow (Volume 0.02947 US Mgal)



938.0
933.0
928.0
923.0
918.0
913.0
908.0
903.0
898.0
893.0
888.0
883.0
878.0
873.0
ft AD
ft
0
736
736
884
1074
1196
1452
MH_G2
B_40
Link
MH_G2.1
G2X.p
B_G2.1
-
B_43.1
B_42.1
B_41.1
Node
MH_G2
G2X
B_G2
B_43B
B_43
B_42
B_41
B_40



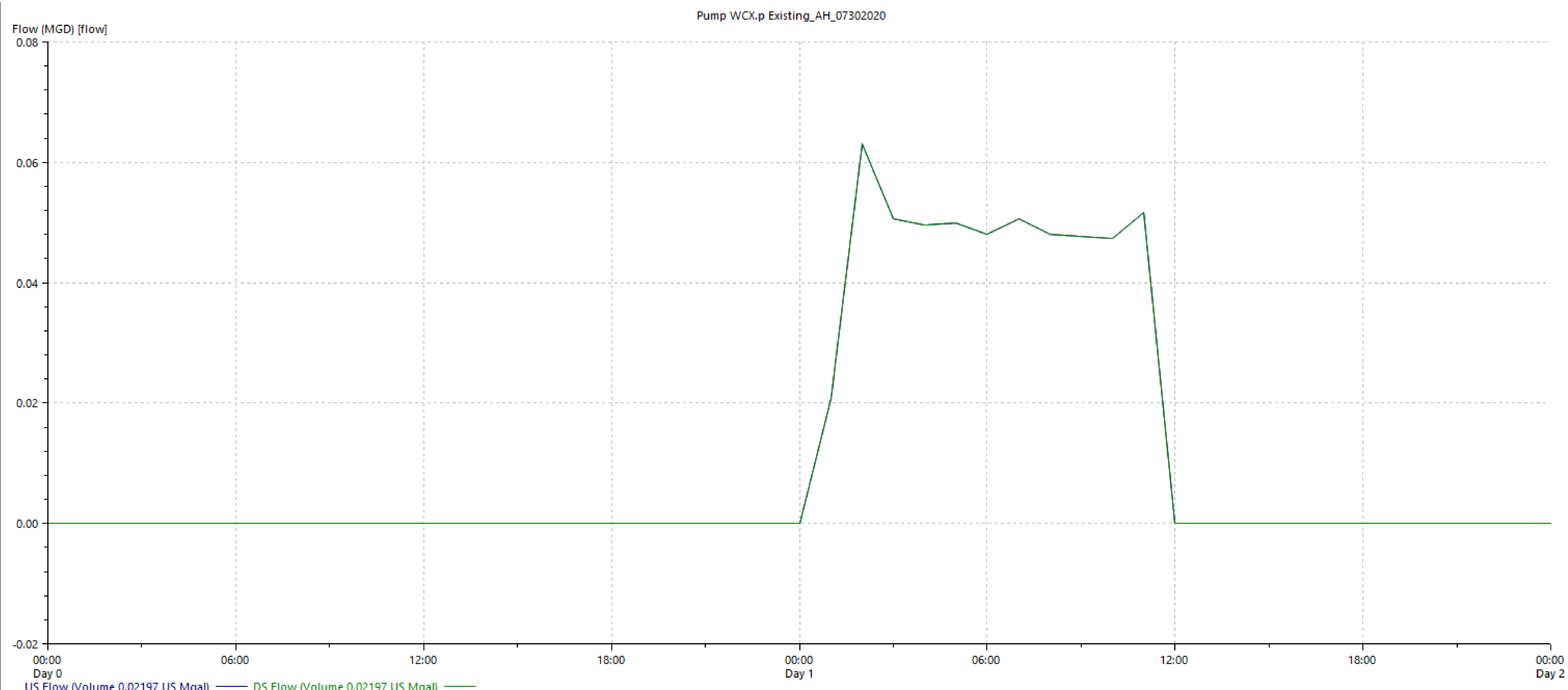
941.0
931.0
921.0
911.0
901.0
891.0
881.0
871.0
861.0
851.0
841.0
831.0
ft AD
B_40
ft
0
166
218
516
663
858
1092
1277
1623
1690
Link
B_40.1
B_39.1
B_38.1
B_37.1
B_36.1
B_35.1
B_34.1
B_33.1
B_32.1
Node
B_40
B_39
B_38
B_37
B_36
B_35
B_34
B_33
B_32
-



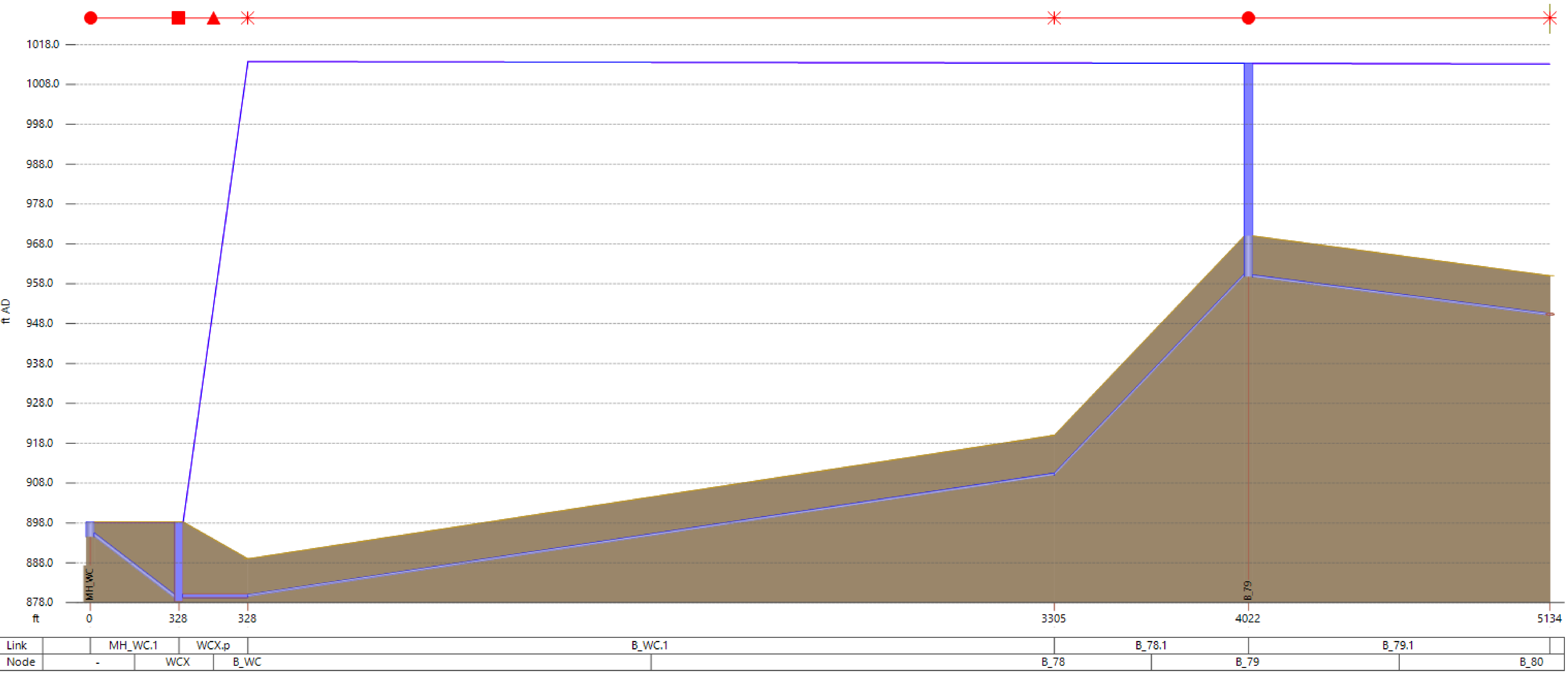
890.0
880.0
870.0
860.0
850.0
840.0
830.0
820.0
810.0
800.0
790.0
780.0
ft
0
812
1179
2080
3328
4332
4828
5257
5912
6987
7764
8916
9543
9847
10556
11892
12365
Link
B_31.1
B_61.1
B_62.1
B_63.1
B_64.1
B_65.1
B_66.1
B_67.1
B_68.1
B_69.1
B_70.1
B_71.1
B_72.1
B_73.1
B_74.1
B_75.1
Node
B_31
B_61
B_62
B_63
B_64
B_65
B_66
B_67
B_68
B_69
B_70
B_71
B_72
B_73
B_74
B_75
-

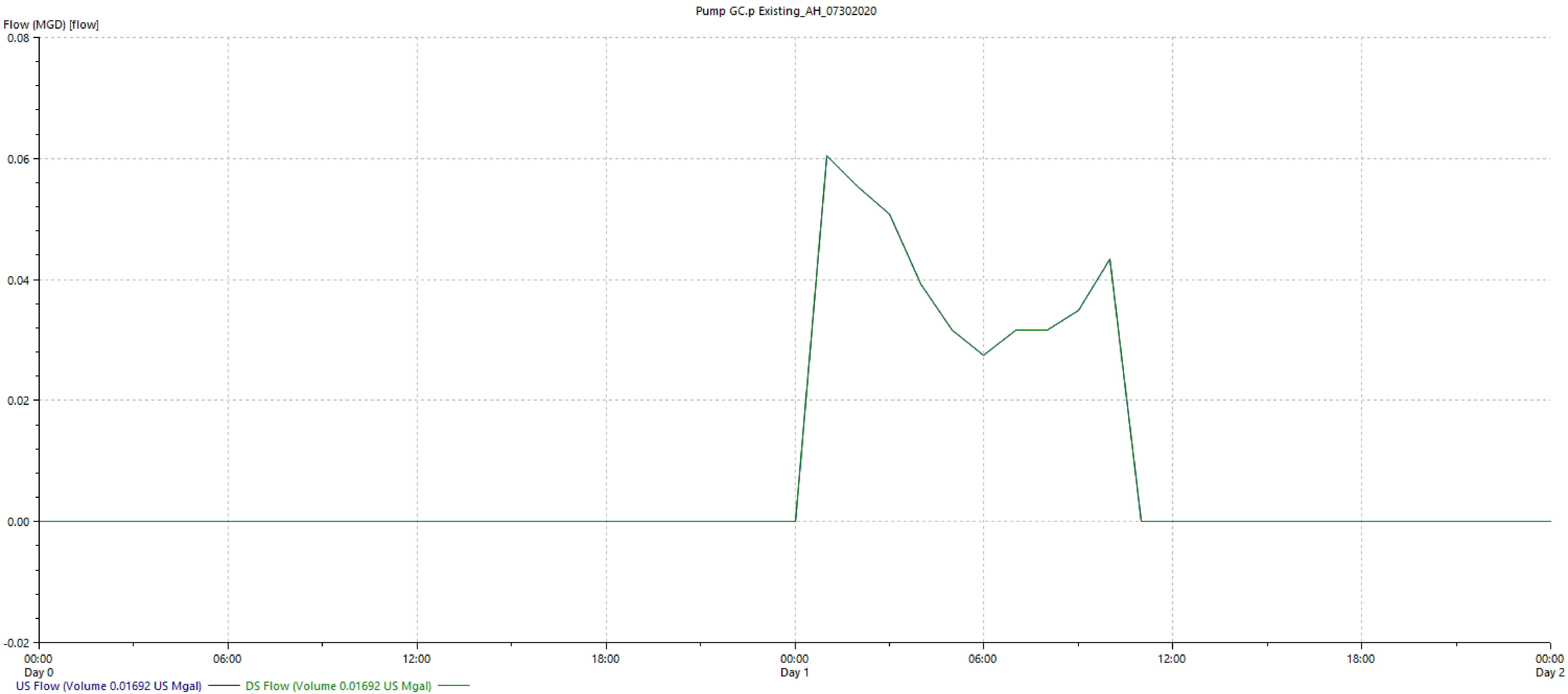
EXISTING SYSTEM MODEL RESULTS

SOUTH FORCEMAIN

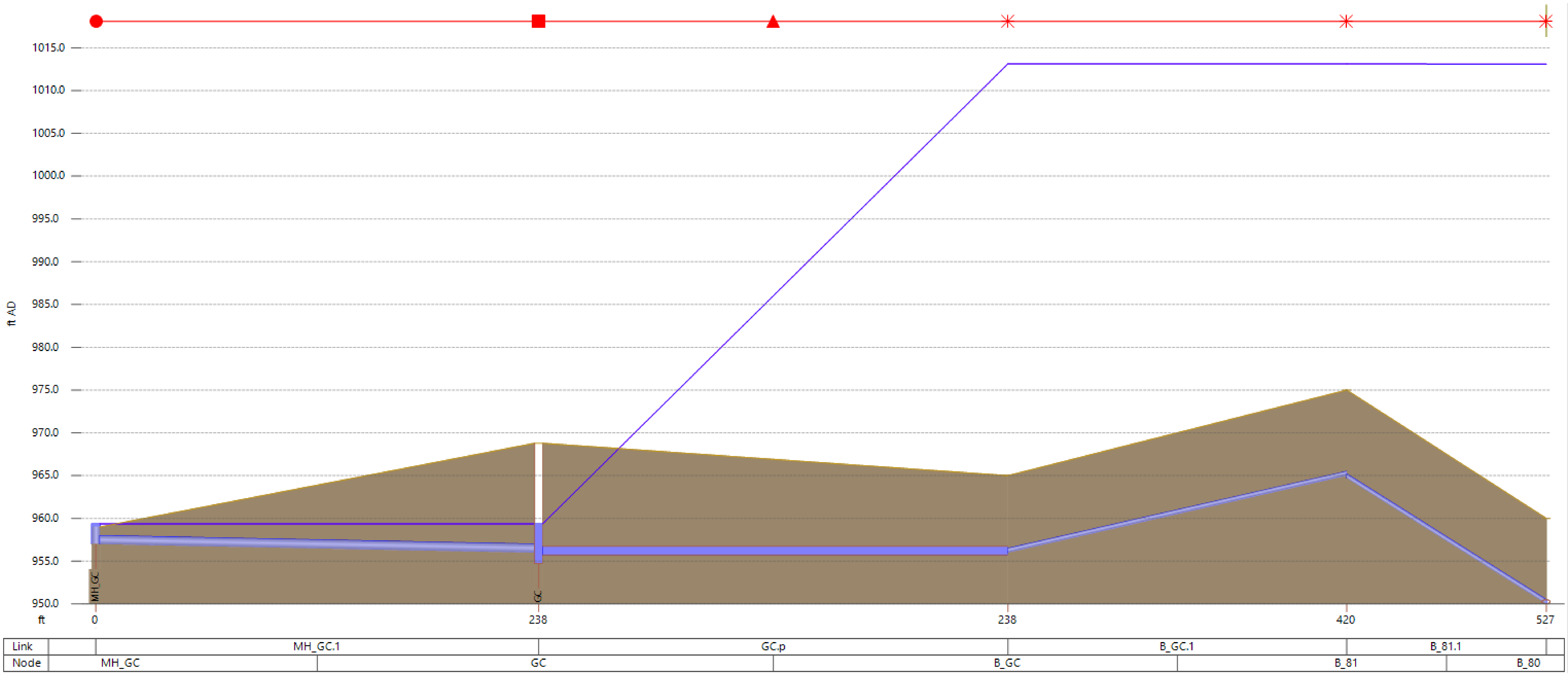


Pump WCX.p Existing_AH_07302020
Flow (MGD) [flow]
0.08
0.06
0.04
0.02
0.00
-0.02
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.02197 US Mgal)
DS Flow (Volume 0.02197 US Mgal)

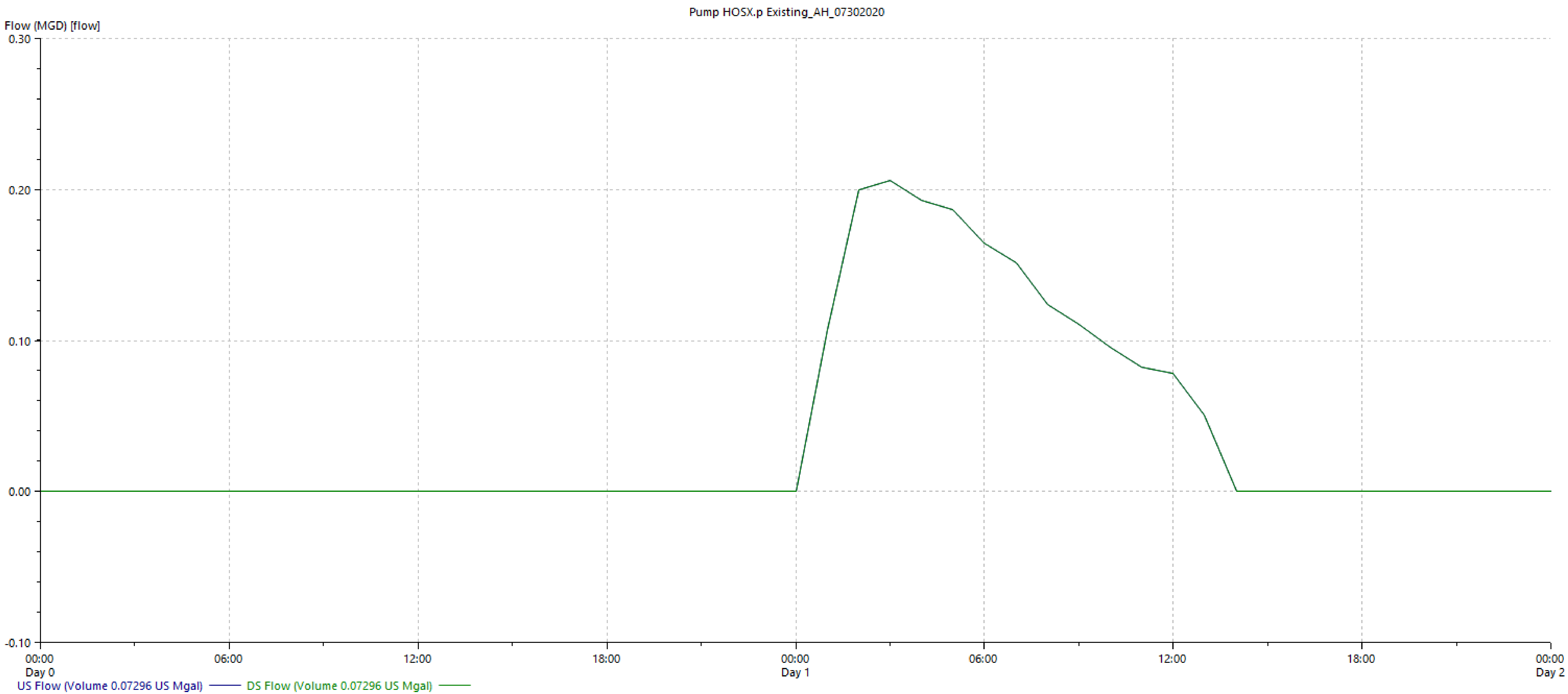

1018.0
1008.0
998.0
988.0
978.0
968.0
958.0
948.0
938.0
928.0
918.0
908.0
898.0
888.0
878.0
ft AD
MH_WC
B_79
ft
0
328
328
3305
4022
5134
Link
MH_WC.1
WCX.p
B_WC.1
B_78.1
B_79.1
Node
-
WCX
B_WC
B_78
B_79
B_80

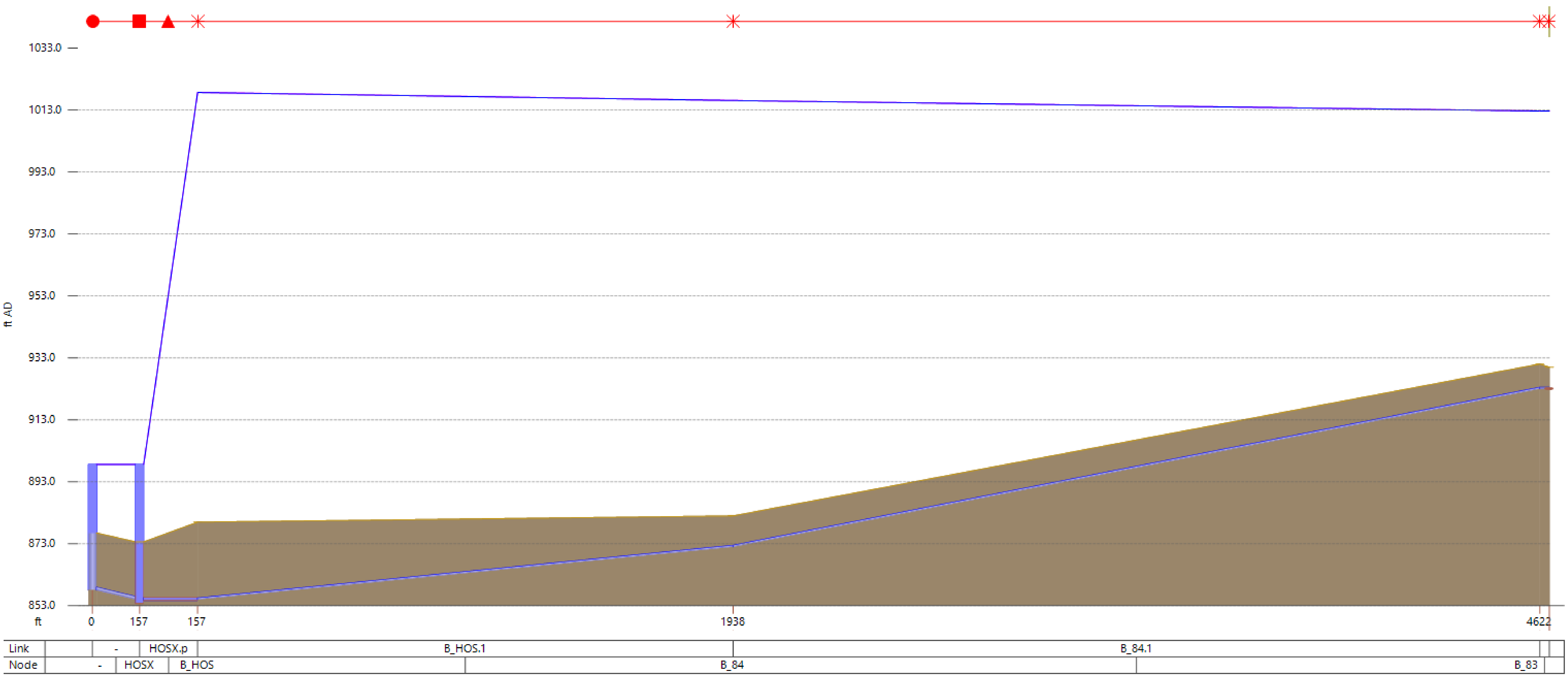


Pump GC.p Existing_AH_07302020
Flow (MGD) [flow]
0.08
0.06
0.04
0.02
0.00
-0.02
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.01692 US Mgal)
DS Flow (Volume 0.01692 US Mgal)

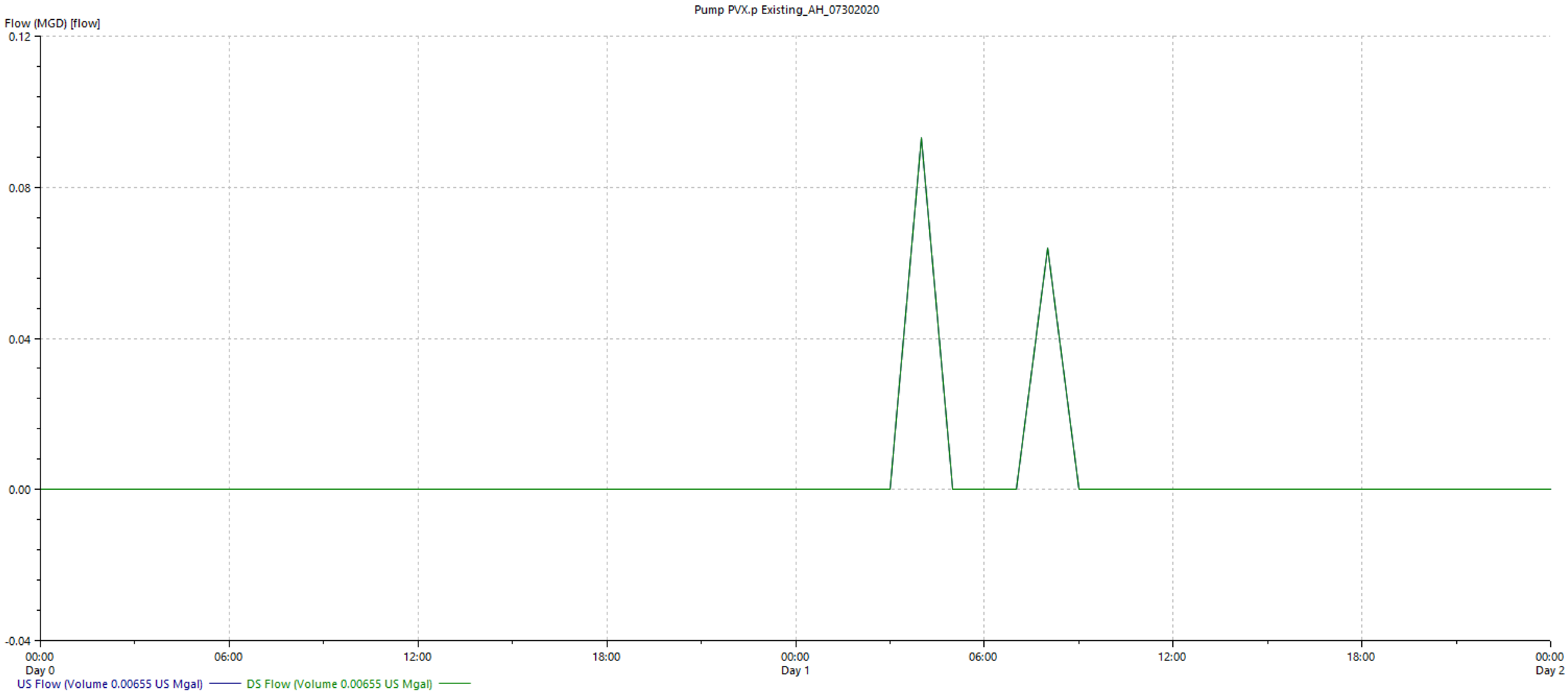


1015.0
1010.0
1005.0
1000.0
995.0
990.0
985.0
980.0
975.0
970.0
965.0
960.0
955.0
950.0
ft AD
ft
0
238
238
420
527
MH_GC
GC
Link
MH_GC.1
GC.p
B_GC.1
B_81.1
Node
MH_GC
GC
B_GC
B_81
B_80

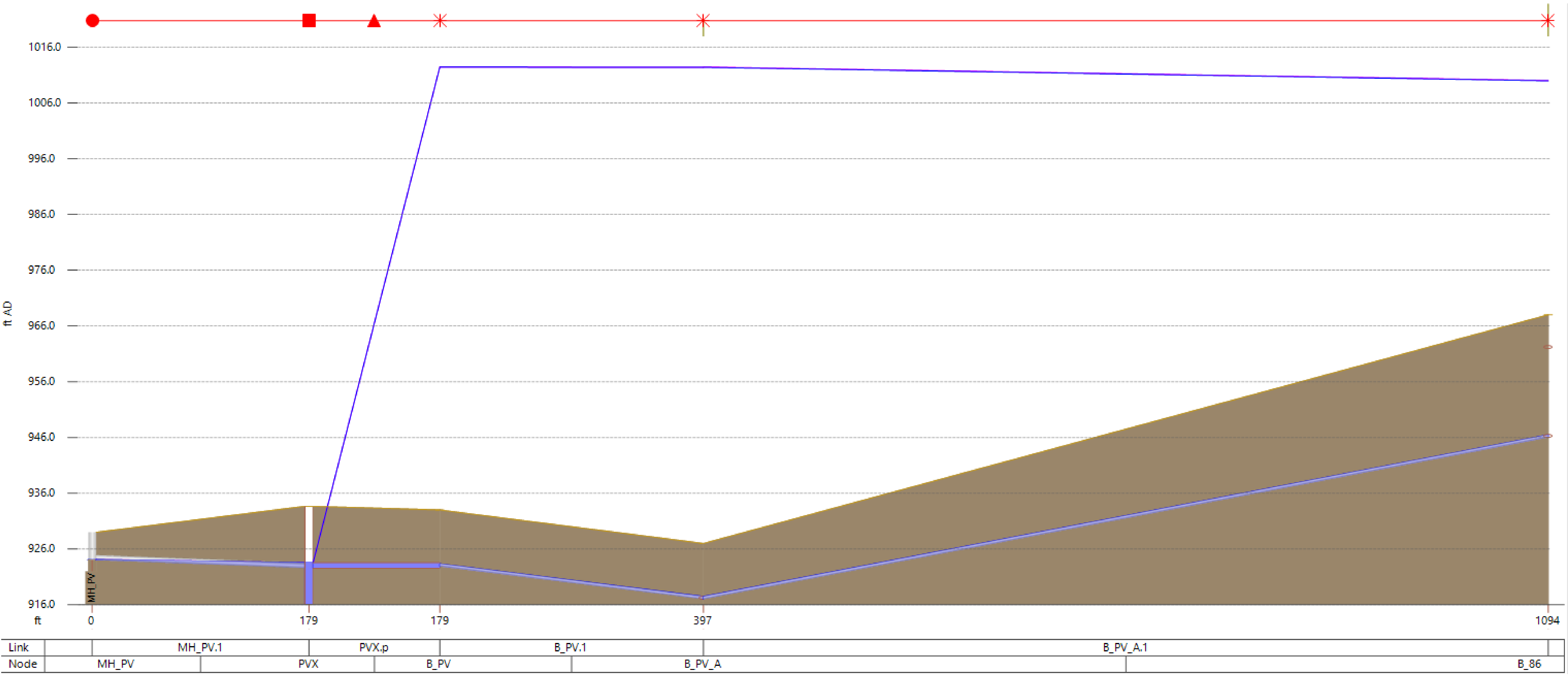

Pump HOSX.p Existing_AH_07302020
Flow (MGD) [flow]
0.30
0.20
0.10
0.00
-0.10
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.07296 US Mgal)
DS Flow (Volume 0.07296 US Mgal)



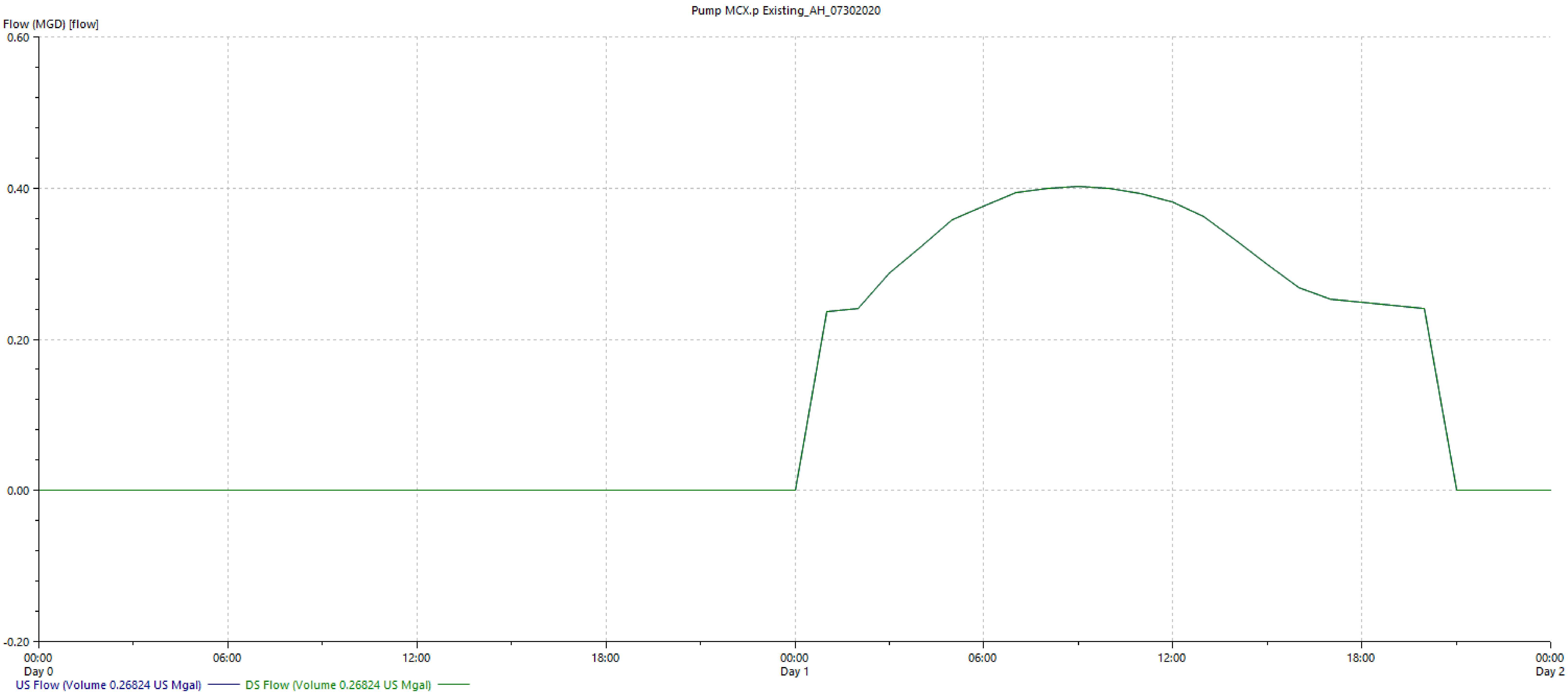
1033.0
1013.0
993.0
973.0
953.0
933.0
913.0
893.0
873.0
853.0
ft AD
ft
0
157
157
1938
4622
Link
-
HOSX.p
B_HOS.1
B_84.1
Node
-
HOSX
B_HOS
B_84
B_83



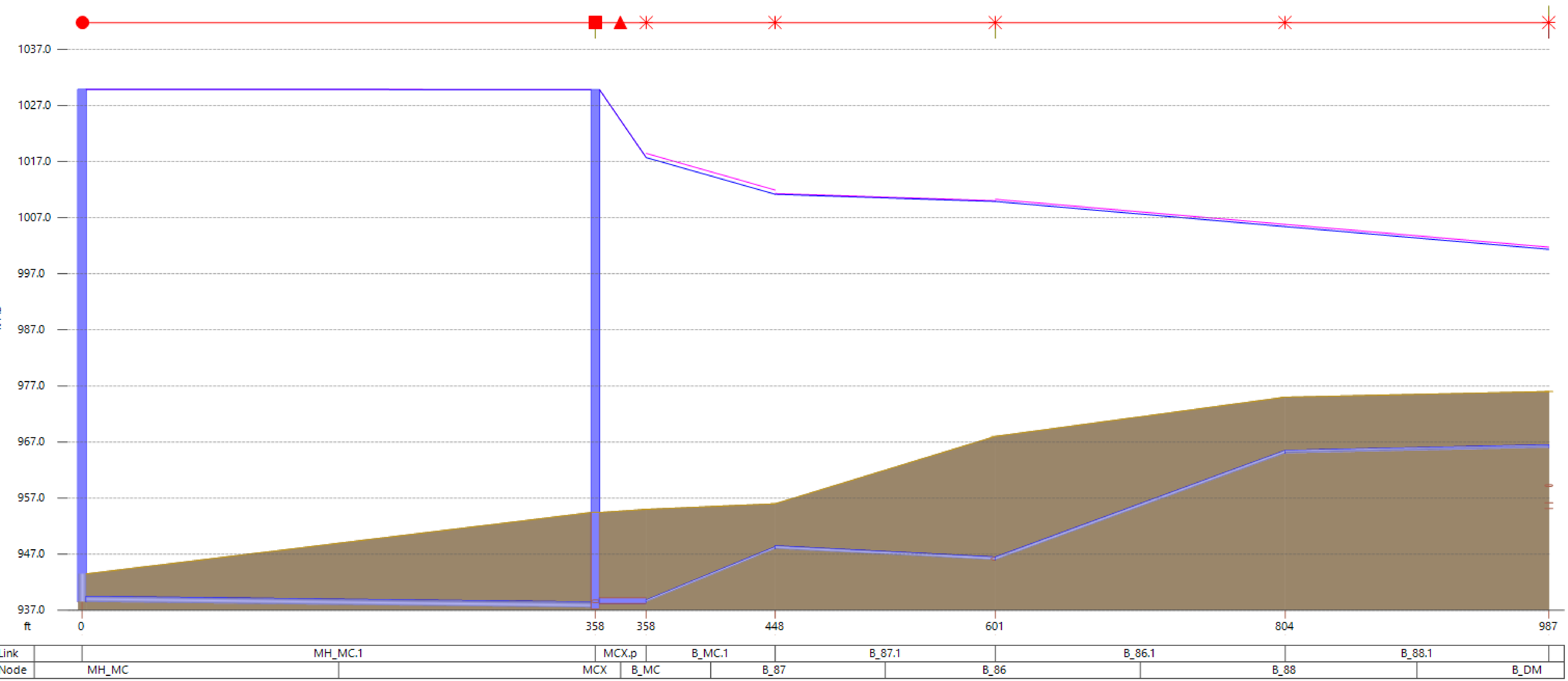
Pump PVX.p Existing_AH_07302020
Flow (MGD) [flow]
0.12
0.08
0.04
0.00
-0.04
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.00655 US Mgal)
DS Flow (Volume 0.00655 US Mgal)



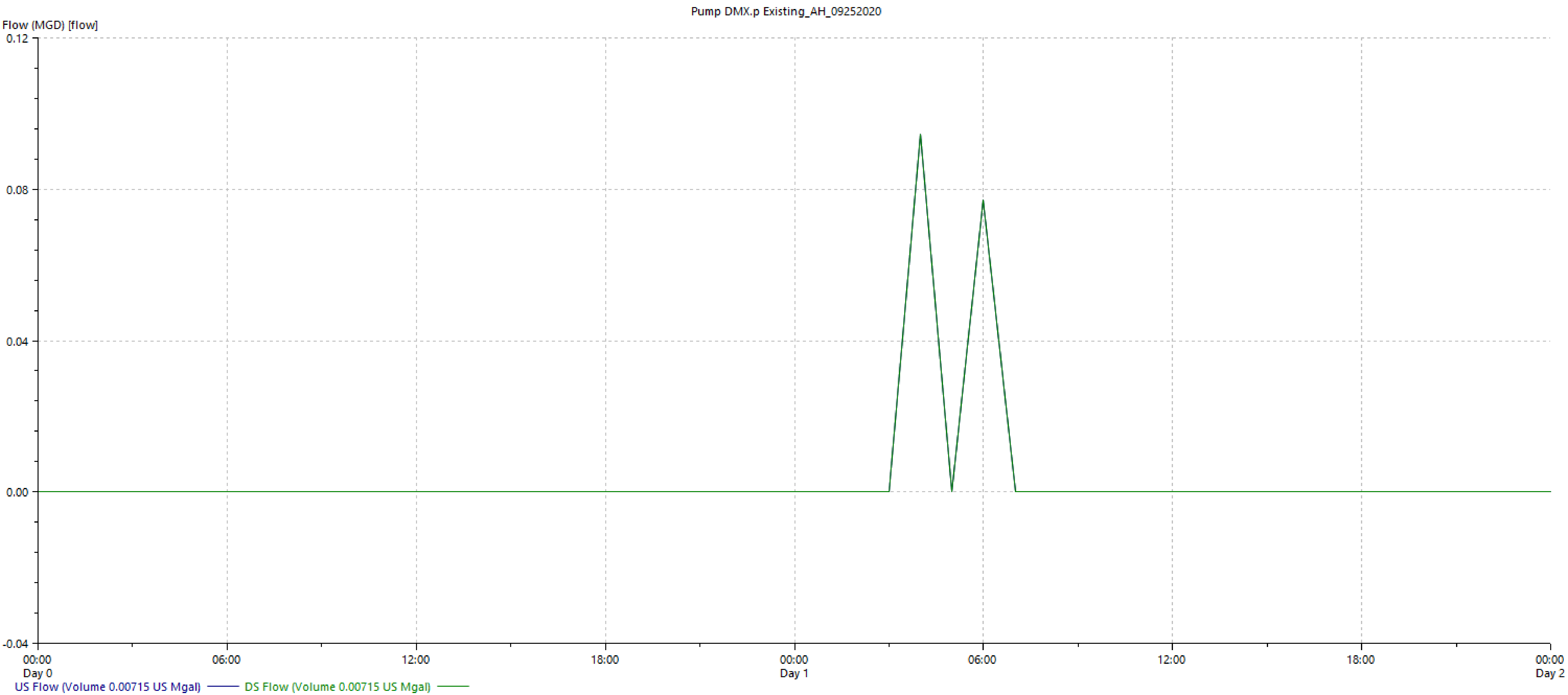
1016.0
1006.0
996.0
986.0
976.0
966.0
956.0
946.0
936.0
926.0
916.0
ft AD
MH_PV
ft
0
179
179
397
1094
Link
MH_PV.1
PVX.p
B_PV.1
B_PV_A.1
Node
MH_PV
PVX
B_PV
B_PV_A
B_86



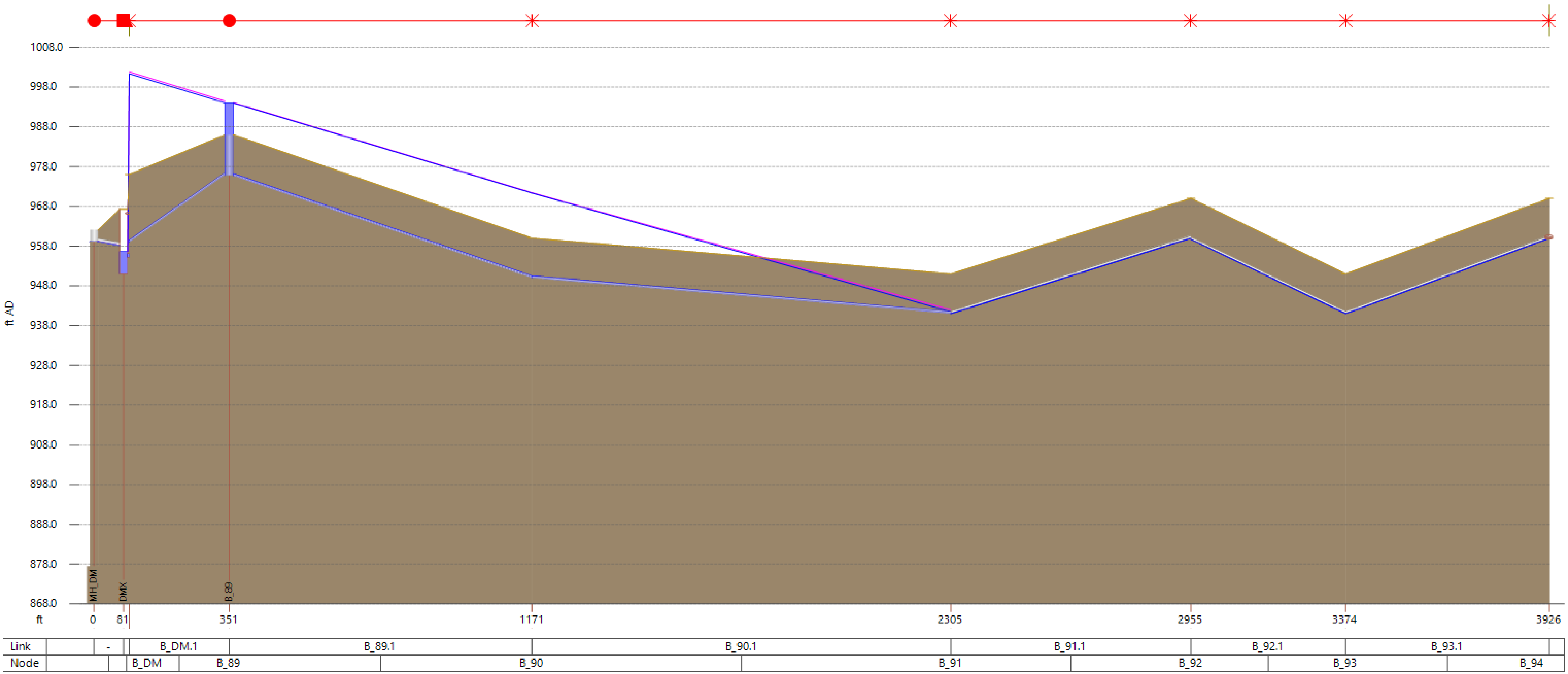
Pump MCX.p Existing_AH_07302020
Flow (MGD) [flow]
0.60
0.40
0.20
0.00
-0.20
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.26824 US Mgal)
DS Flow (Volume 0.26824 US Mgal)



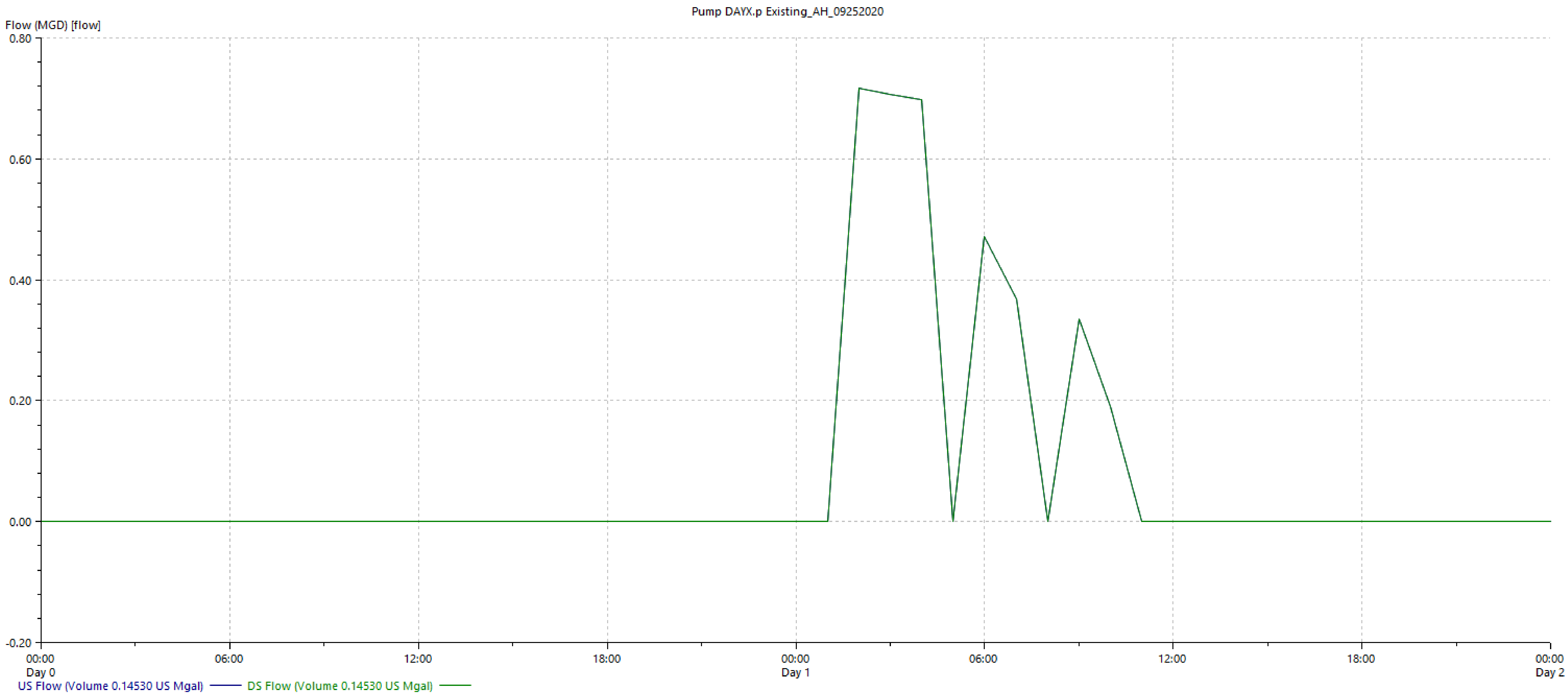
1037.0
1027.0
1017.0
1007.0
997.0
987.0
977.0
967.0
957.0
947.0
937.0
ft
0
358
358
448
601
804
987
Link
MH_MC.1
MCX.p
B_MC.1
B_87.1
B_86.1
B_88.1
Node
MH_MC
MCX
B_MC
B_87
B_86
B_88
B_DM



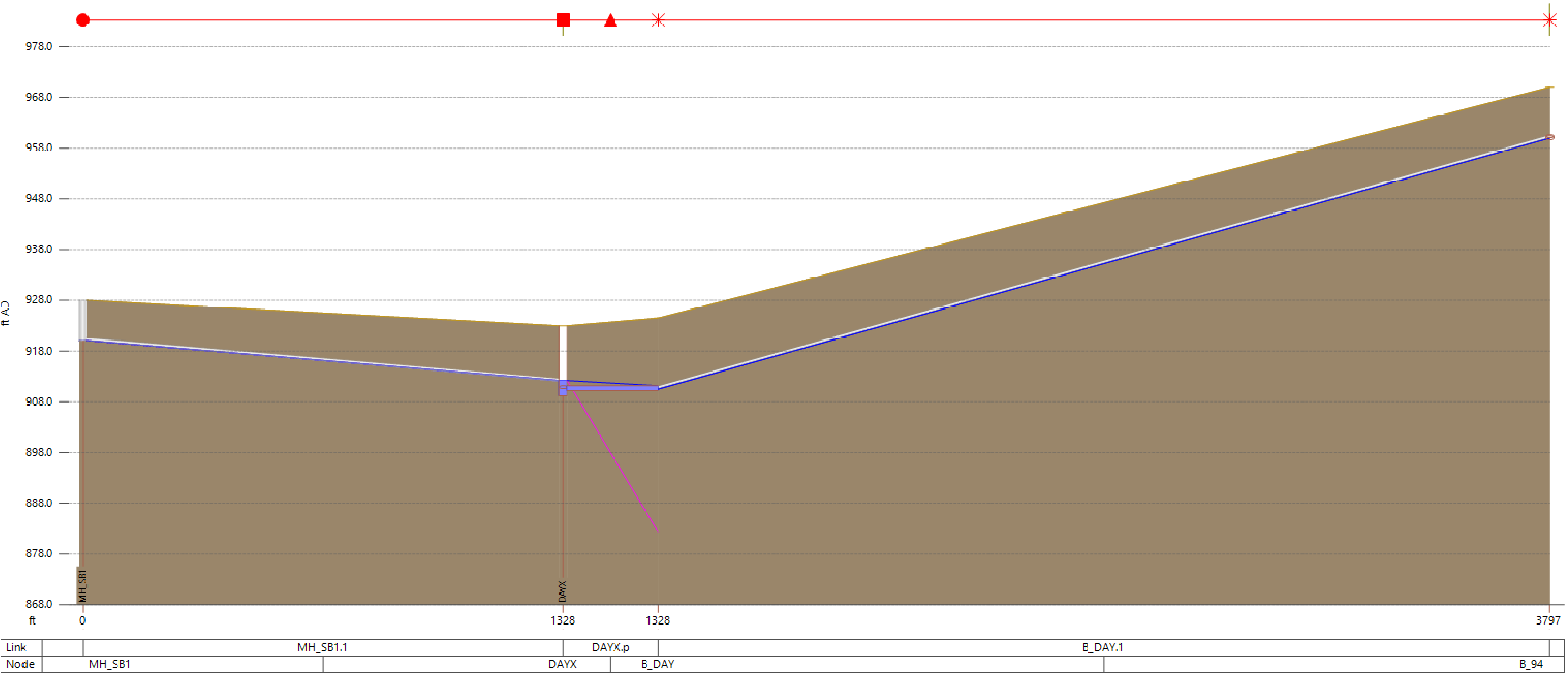
Pump DMX.p Existing_AH_09252020
Flow (MGD) [flow]
0.12
0.08
0.04
0.00
-0.04
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.00715 US Mgal)
DS Flow (Volume 0.00715 US Mgal)



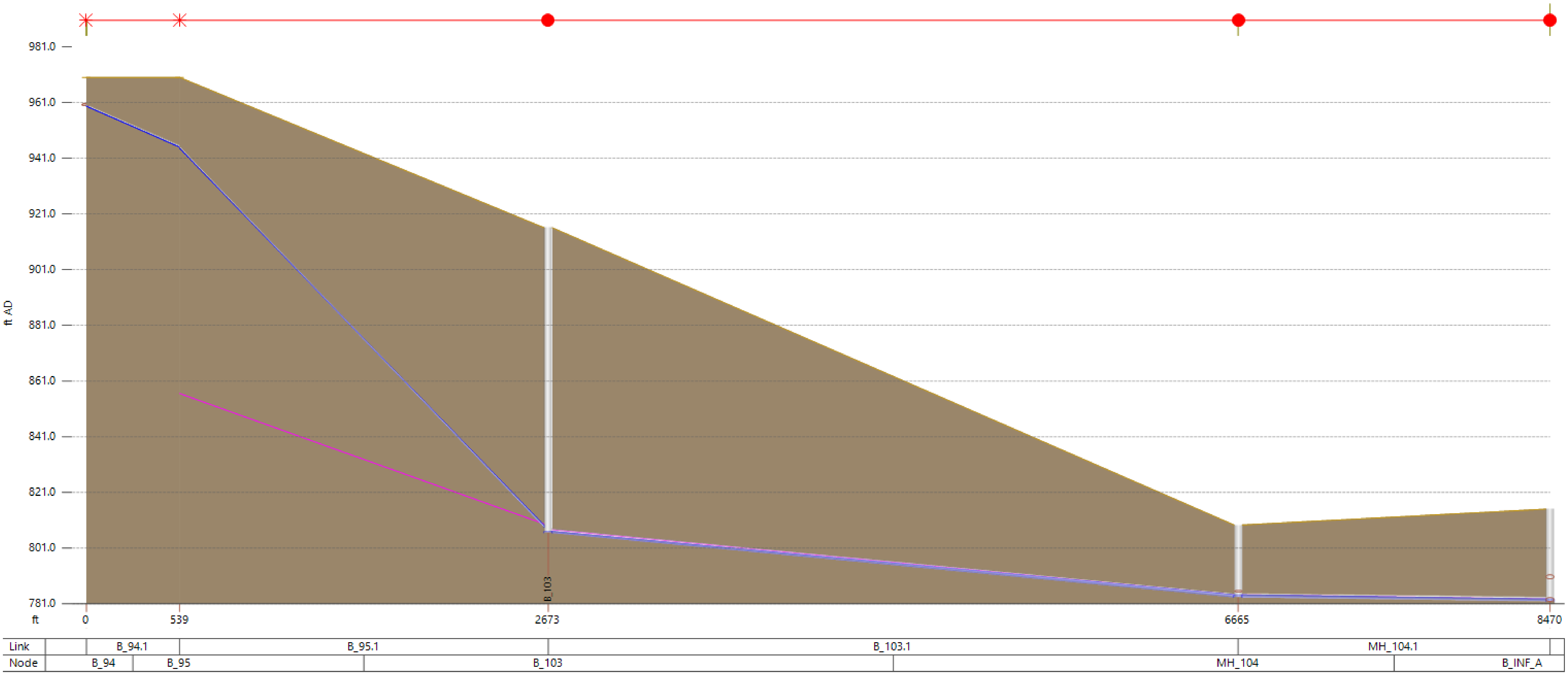
1008.0
998.0
988.0
978.0
968.0
958.0
948.0
938.0
928.0
918.0
908.0
898.0
888.0
878.0
868.0
ft AD
MH_DM
DMX
B_89
ft
0
81
351
1171
2305
2955
3374
3926
Link
-
B_DM.1
B_89.1
B_90.1
B_91.1
B_92.1
B_93.1
Node
B_DM
B_89
B_90
B_91
B_92
B_93
B_94



Pump DAYX.p Existing_AH_09252020
Flow (MGD) [flow]
0.80
0.60
0.40
0.20
0.00
-0.20
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.14530 US Mgal)
DS Flow (Volume 0.14530 US Mgal)

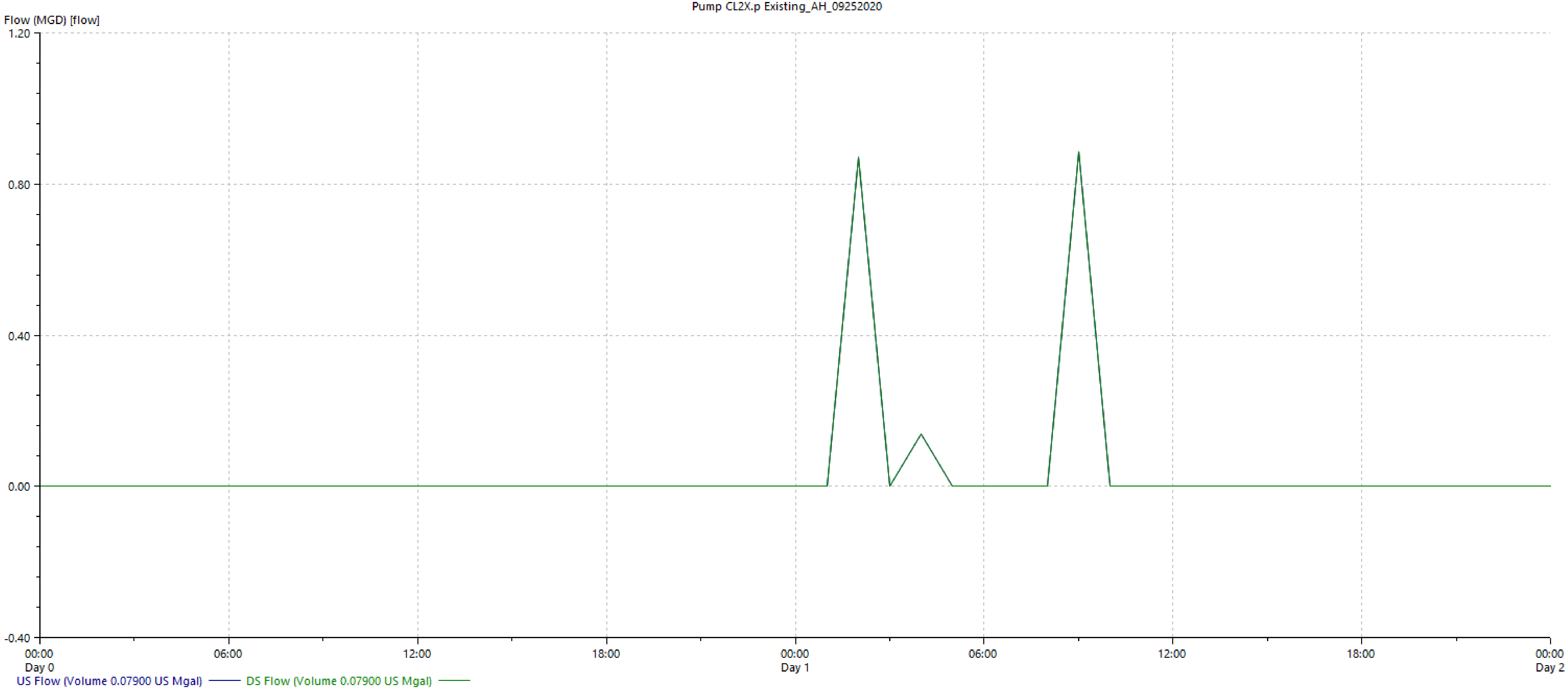


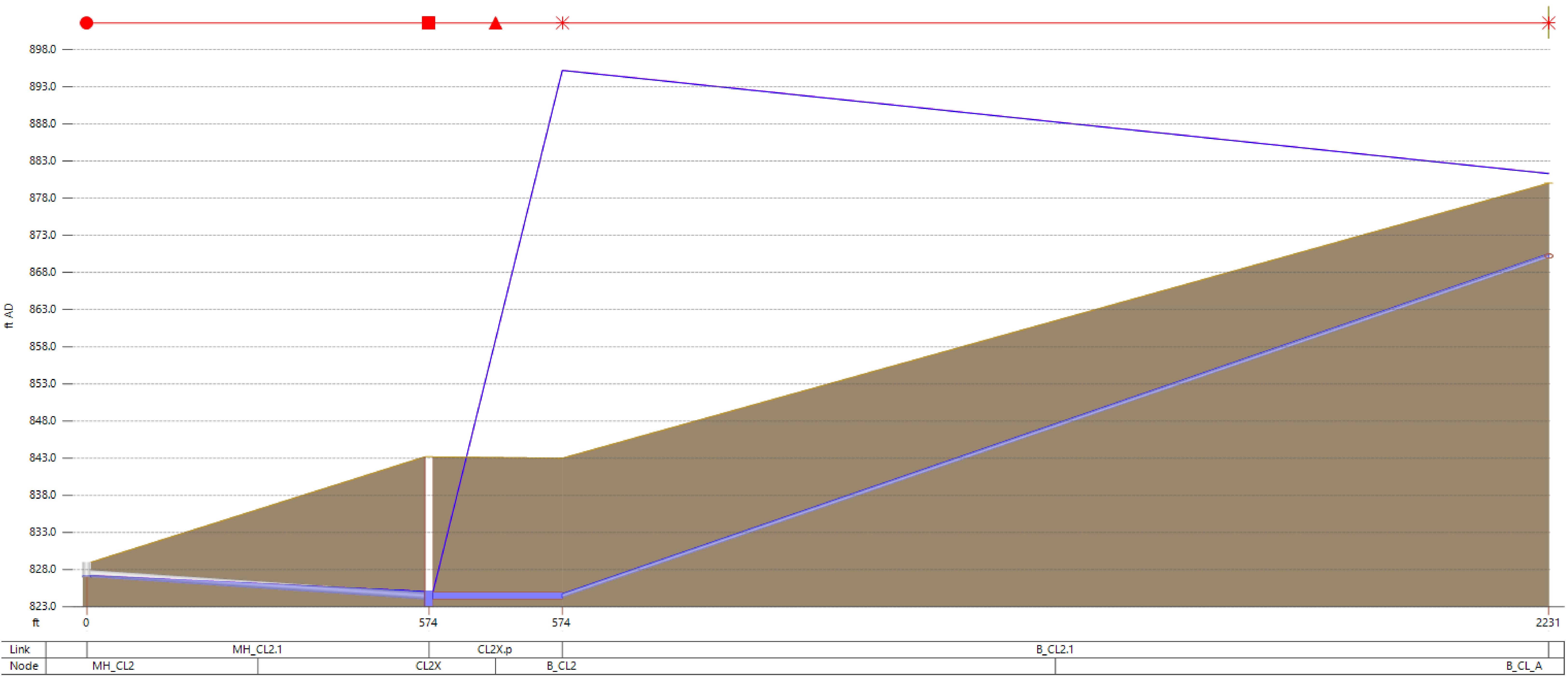
978.0
968.0
958.0
948.0
938.0
928.0
918.0
908.0
898.0
888.0
878.0
868.0
ft AD
ft
0
1328
1328
3797
MH_SB1
DAYX
Link
MH_SB1.1
DAYX.p
B_DAY.1
Node
MH_SB1
DAYX
B_DAY
B_94

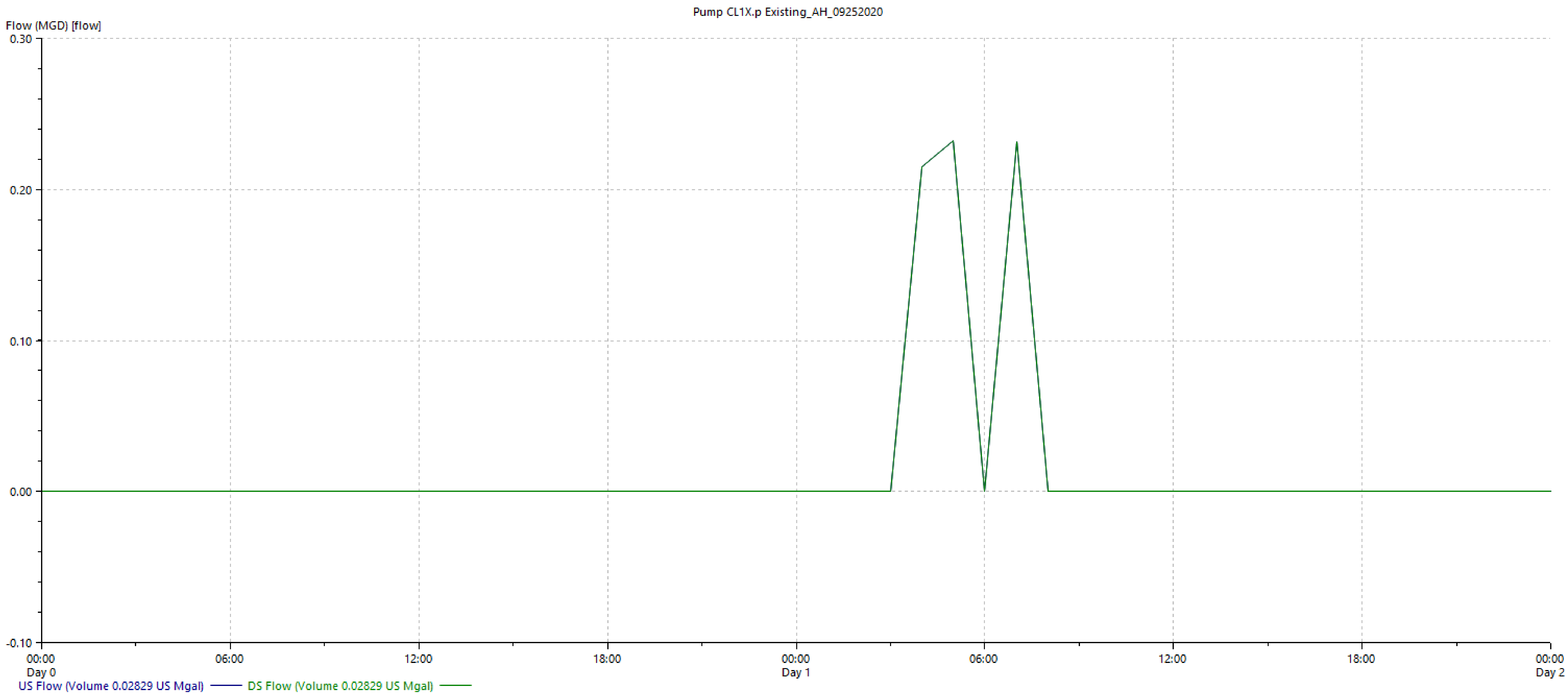


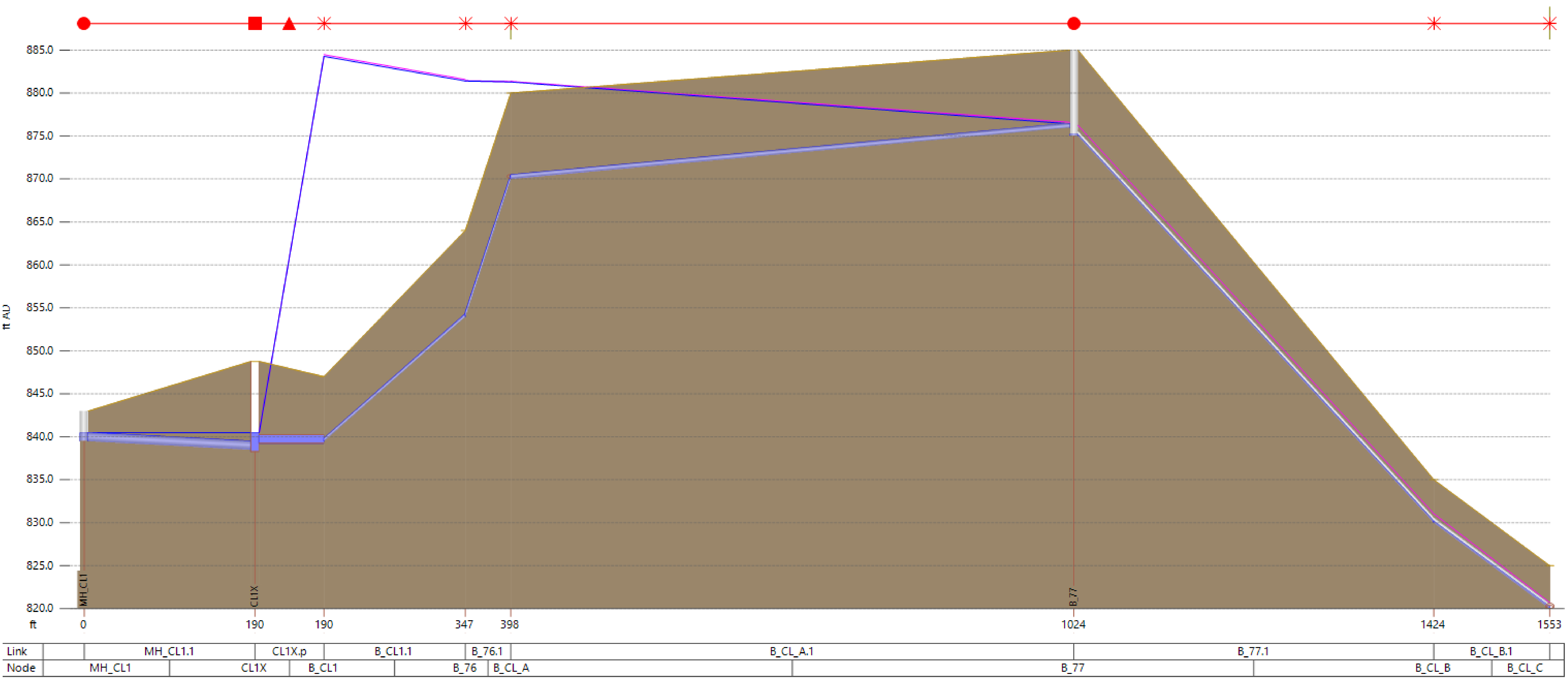
981.0
961.0
941.0
921.0
901.0
881.0
861.0
841.0
821.0
801.0
781.0
ft AD
ft
0
539
2673
6665
8470
B_103
Link
B_94.1
B_95.1
B_103.1
MH_104.1
Node
B_94
B_95
B_103
MH_104
B_INF_A

Pump CL2X.p Existing_AH_09252020

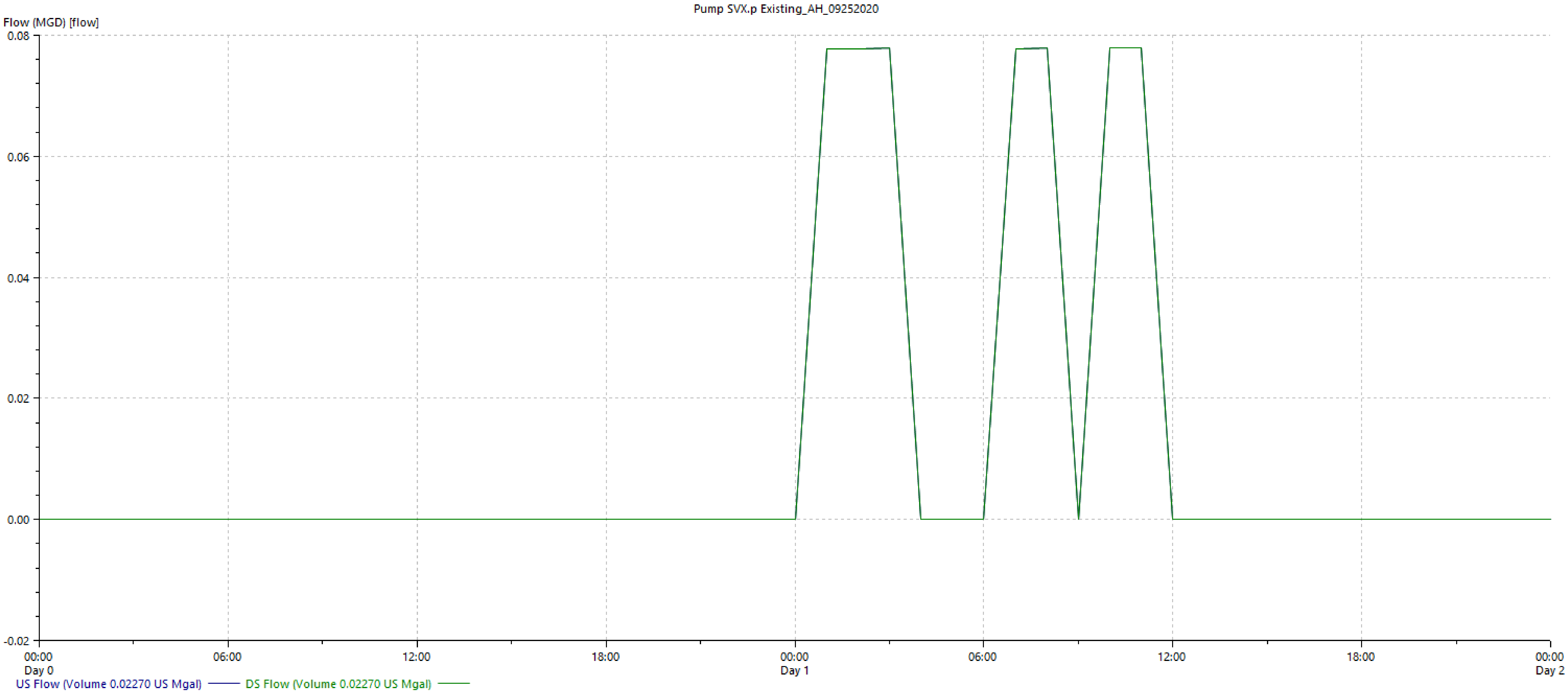


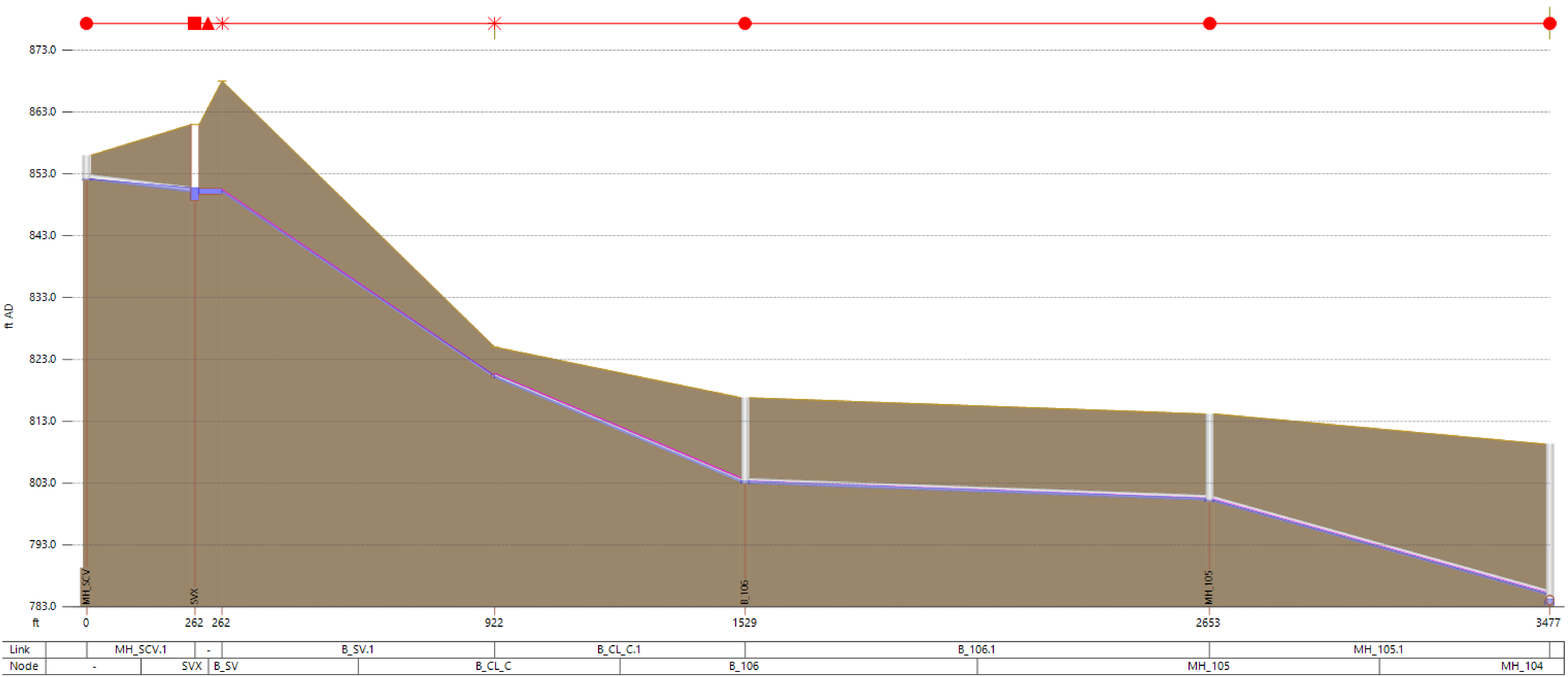

898.0
893.0
888.0
883.0
878.0
873.0
868.0
863.0
858.0
853.0
848.0
843.0
838.0
833.0
828.0
823.0
ft AD
ft
0
574
574
2231
Link
MH_CL2.1
CL2X.p
B_CL2.1
Node
MH_CL2
CL2X
B_CL2
B_CL_A


Pump CL1X.p Existing_AH_09252020
Flow (MGD) [flow]
0.30
0.20
0.10
0.00
-0.10
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.02829 US Mgal)
DS Flow (Volume 0.02829 US Mgal)

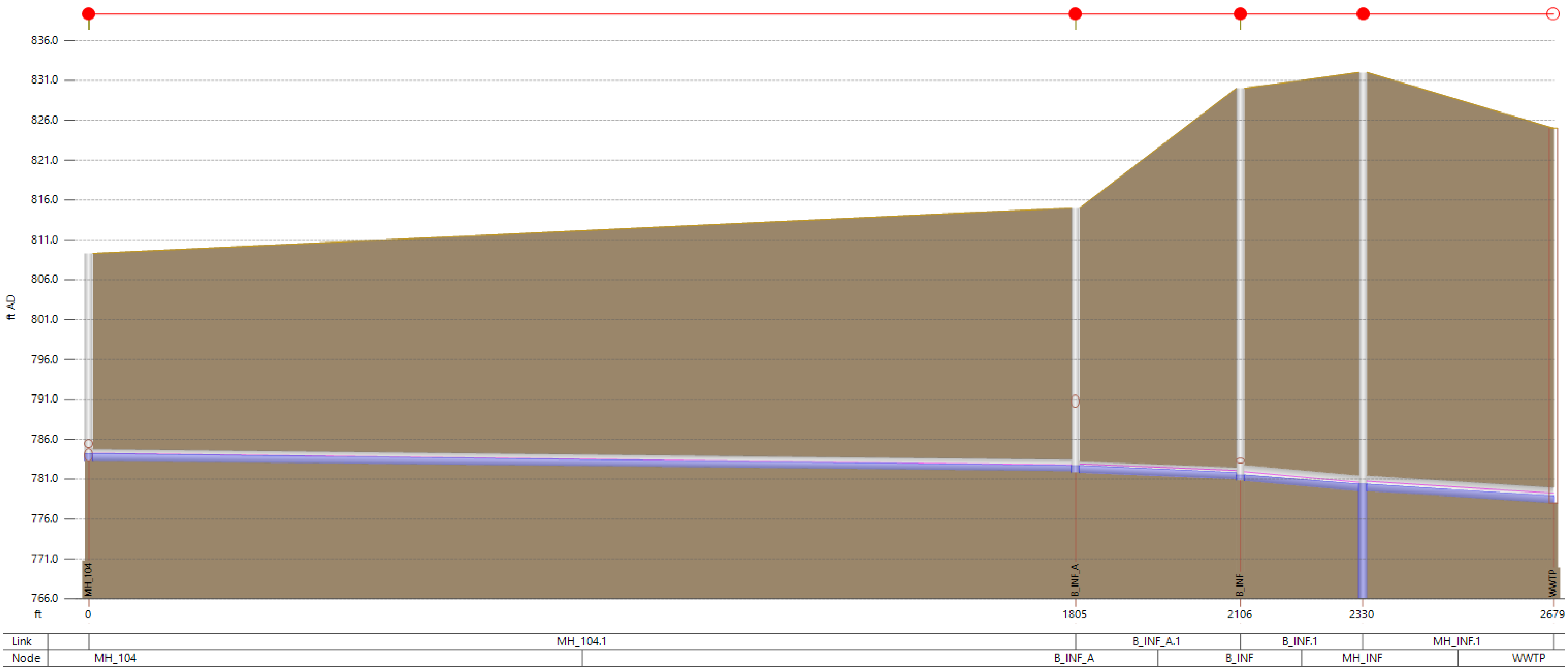


885.0
880.0
875.0
870.0
865.0
860.0
855.0
850.0
845.0
840.0
835.0
830.0
825.0
820.0
ft AD
ft
0
190
190
347
398
1024
1424
1553
MH_CL1
CL1X
B_77
Link
MH_CL1.1
CL1X.p
B_CL1.1
B_76.1
B_CL_A.1
B_77.1
B_CL_B.1
Node
MH_CL1
CL1X
B_CL1
B_76
B_CL_A
B_77
B_CL_B
B_CL_C


Pump SVX.p Existing_AH_09252020
Flow (MGD) [flow]
0.08
0.06
0.04
0.02
0.00
-0.02
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.02270 US Mgal)
DS Flow (Volume 0.02270 US Mgal)

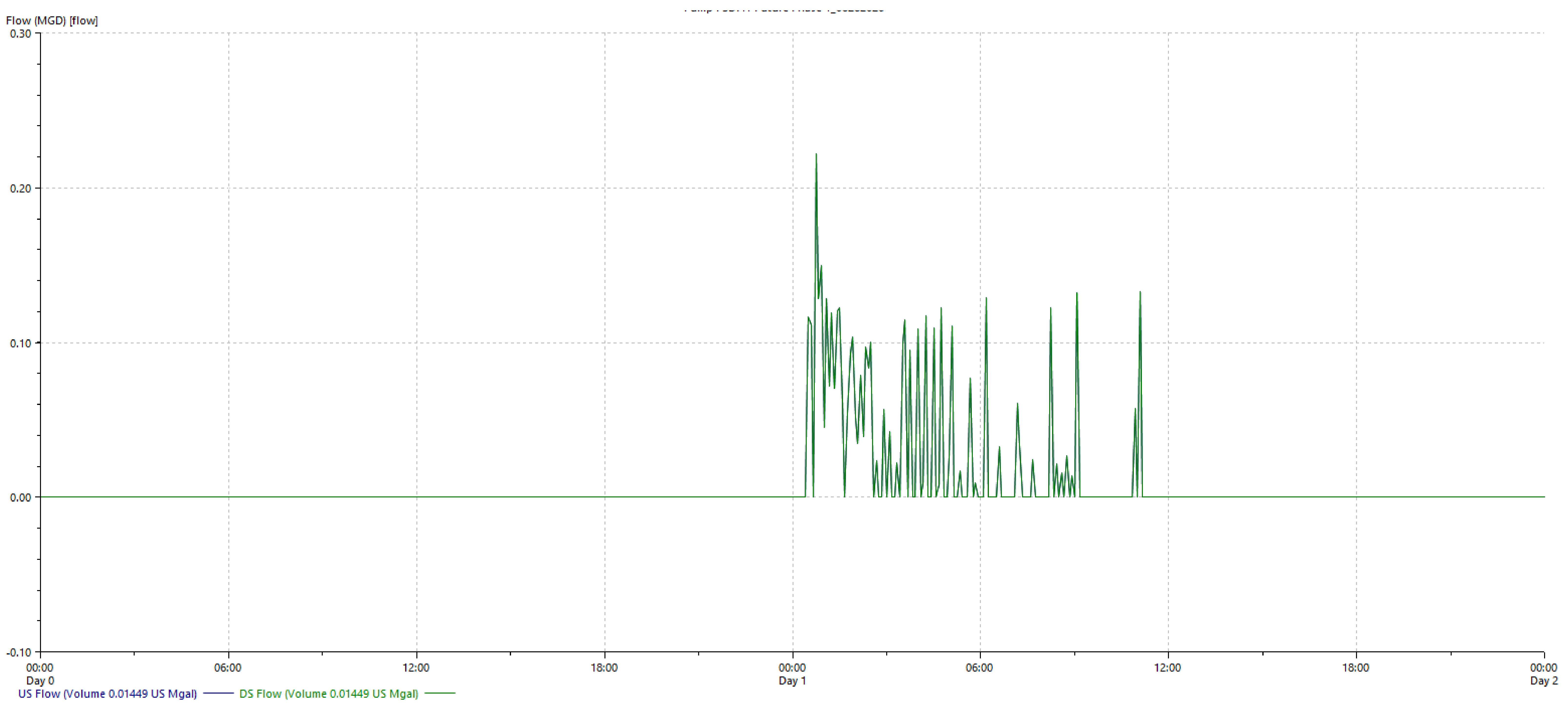


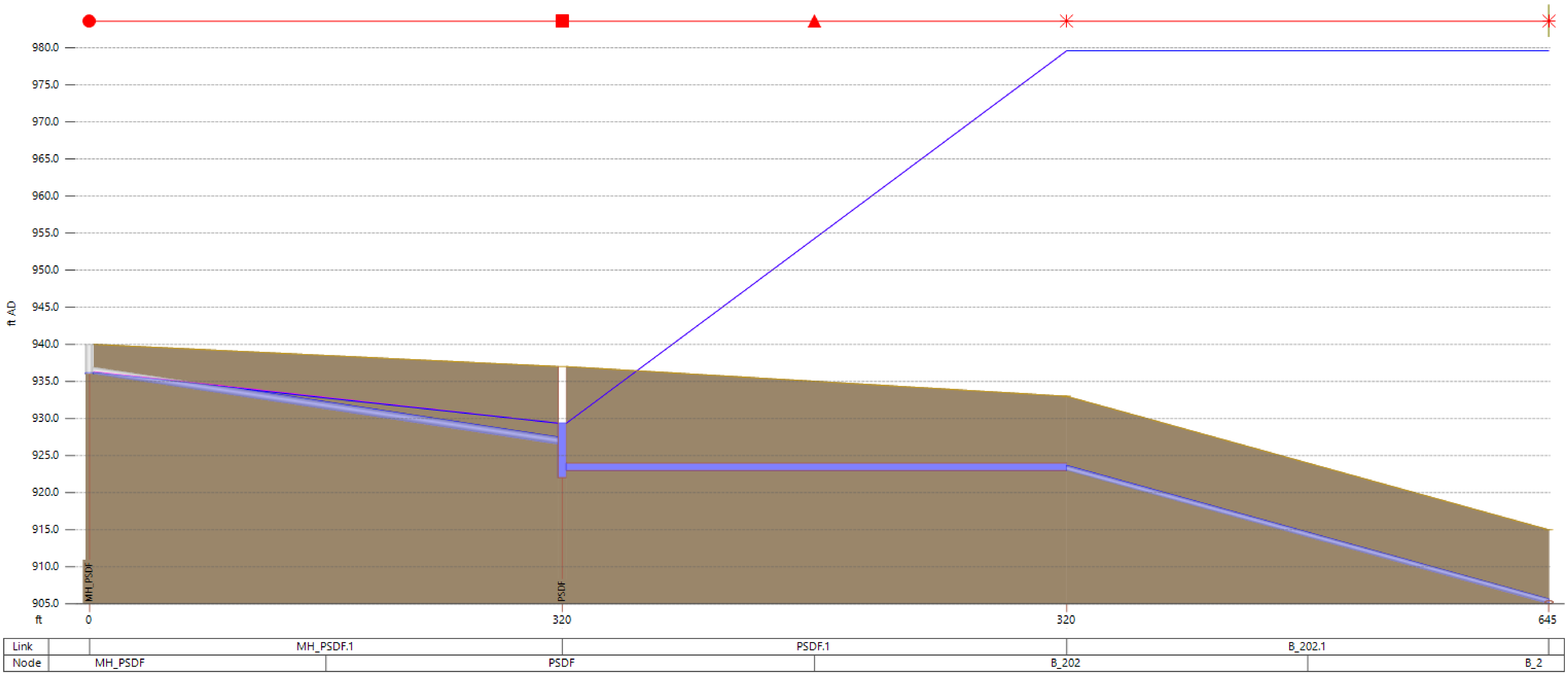
873.0
863.0
853.0
843.0
833.0
823.0
813.0
803.0
793.0
783.0
ft AD
MH_SCV
SVX
B_106
MH_105
ft
0
262
262
922
1529
2653
3477
Link
MH_SCV.1
-
B_SV.1
B_CL_C.1
B_106.1
MH_105.1
Node
-
SVX
B_SV
B_CL_C
B_106
MH_105
MH_104



836.0
831.0
826.0
821.0
816.0
811.0
806.0
801.0
796.0
791.0
786.0
781.0
776.0
771.0
766.0
ft AD
MH_104
B_INF_A
B_INF
WWTP
ft
0
1805
2106
2330
2679
Link
MH_104.1
B_INF_A.1
B_INF.1
MH_INF.1
Node
MH_104
B_INF_A
B_INF
MH_INF
WWTP

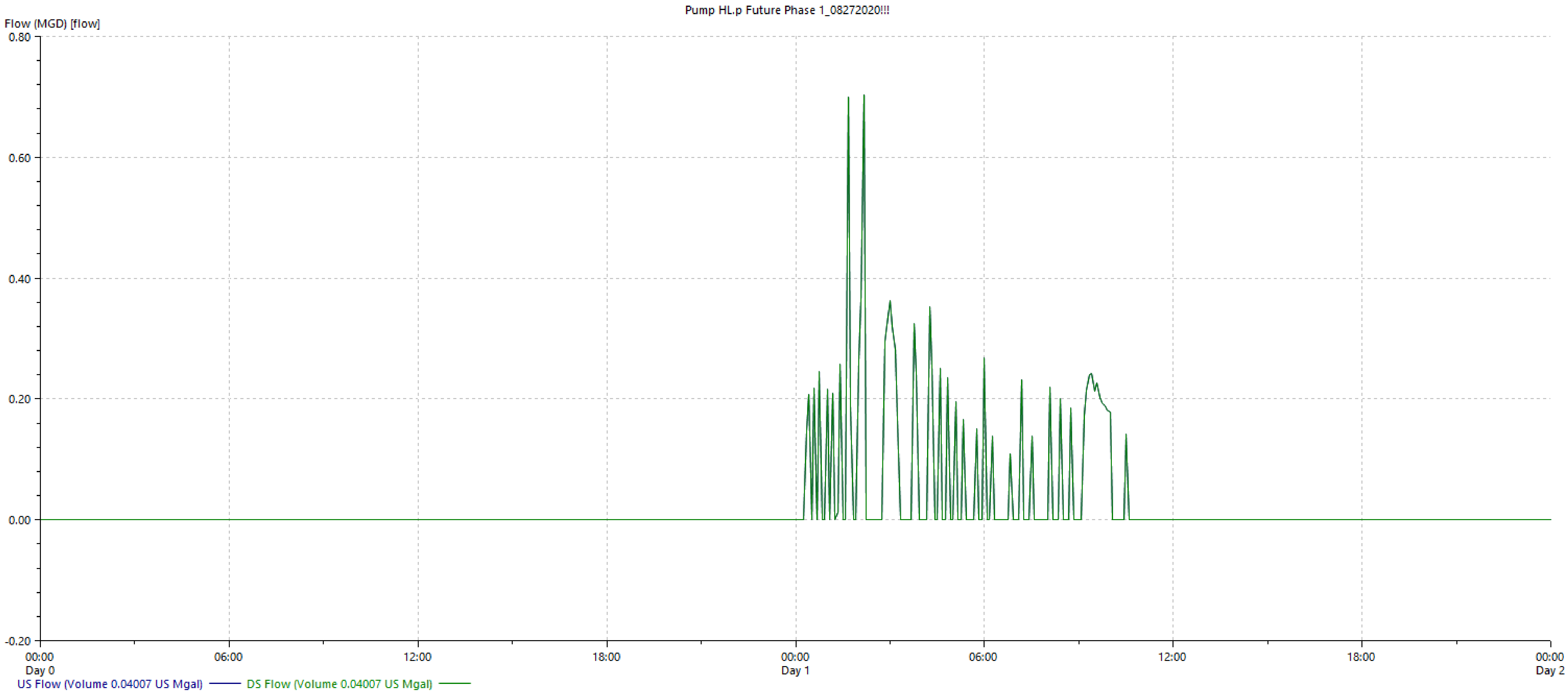
DAVENPORT FARMS PS

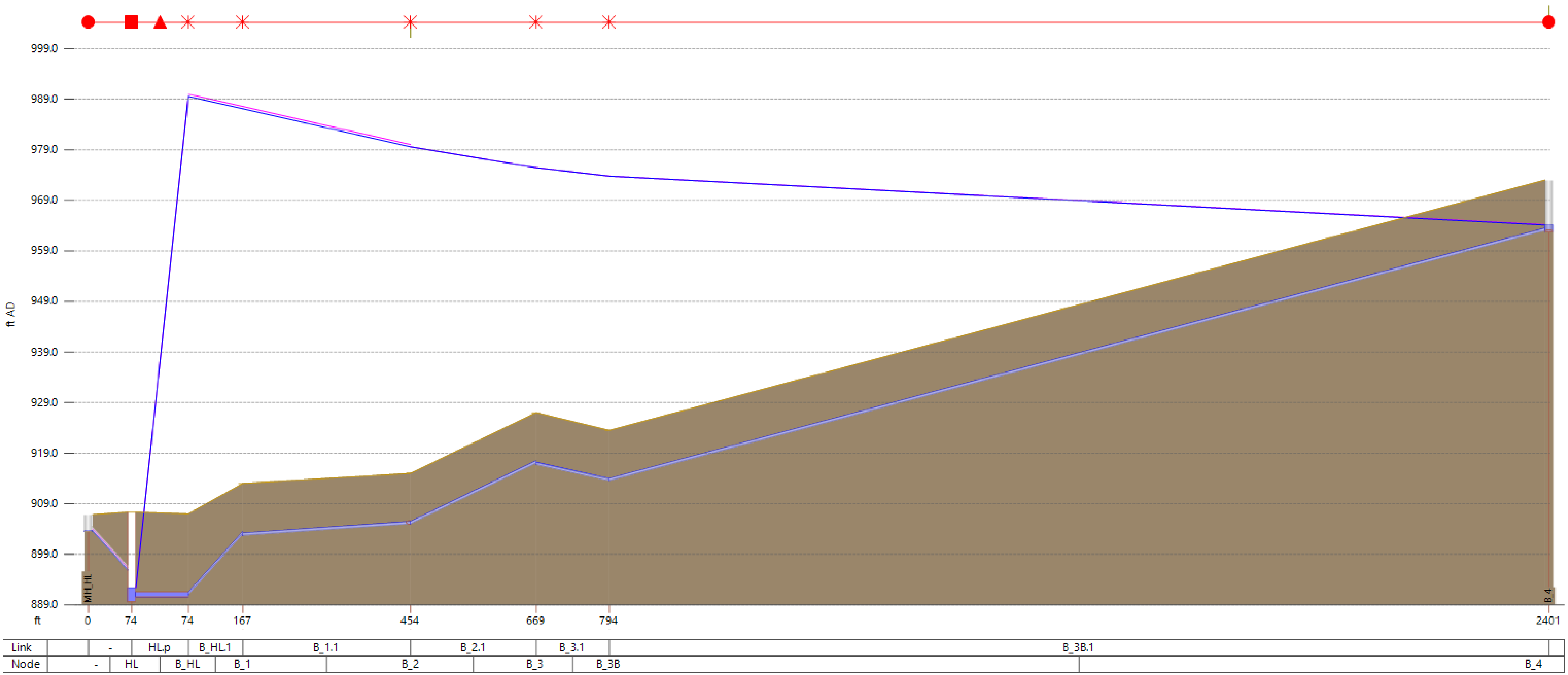




980.0
975.0
970.0
965.0
960.0
955.0
950.0
945.0
940.0
935.0
930.0
925.0
920.0
915.0
910.0
905.0
ft AD
MH_PSDF
PSDF
ft
0
320
320
645
Link
MH_PSDF.1
PSDF.1
B_202.1
Node
MH_PSDF
PSDF
B_202
B_2

HARBOR LAKES PUMP STATION

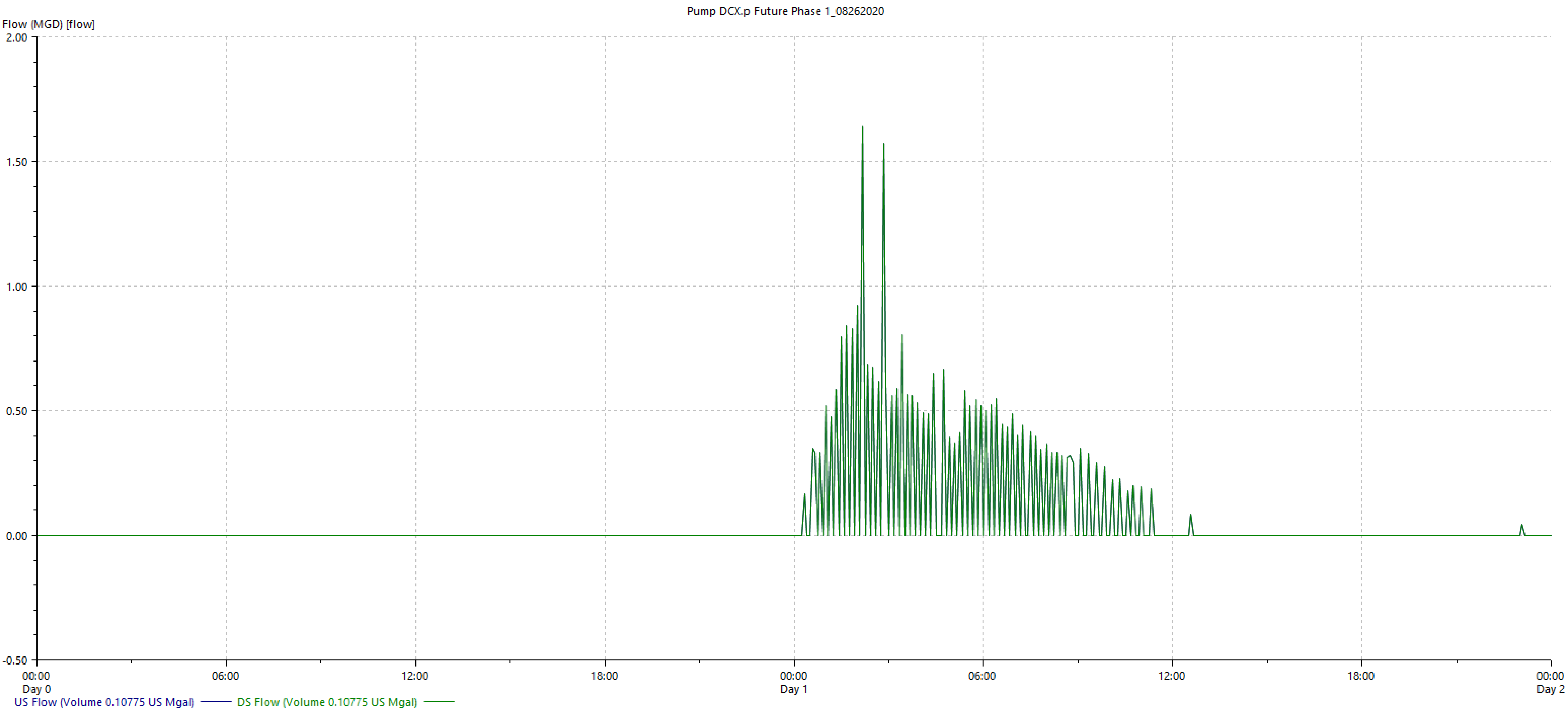


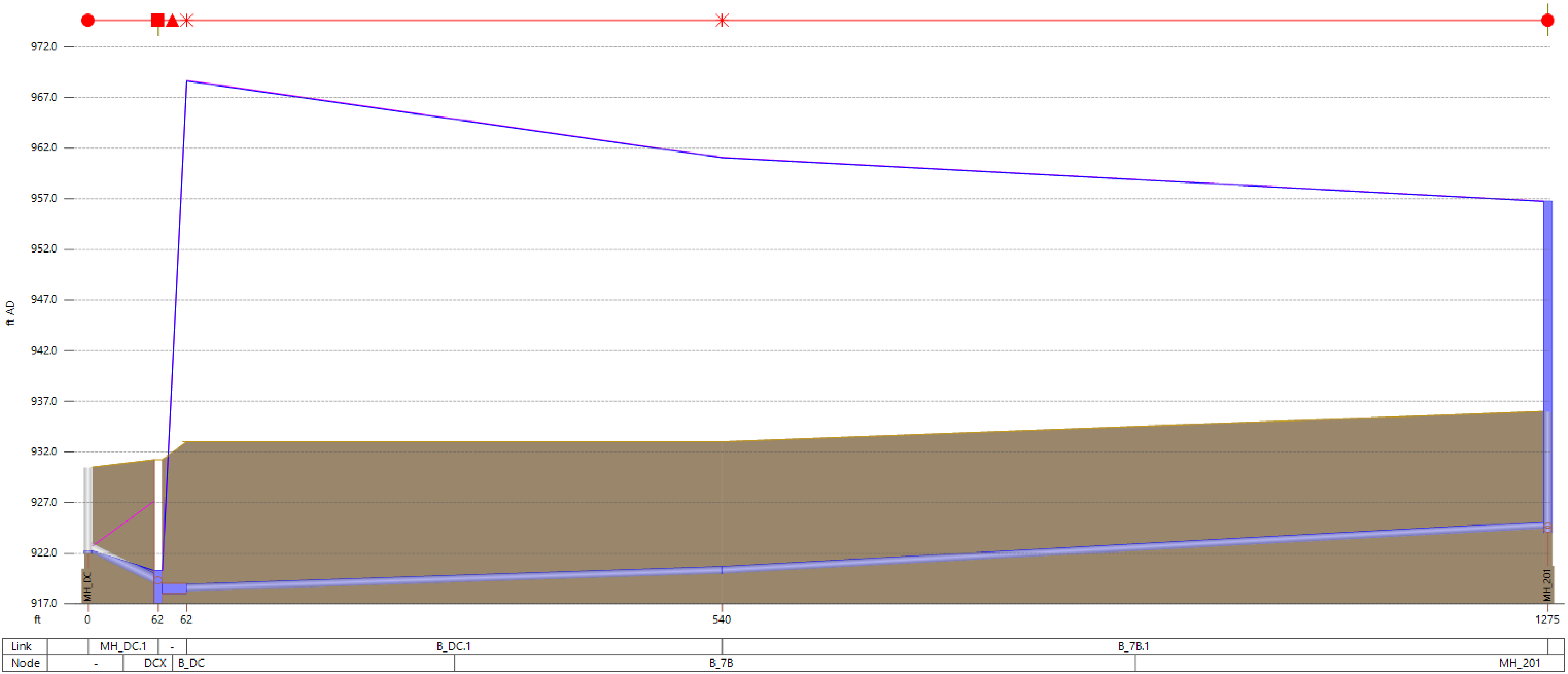


999.0
989.0
979.0
969.0
959.0
949.0
939.0
929.0
919.0
909.0
899.0
889.0
ft AD
MH_HL
B_4
ft
0
74
74
167
454
669
794
2401
Link
-
HLp
B_HL1
B_1.1
B_2.1
B_3.1
B_3B.1
Node
-
HL
B_HL
B_1
B_2
B_3
B_3B
B_4

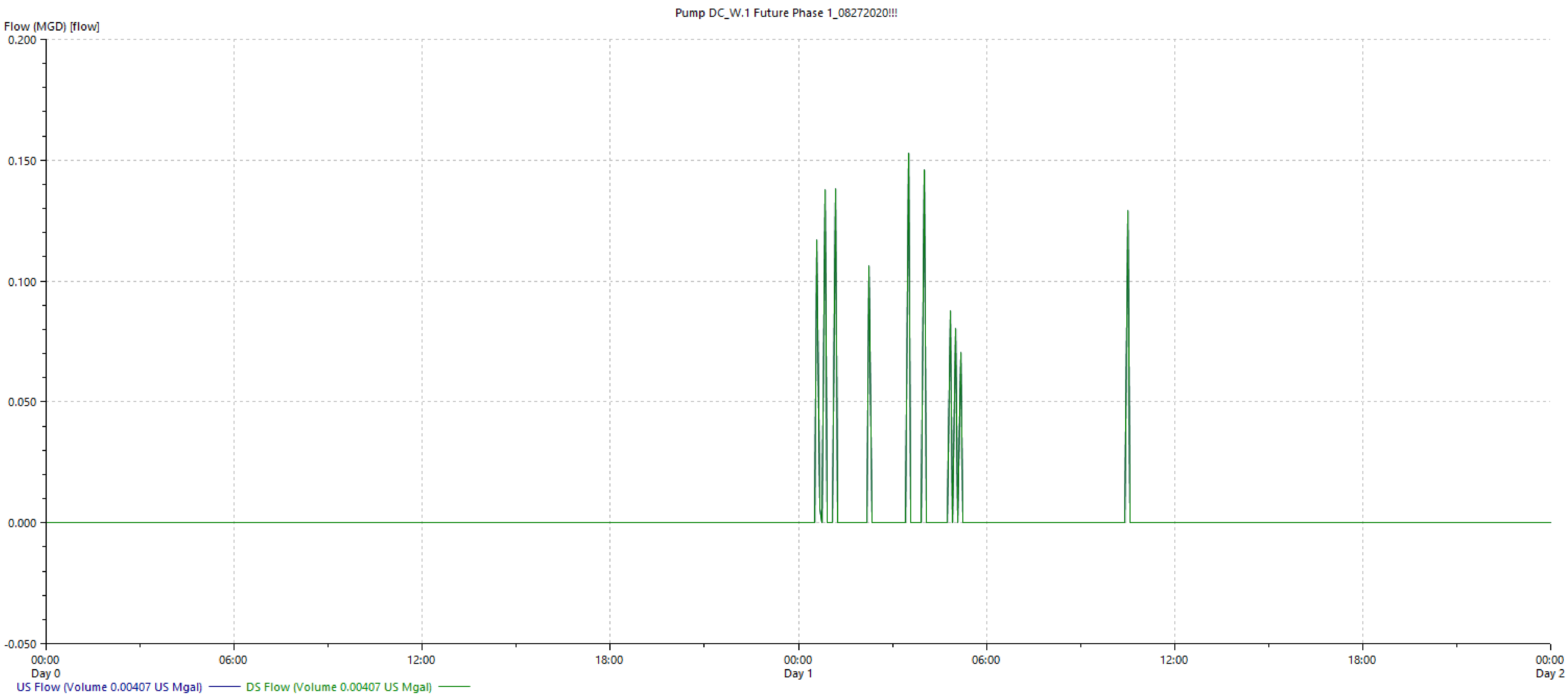
977.0
972.0
967.0
962.0
957.0
952.0
947.0
942.0
937.0
932.0
927.0
922.0
917.0
ft AD
B_4
B_6
ft
0
1348
1651
2995
3105
Link
B_4.1
B_5.1
B_6.1
B_99.1
Node
B_4
B_5
B_6
B_99
-

DIAMOND CREST PS

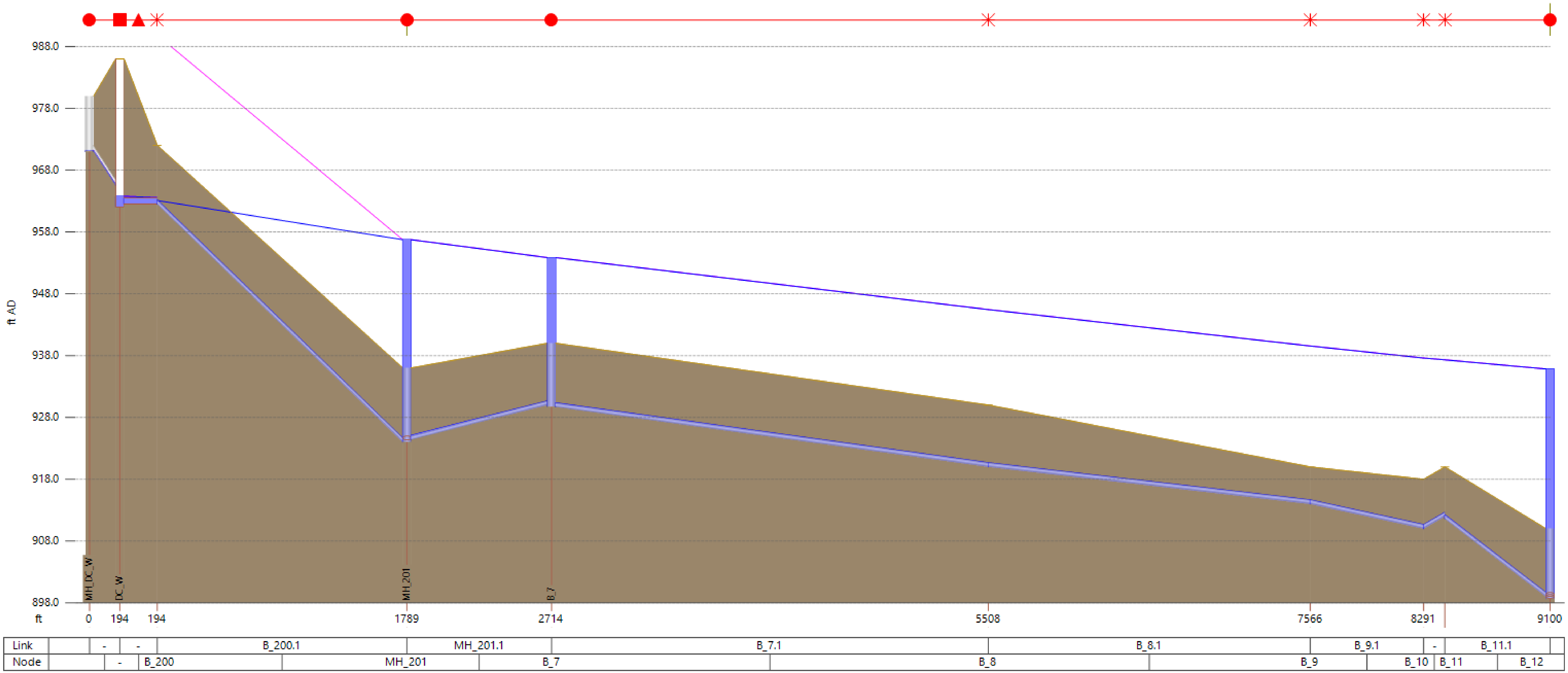




972.0
967.0
962.0
957.0
952.0
947.0
942.0
937.0
932.0
927.0
922.0
917.0
ft AD
MH_DC
MH_201
ft
0
62
62
540
1275
Link
MH_DC.1
-
B_DC.1
B_7B.1
Node
-
DCX
B_DC
B_7B
MH_201

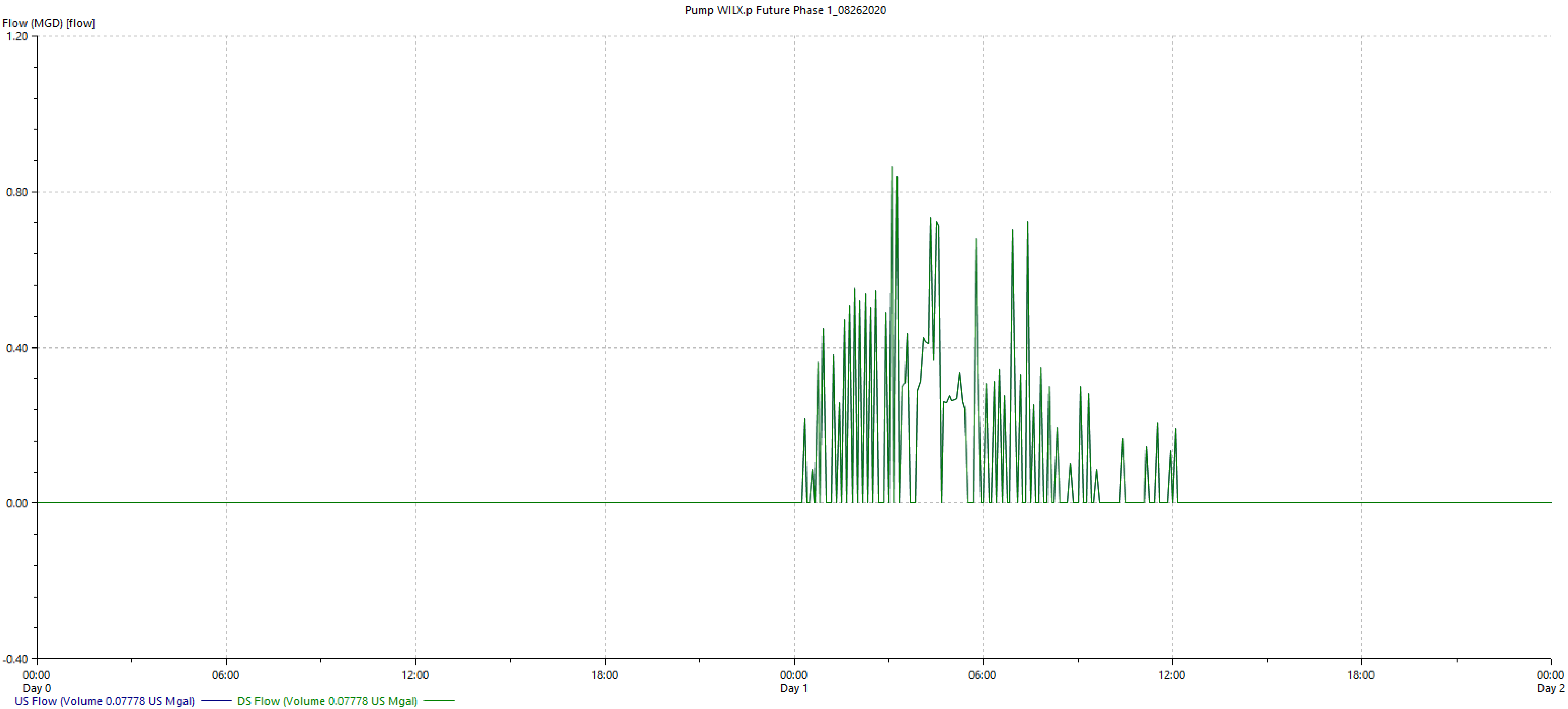


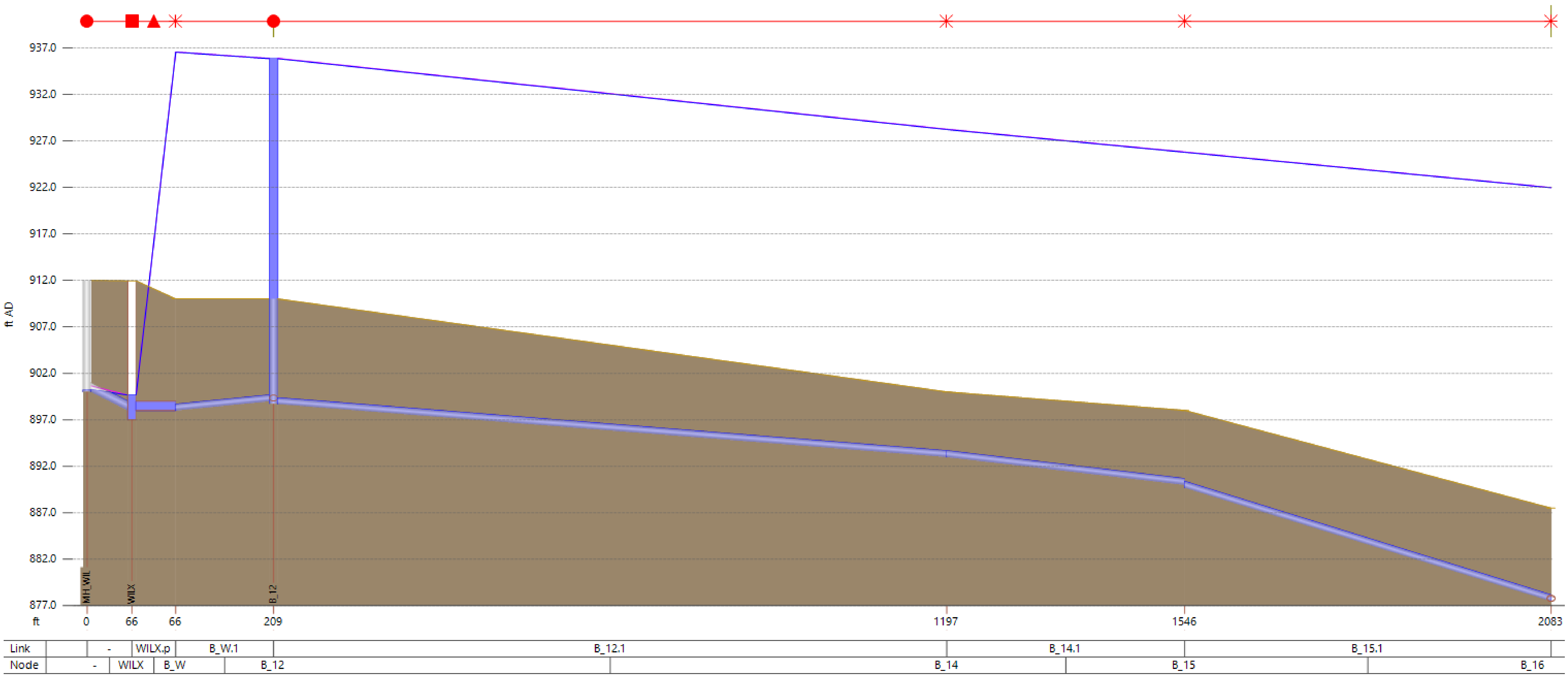
Pump DC_W.1 Future Phase 1_08272020!!!
Flow (MGD) [flow]
0.200
0.150
0.100
0.050
0.000
-0.050
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.00407 US Mgal)
DS Flow (Volume 0.00407 US Mgal)



988.0
978.0
968.0
958.0
948.0
938.0
928.0
918.0
908.0
898.0
ft AD
MH_DC_W
DC_W
MH_201
B_7
ft
0
194
194
1789
2714
5508
7566
8291
9100
Link
-
-
B_200.1
MH_201.1
B_7.1
B_8.1
B_9.1
-
B_11.1
Node
-
B_200
MH_201
B_7
B_8
B_9
B_10
B_11
B_12

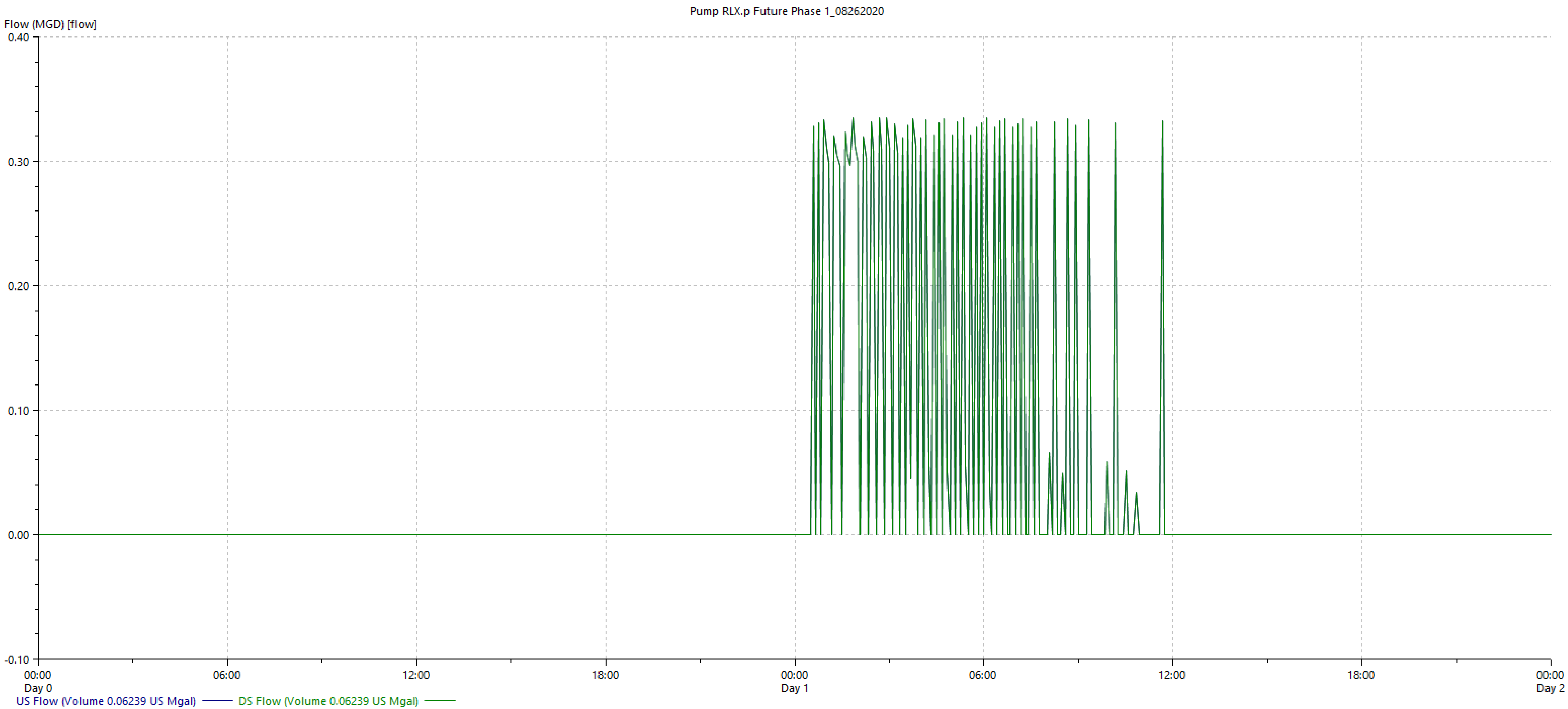
WILDFLOWER PS

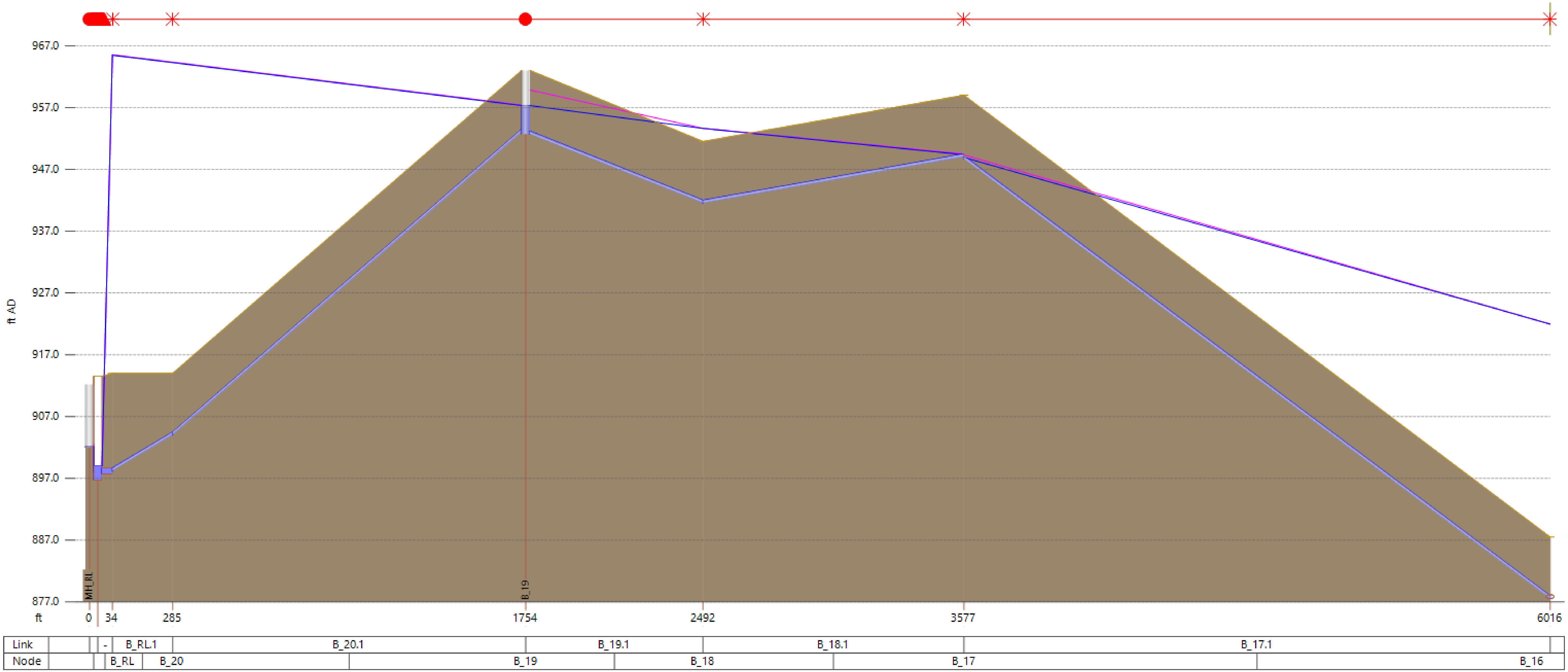




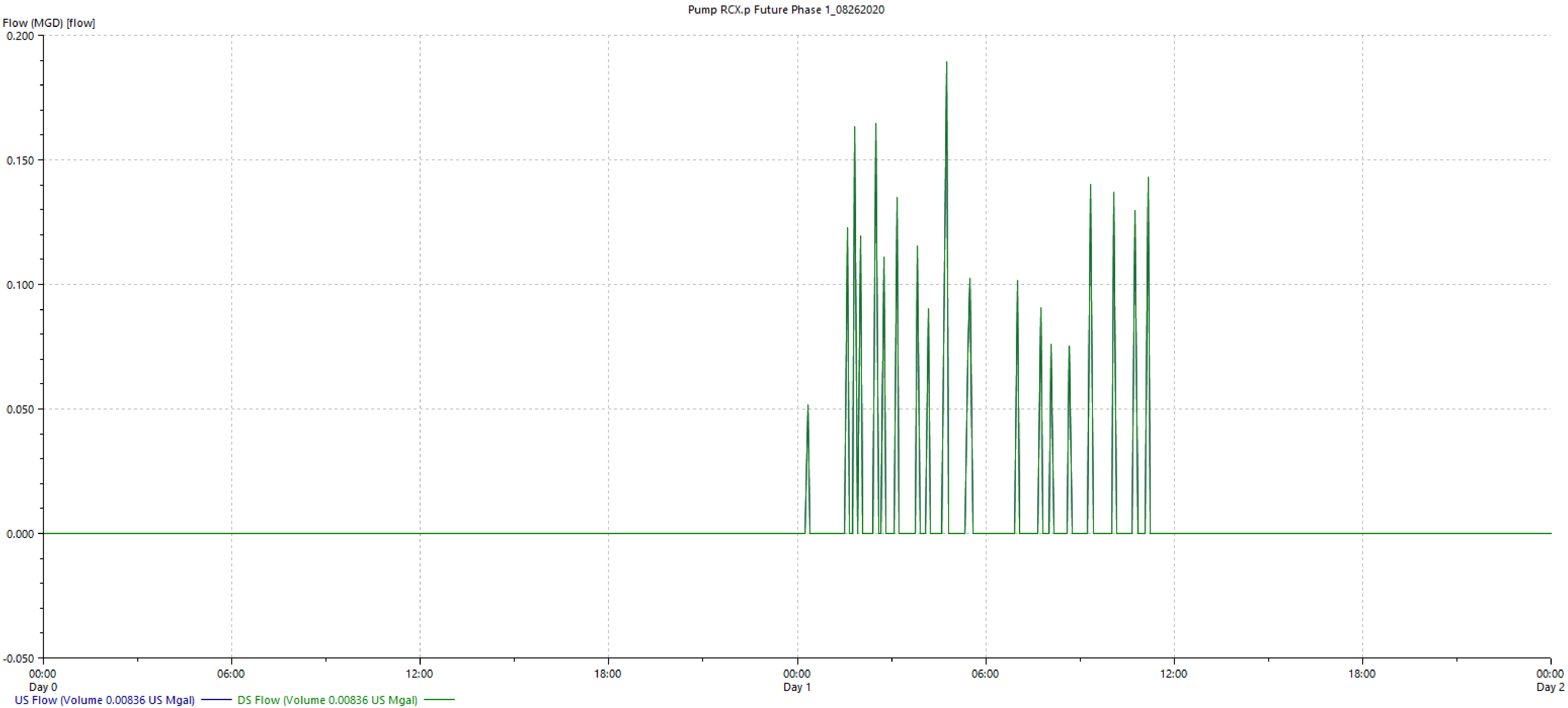
937.0
932.0
927.0
922.0
917.0
912.0
907.0
902.0
897.0
892.0
887.0
882.0
877.0
ft AD
MH_WIL
WILX
B_12
ft
0
66
66
209
1197
1546
2083
Link
-
WILX.p
B_W.1
B_12.1
B_14.1
B_15.1
Node
-
WILX
B_W
B_12
B_14
B_15
B_16

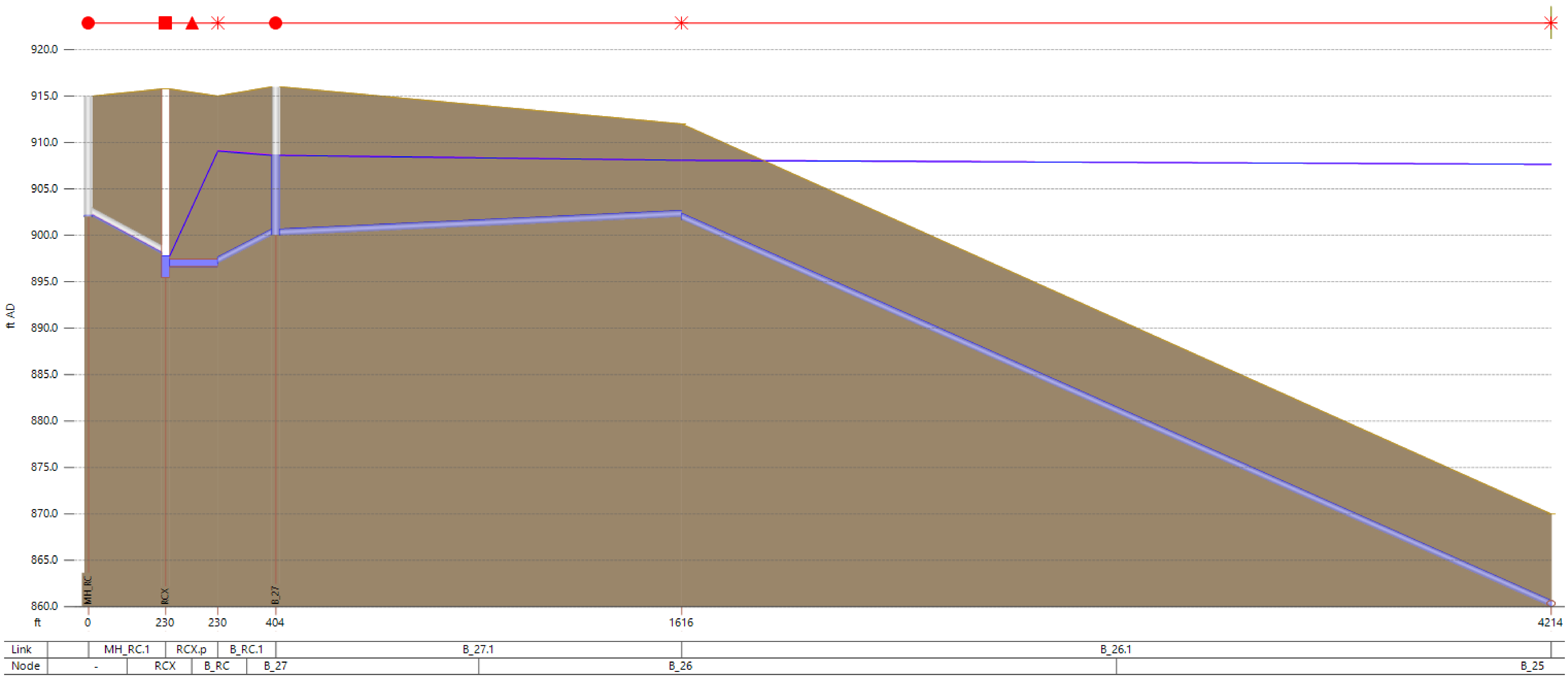
ROLLINS LANDING PS




967.0
957.0
947.0
937.0
927.0
917.0
907.0
897.0
887.0
877.0
ft AD
MH_RL
B_19
ft
0
34
285
1754
2492
3577
6016
Link
-
B_RL.1
B_20.1
B_19.1
B_18.1
B_17.1
Node
B_RL
B_20
B_19
B_18
B_17
B_16

ROCK CREEK PS

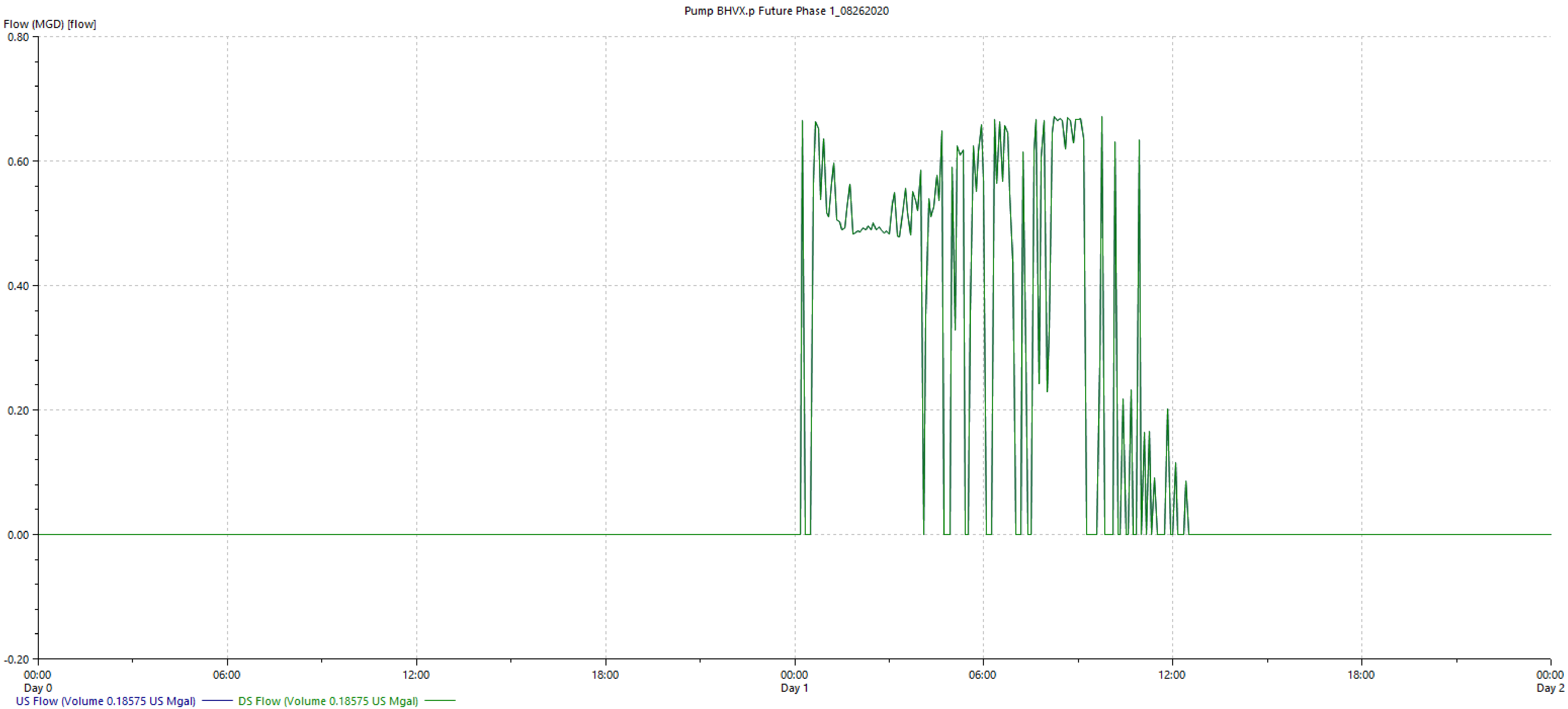


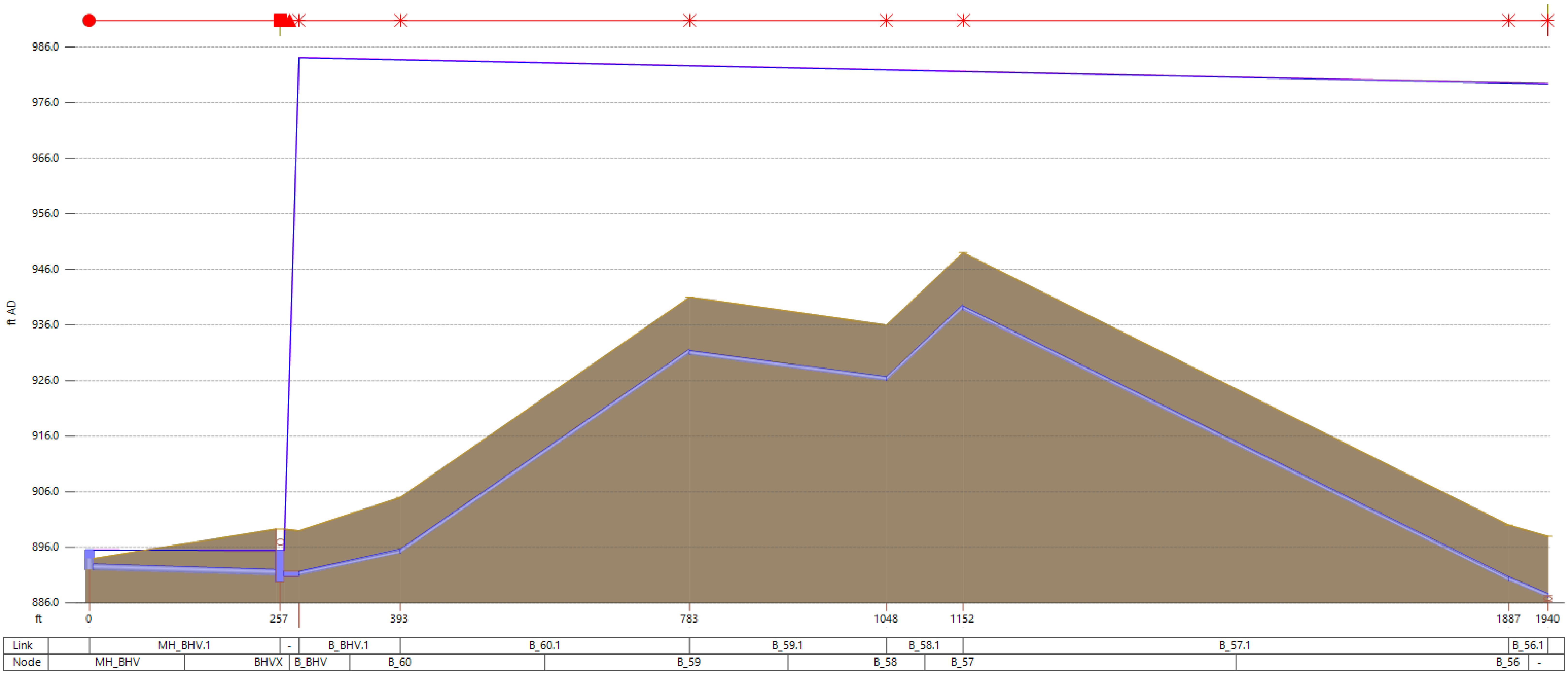


920.0
915.0
910.0
905.0
900.0
895.0
890.0
885.0
880.0
875.0
870.0
865.0
860.0
ft AD
MH_RC
RCX
B_27
ft
0
230
230
404
1616
4214
Link
MH_RC.1
RCX.p
B_RC.1
B_27.1
B_26.1
Node
-
RCX
B_RC
B_27
B_26
B_25


912.0
902.0
892.0
882.0
872.0
862.0
852.0
842.0
832.0
ft AD
ft
0
3910
5057
5320
6245
Link
B_25.1
B_28.1
B_29.1
B_30.1
Node
B_25
B_28
B_29
B_30
B_31

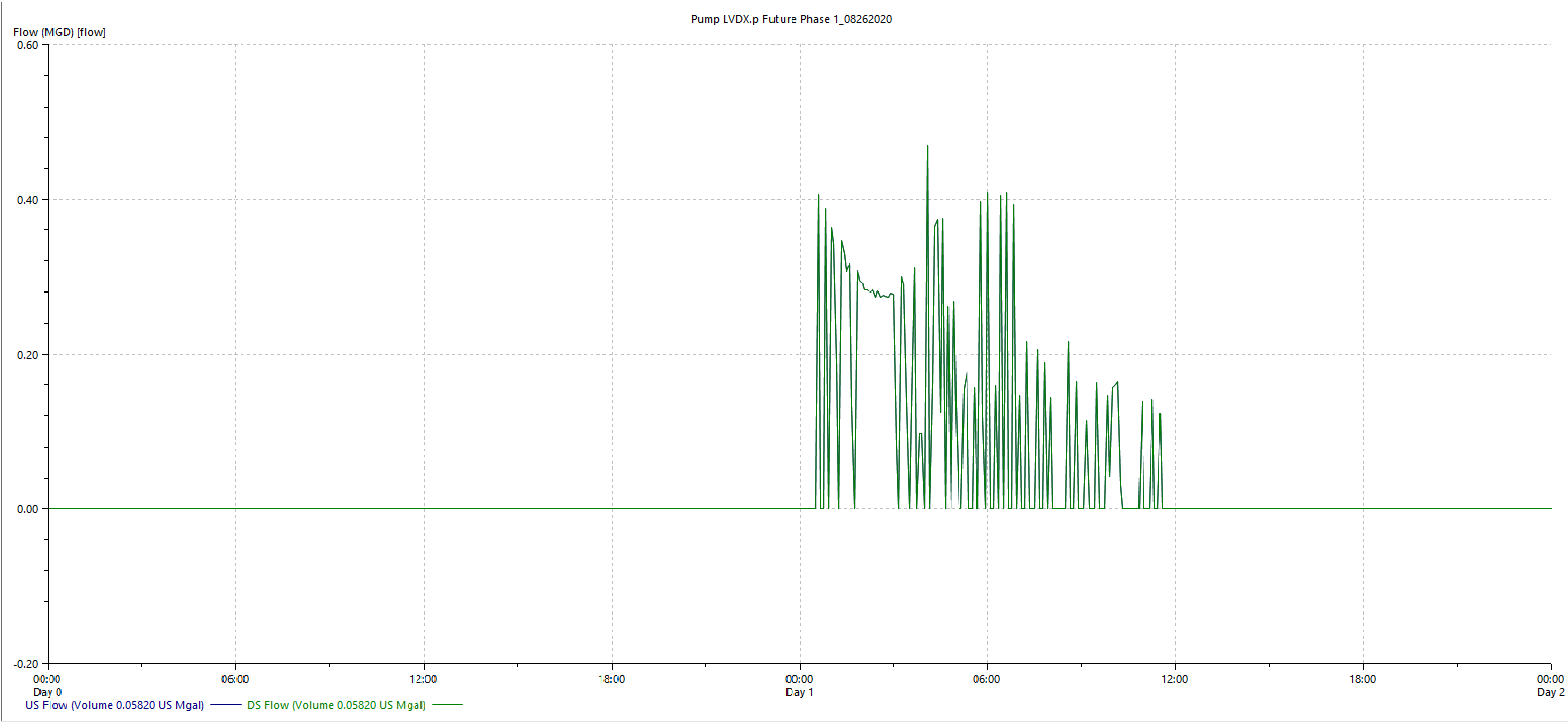
BIG HARBORVIEW PS

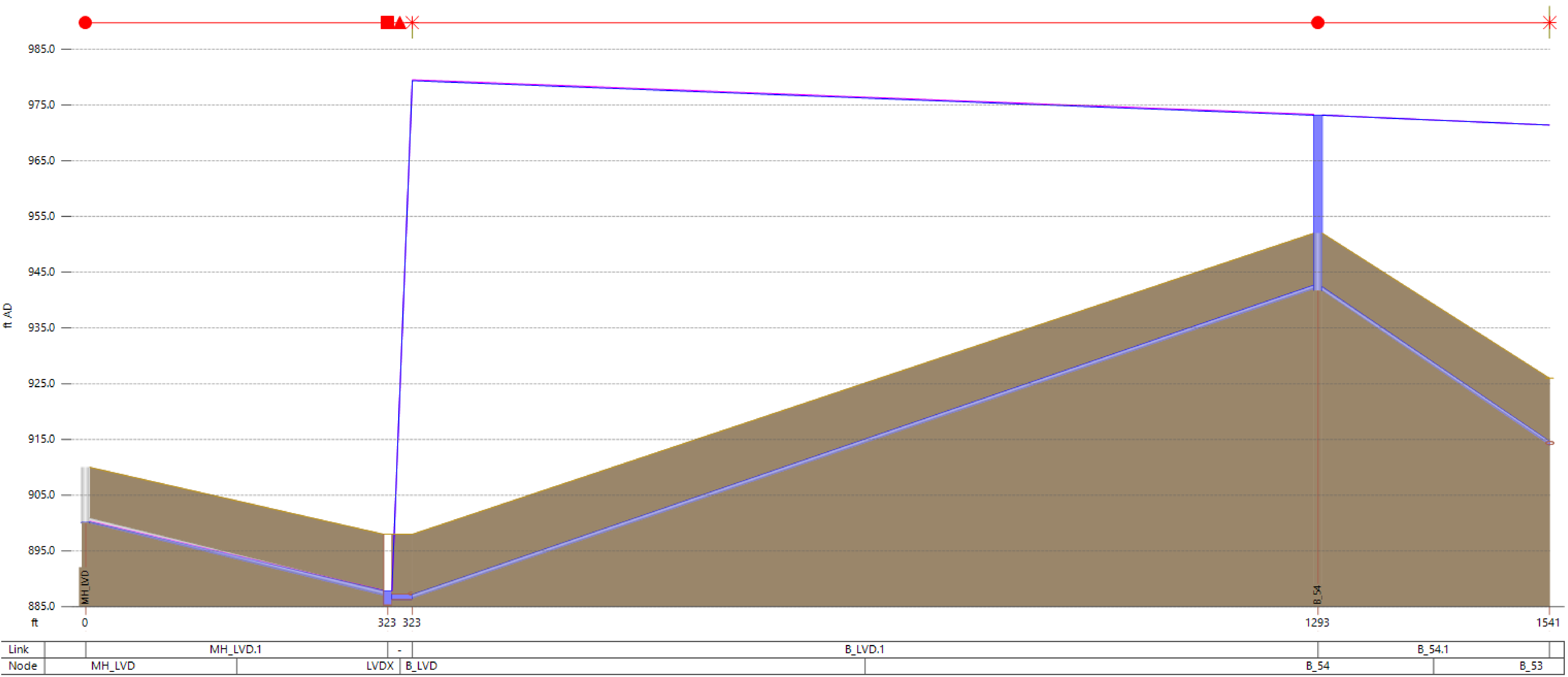




986.0
976.0
966.0
956.0
946.0
936.0
926.0
916.0
906.0
896.0
886.0
ft AD
ft
0
257
393
783
1048
1152
1887
1940
Link
MH_BHV.1
-
B_BHV.1
B_60.1
B_59.1
B_58.1
B_57.1
B_56.1
Node
MH_BHV
BHVX
B_BHV
B_60
B_59
B_58
B_57
B_56
-

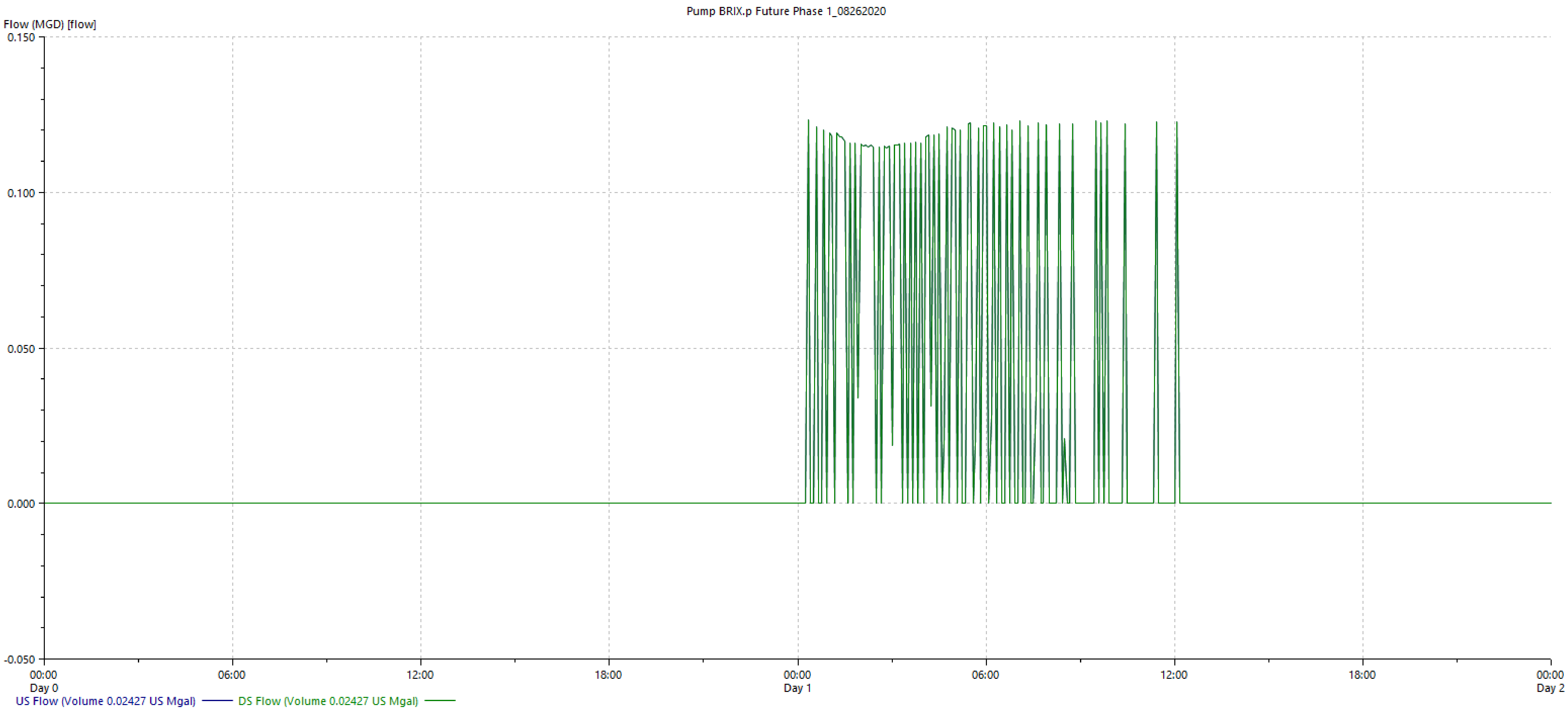
LAKEVIEW DRIVE PS

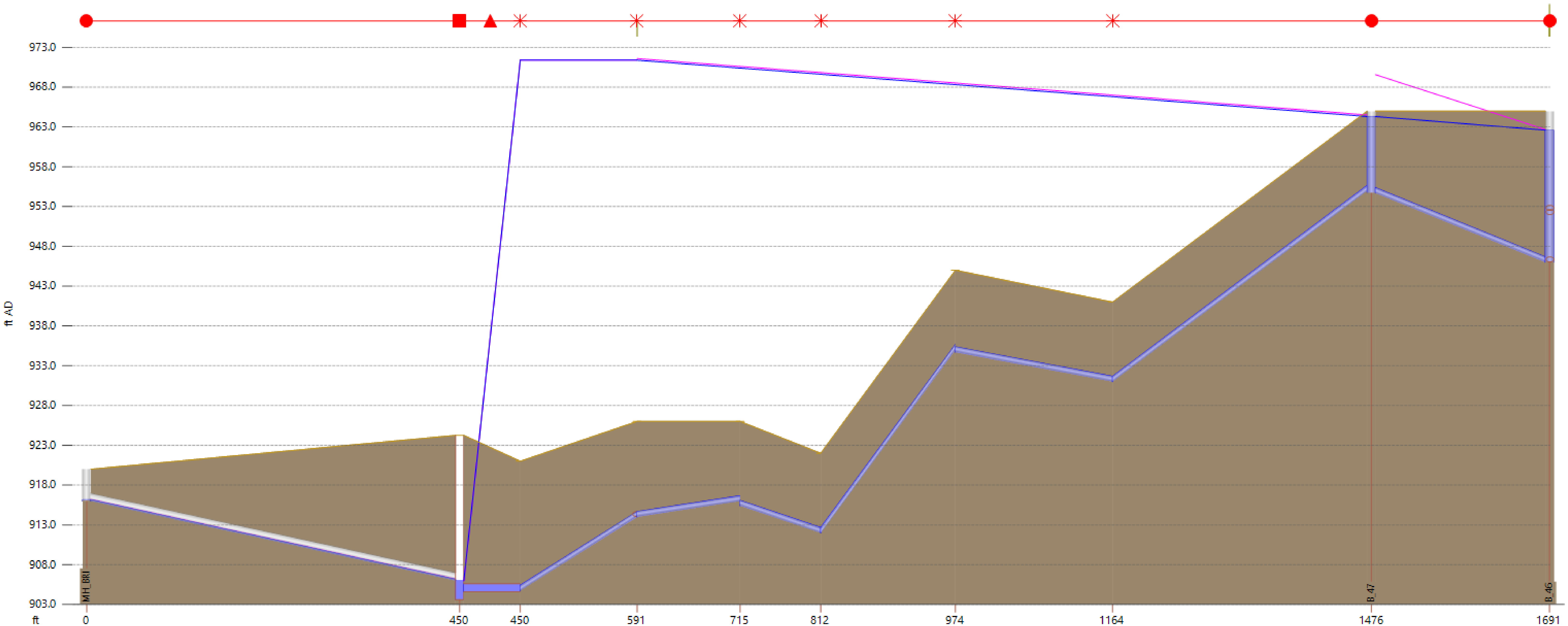




985.0
975.0
965.0
955.0
945.0
935.0
925.0
915.0
905.0
895.0
885.0
ft AD
MH_LVD
B_54
ft
0
323
323
1293
1541
Link
MH_LVD.1
-
B_LVD.1
B_54.1
Node
MH_LVD
LVDX
B_LVD
B_54
B_53

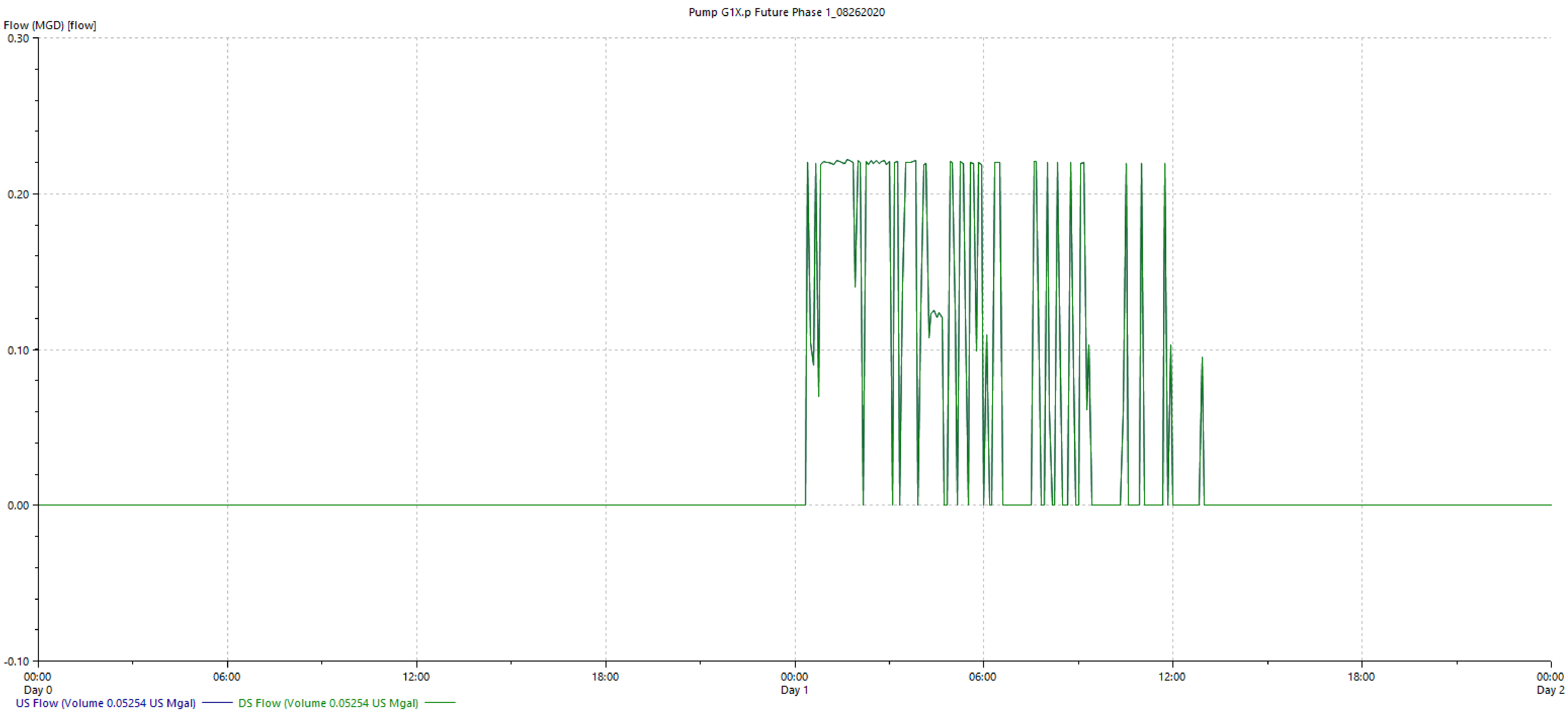
BRIDGEPORT PS



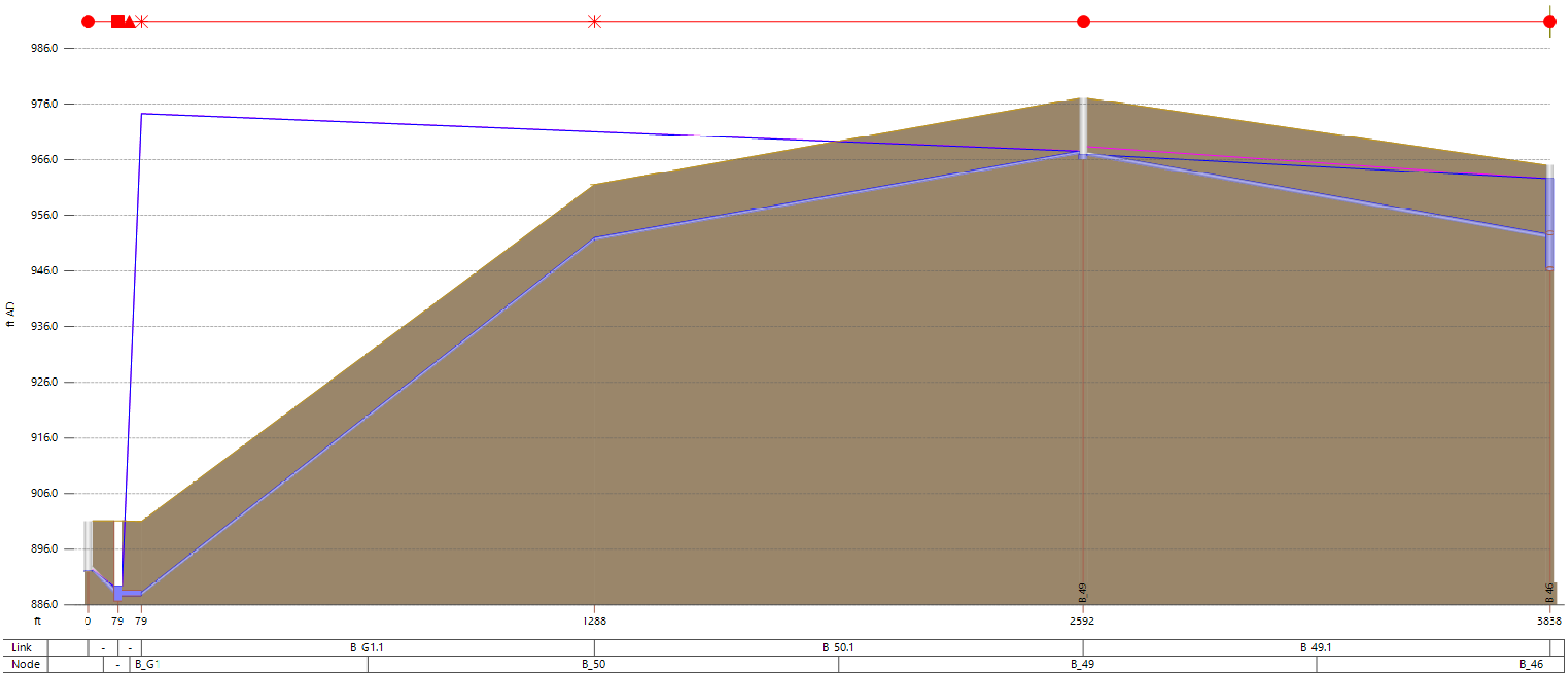


Link	MH_BRI.1	BRIX.p	B_BRI.1	B_53.1	B_52.1	B_51.1	B_51A.1	B_48.1	B_47.1
Node	MH_BRI	BRIX	B_BRI	B_53	B_52	B_51	B_51A	B_48	B_47	B_46

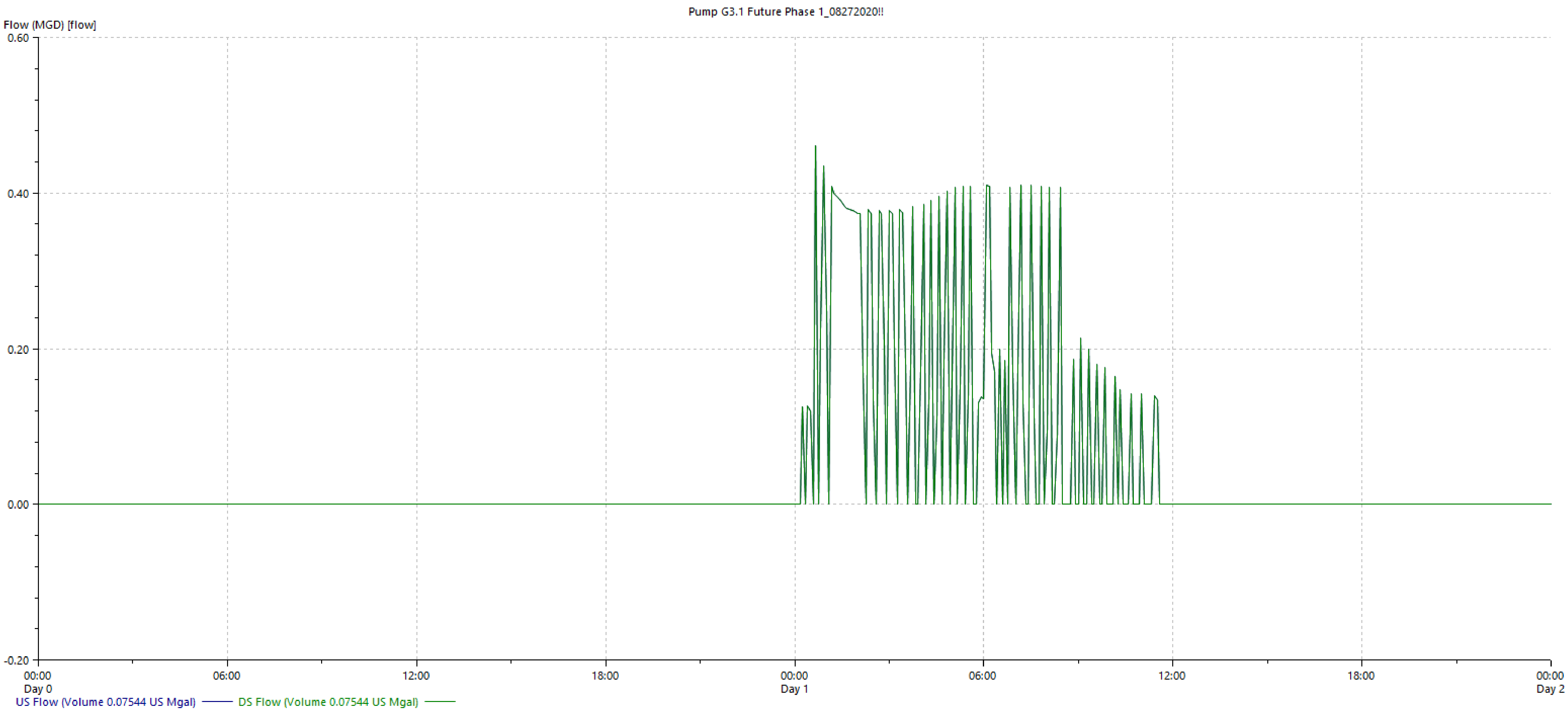
GREYHAWKE #1



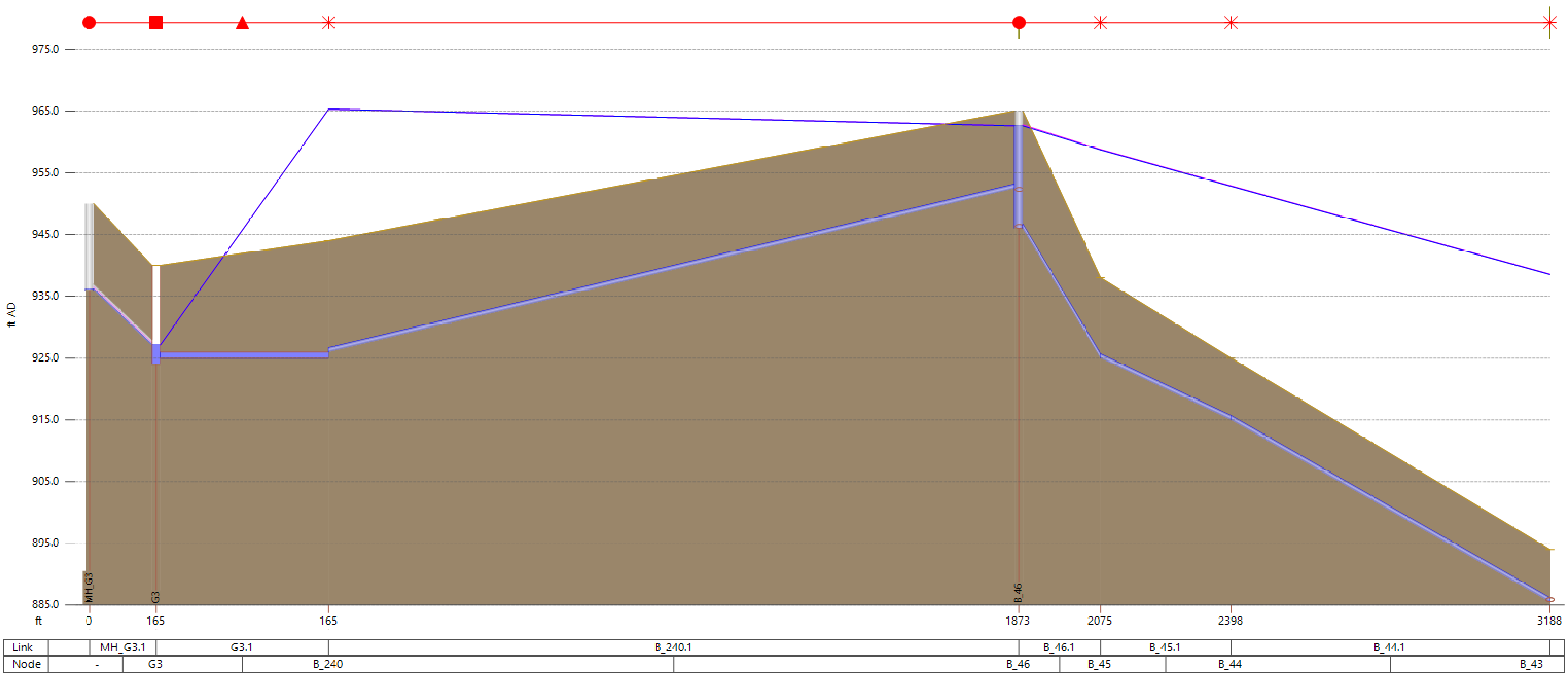
Pump G1X.p Future Phase 1_08262020
Flow (MGD) [flow]
0.30
0.20
0.10
0.00
-0.10
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.05254 US Mgal)
DS Flow (Volume 0.05254 US Mgal)


986.0
976.0
966.0
956.0
946.0
936.0
926.0
916.0
906.0
896.0
886.0
ft AD
ft
0
79
79
1288
2592
3838
B_49
B_46
Link
-
-
B_G1.1
B_50.1
B_49.1
Node
-
B_G1
B_50
B_49
B_46

GREYHAWKE #3

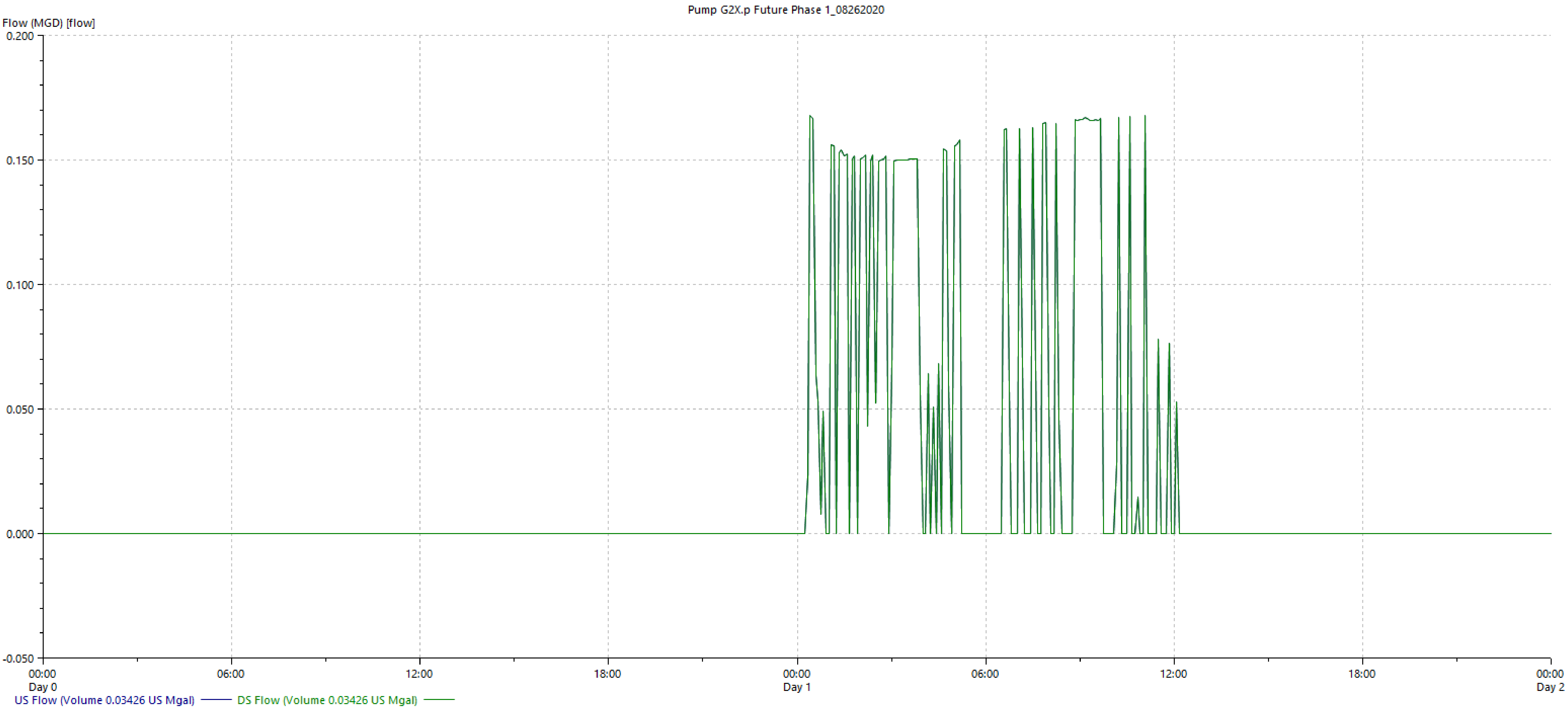


Pump G3.1 Future Phase 1_08272020!!
Flow (MGD) [flow]
0.60
0.40
0.20
0.00
-0.20
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.07544 US Mgal)
DS Flow (Volume 0.07544 US Mgal)

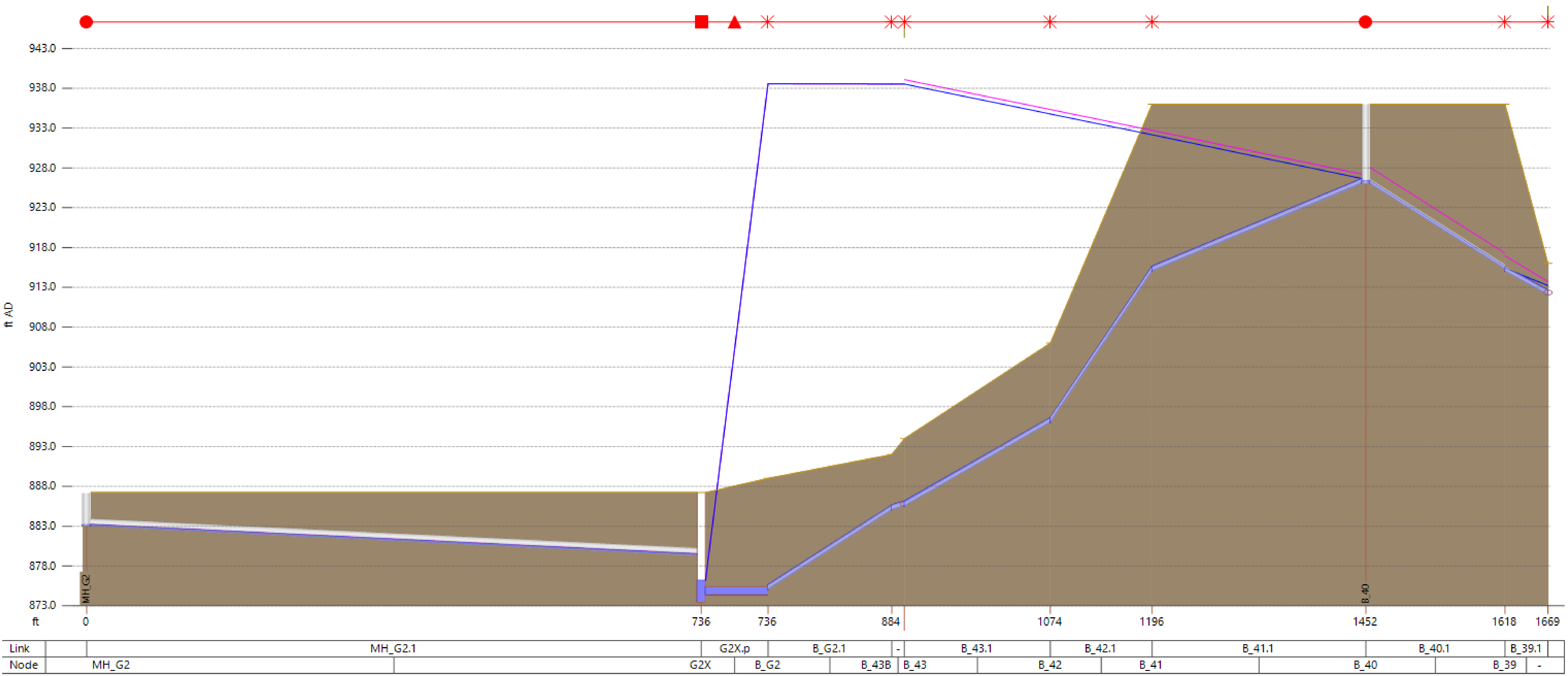


975.0
965.0
955.0
945.0
935.0
925.0
915.0
905.0
895.0
885.0
ft AD
MH_G3
G3
B_46
ft
0
165
165
1873
2075
2398
3188
Link
MH_G3.1
G3.1
B_240.1
B_46.1
B_45.1
B_44.1
Node
-
G3
B_240
B_46
B_45
B_44
B_43

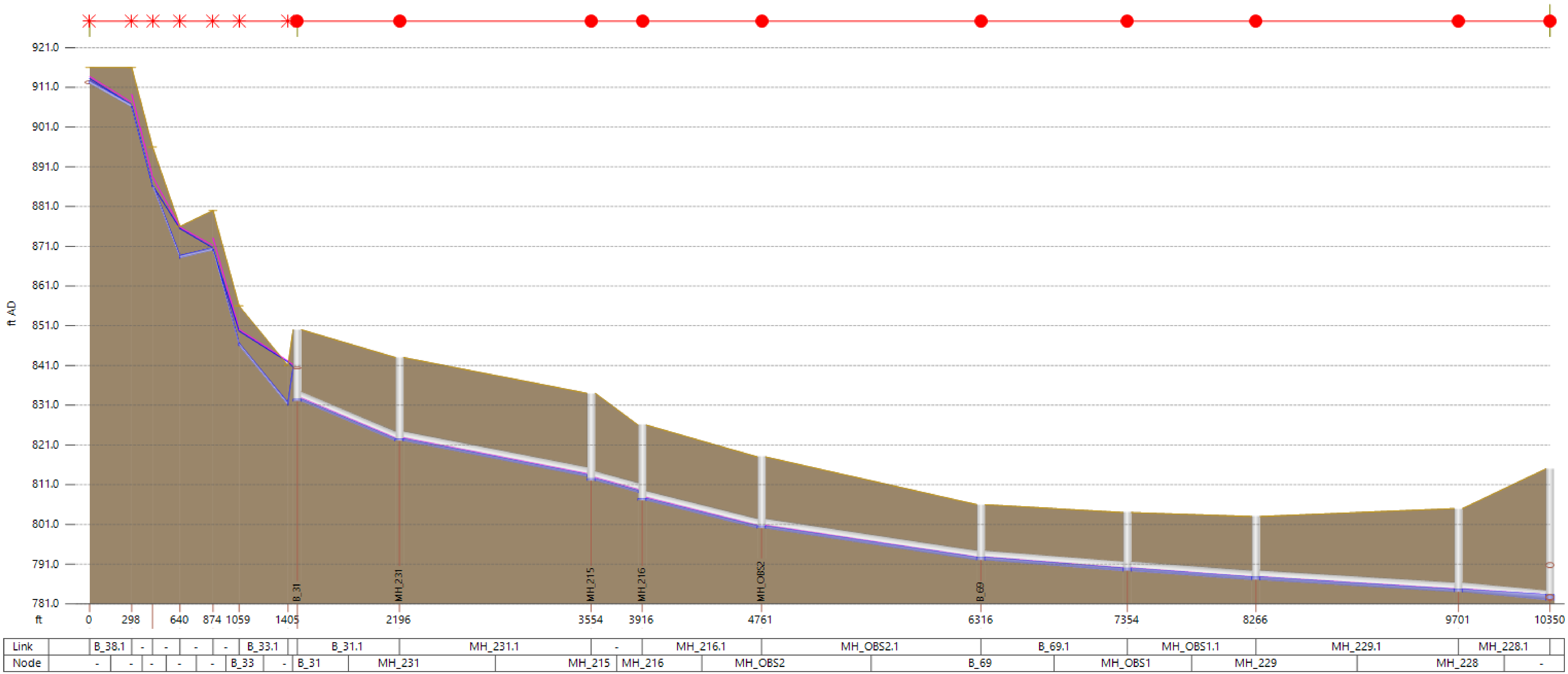
GREYHAWKE #2



Pump G2X.p Future Phase 1_08262020
Flow (MGD) [flow]
0.200
0.150
0.100
0.050
0.000
-0.050
00:00
Day 0
06:00
12:00
18:00
00:00
Day 1
06:00
12:00
18:00
00:00
Day 2
US Flow (Volume 0.03426 US Mgal)
DS Flow (Volume 0.03426 US Mgal)



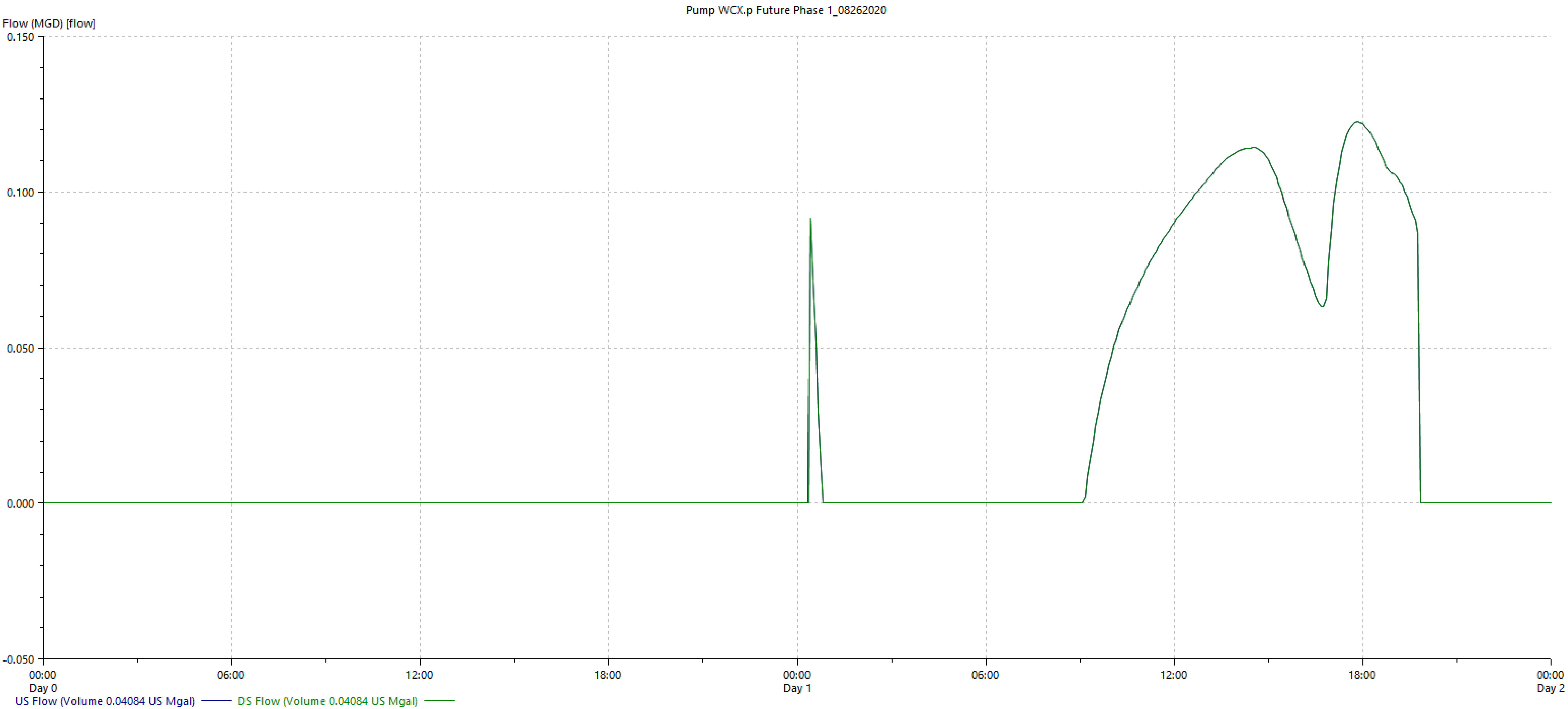
943.0
938.0
933.0
928.0
923.0
918.0
913.0
908.0
903.0
898.0
893.0
888.0
883.0
878.0
873.0
ft AD
ft
0
736
736
884
1074
1196
1452
1618
1669
MH_G2
B_40
Link
MH_G2.1
G2X.p
B_G2.1
-
B_43.1
B_42.1
B_41.1
B_40.1
B_39.1
Node
MH_G2
G2X
B_G2
B_43B
B_43
B_42
B_41
B_40
B_39
-

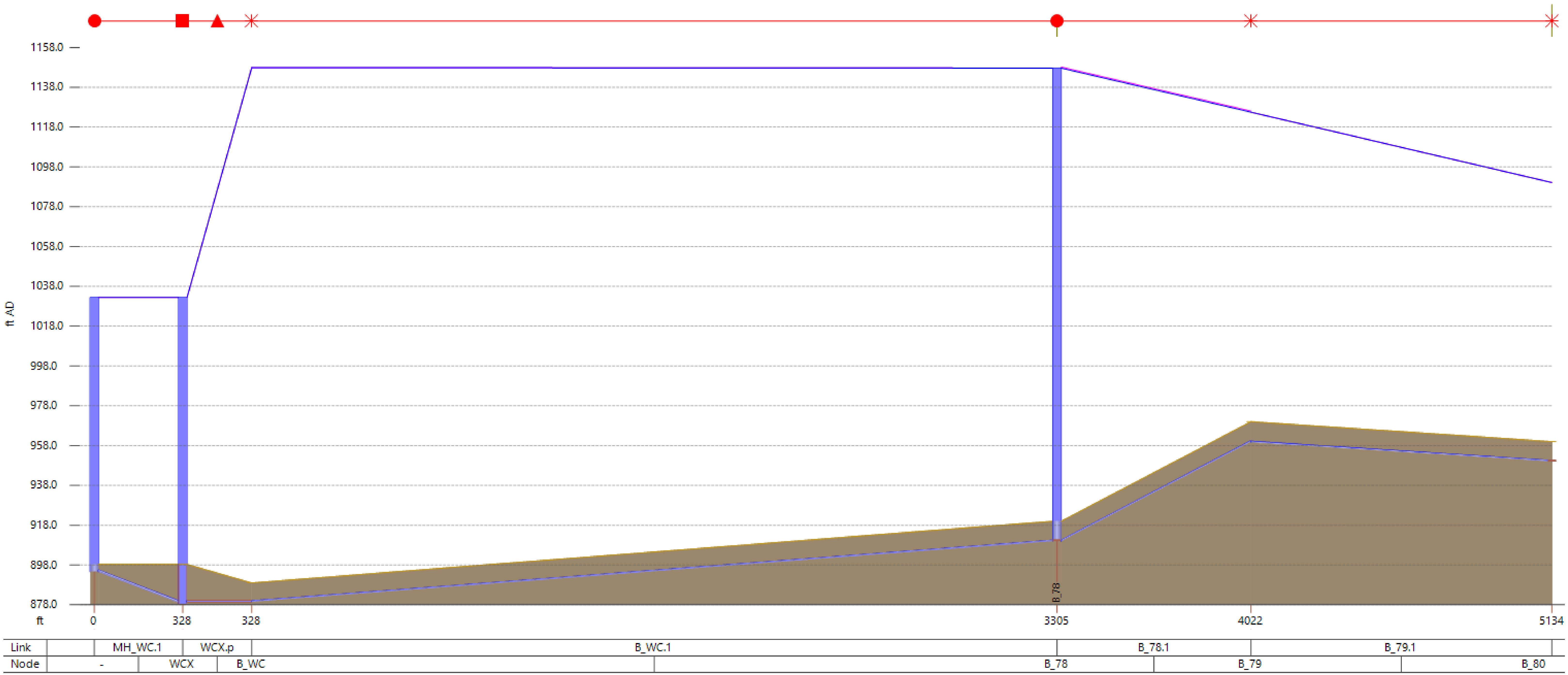

921.0
911.0
901.0
891.0
881.0
871.0
861.0
851.0
841.0
831.0
821.0
811.0
801.0
791.0
781.0
ft AD
B_31
MH_231
MH_215
MH_216
MH_OBS2
B_69
ft
0
298
640
874
1059
1405
2196
3554
3916
4761
6316
7354
8266
9701
10350
Link
B_38.1
-
-
-
-
B_33.1
B_31.1
MH_231.1
-
MH_216.1
MH_OBS2.1
B_69.1
MH_OBS1.1
MH_229.1
MH_228.1
Node
-
-
-
-
-
B_33
-
B_31
MH_231
MH_215
MH_216
MH_OBS2
B_69
MH_OBS1
MH_229
MH_228
-

PROPOSED 10-YEAR SYSTEM MODEL RESULTS

NORTH FORCEMAIN

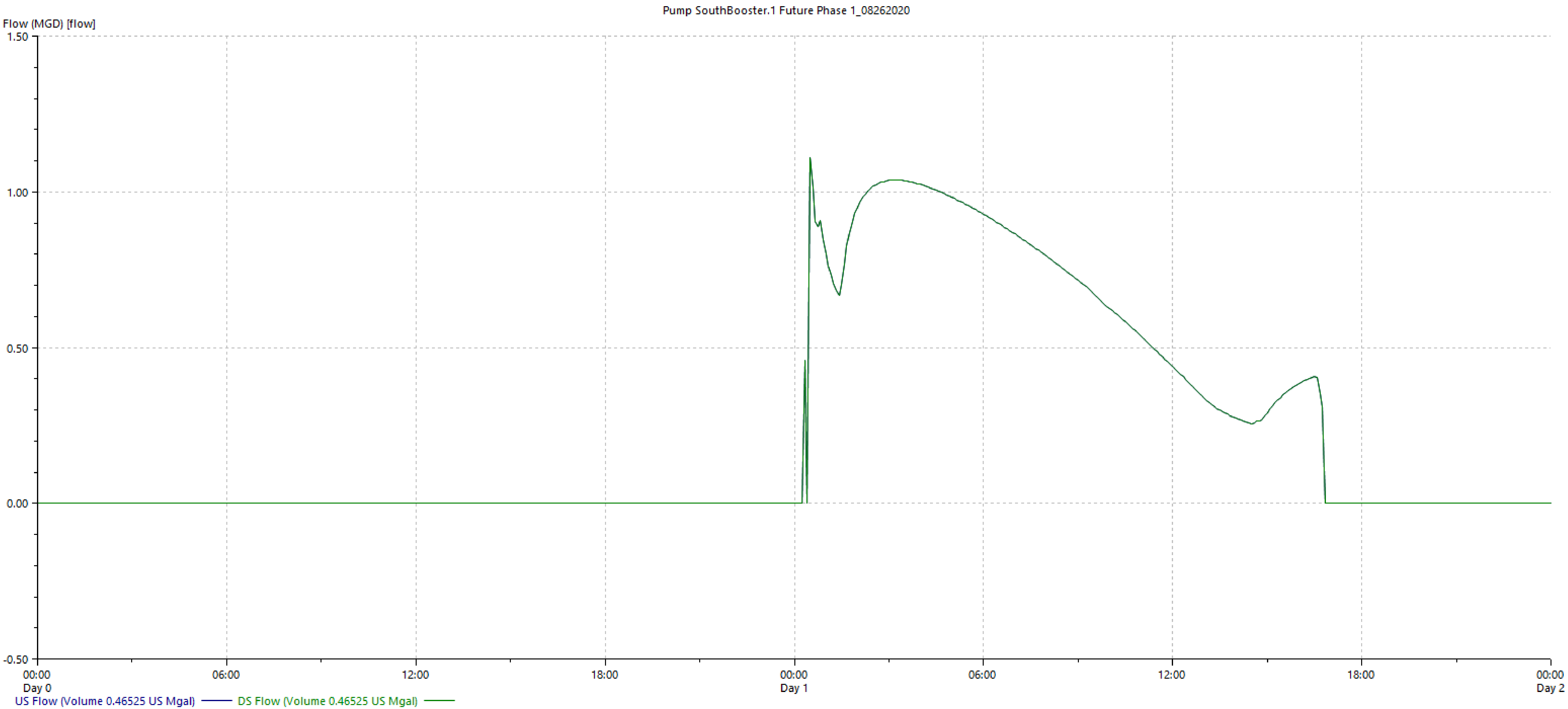
WOODS COURT PS

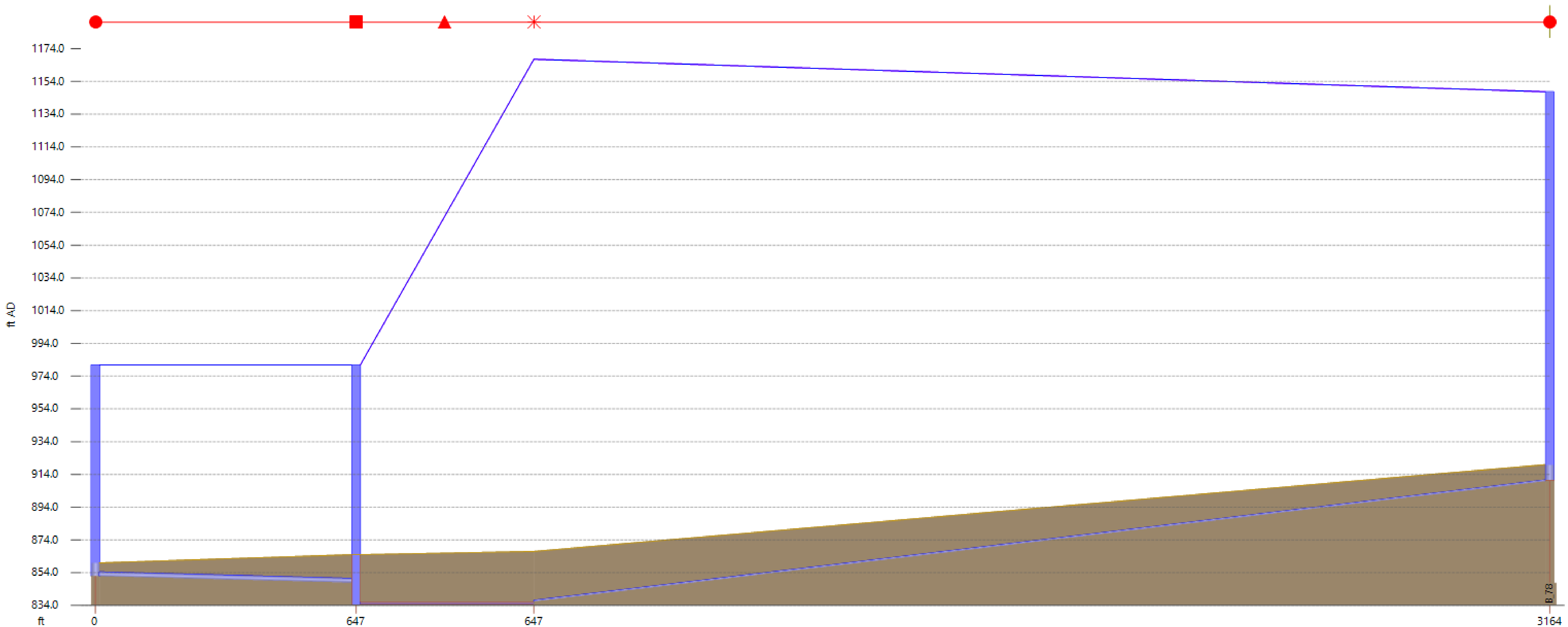




1158.0
1138.0
1118.0
1098.0
1078.0
1058.0
1038.0
1018.0
998.0
978.0
958.0
938.0
918.0
898.0
878.0
ft AD
B_78
ft
0
328
328
3305
4022
5134
Link
MH_WC.1
WCX.p
B_WC.1
B_78.1
B_79.1
Node
-
WCX
B_WC
B_78
B_79
B_80

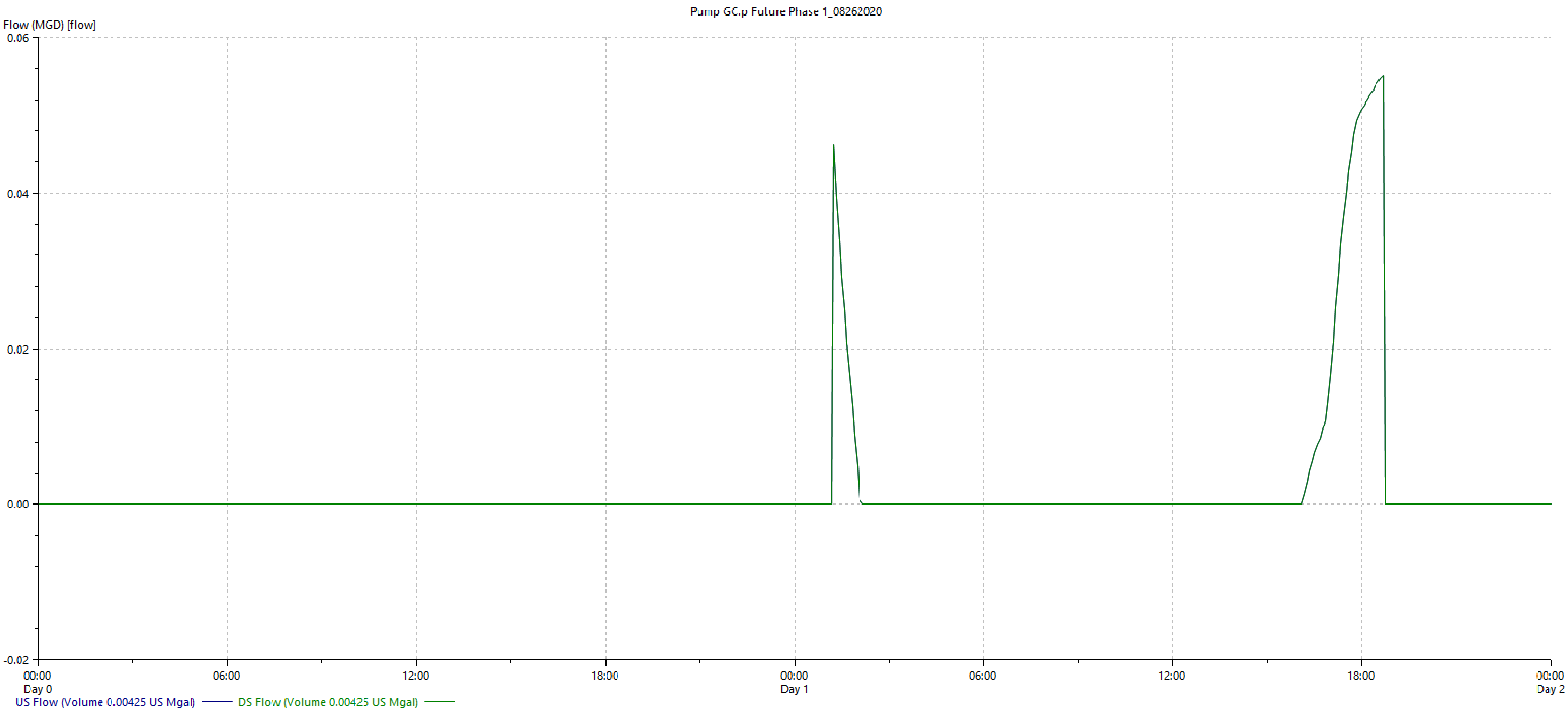
SOUTH BOOSTER PS

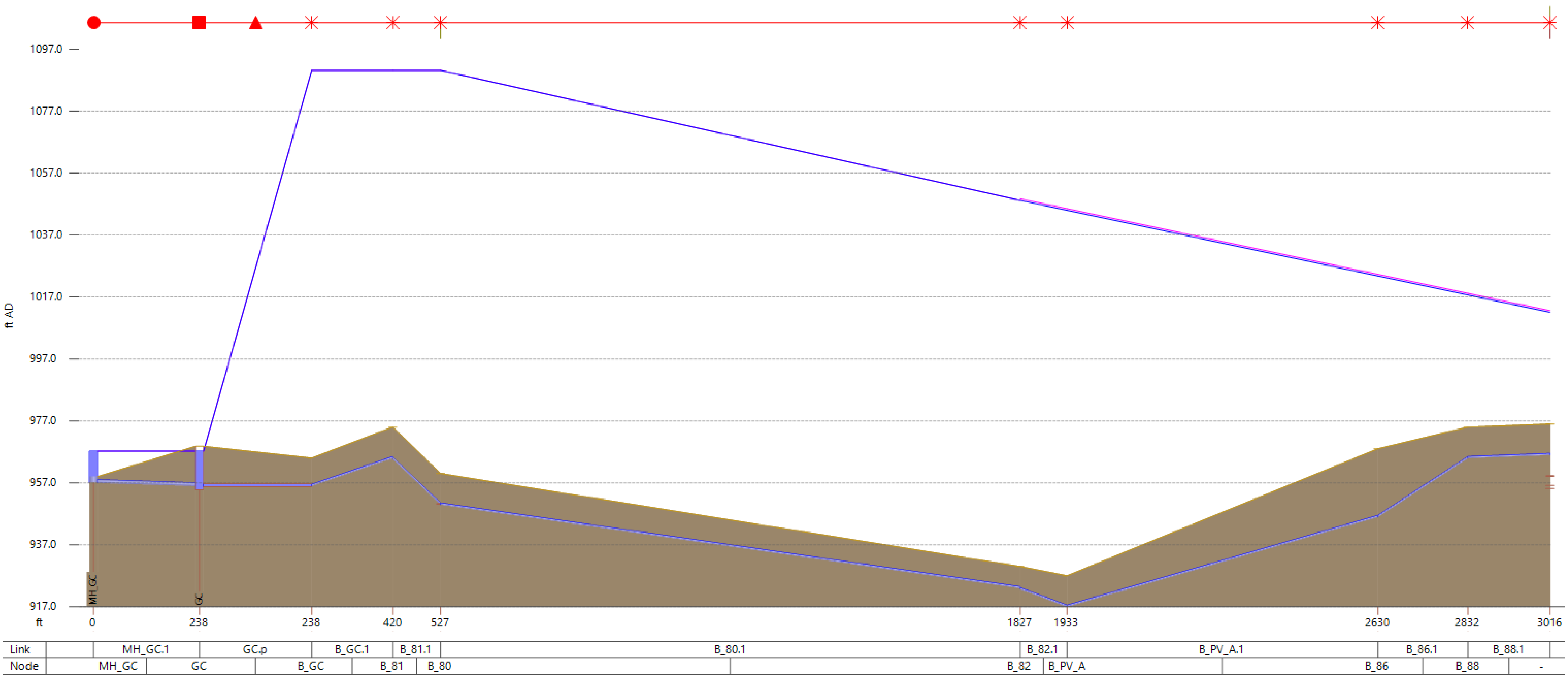




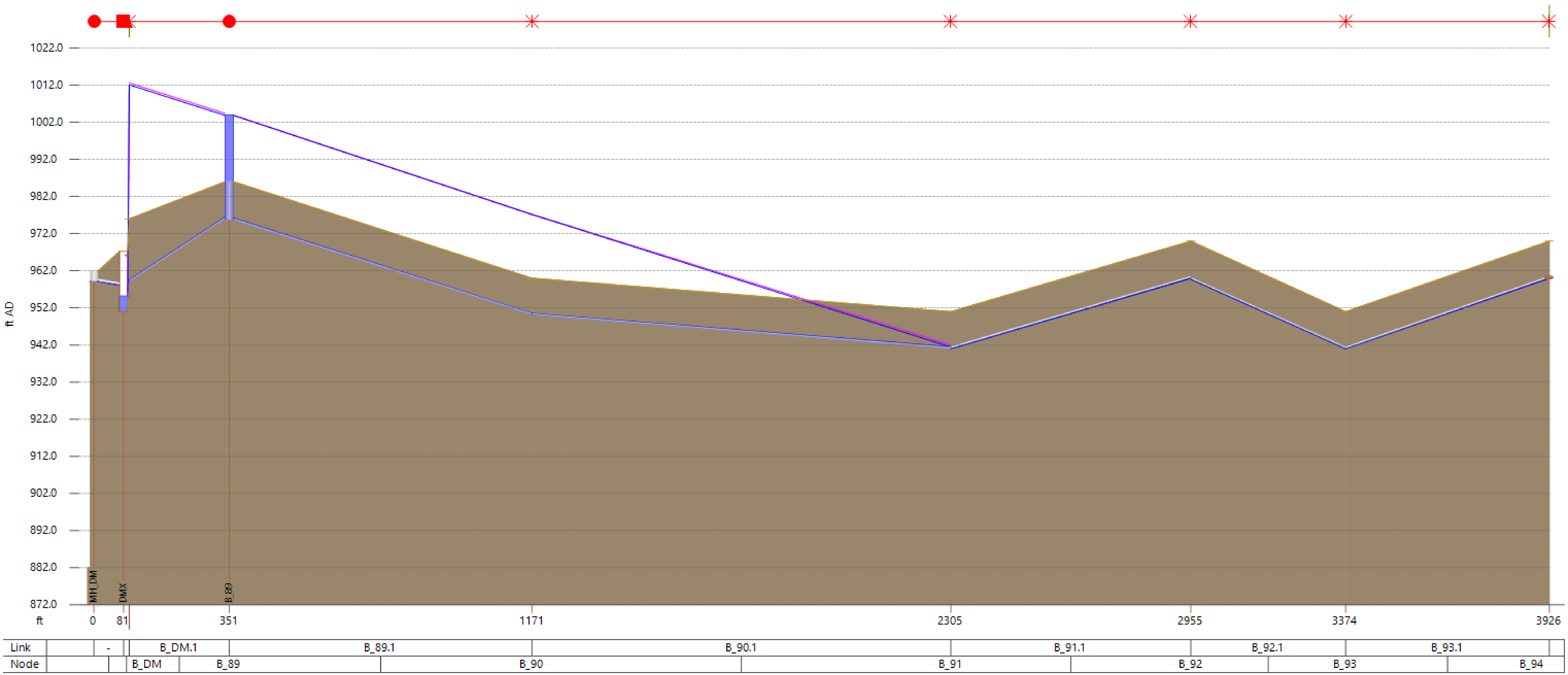
Link	MH_SouthBooster.1	SouthBooster.1	MH_205.1	
Node	MH_SouthBooster	SouthBooster	MH_205	B_78

GERBER COLLISION PS

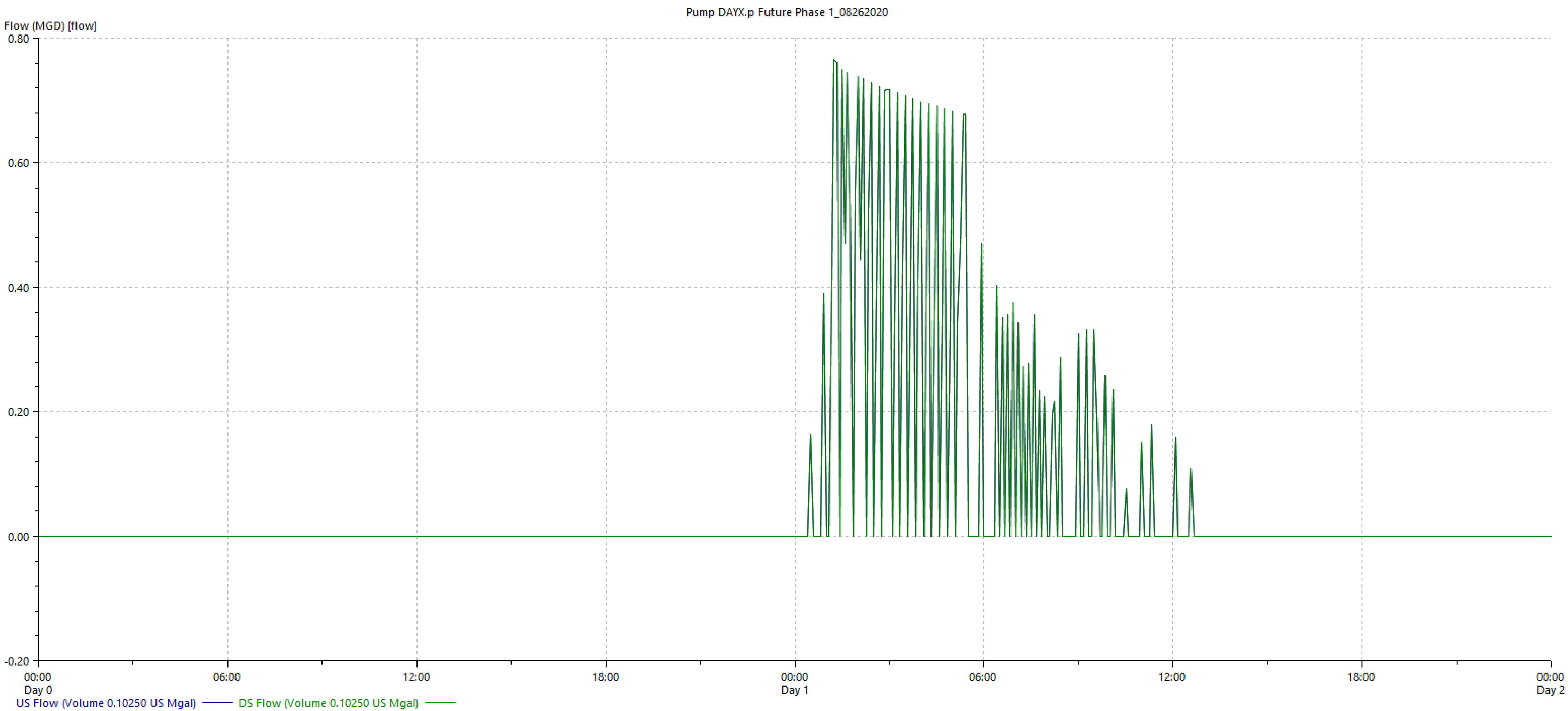




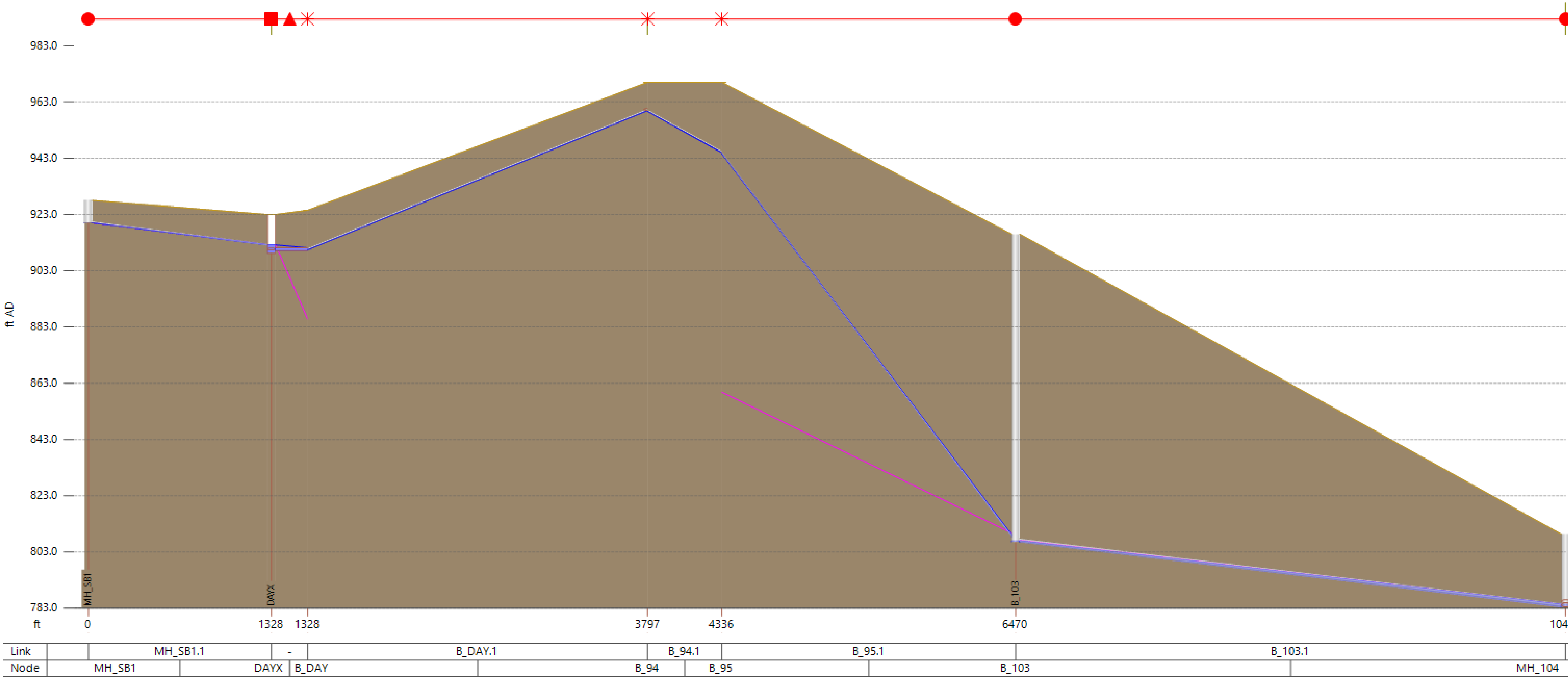
1097.0
1077.0
1057.0
1037.0
1017.0
997.0
977.0
957.0
937.0
917.0
ft AD
MH_GC
GC
ft
0
238
238
420
527
1827
1933
2630
2832
3016
Link
MH_GC.1
GC.p
B_GC.1
B_81.1
B_80.1
B_82.1
B_PV_A.1
B_86.1
B_88.1
Node
MH_GC
GC
B_GC
B_81
B_80
B_82
B_PV_A
B_86
B_88
-


1022.0
1012.0
1002.0
992.0
982.0
972.0
962.0
952.0
942.0
932.0
922.0
912.0
902.0
892.0
882.0
872.0
ft AD
MH_DM
DMX
B_89
ft
0
81
351
1171
2305
2955
3374
3926
Link
-
B_DM.1
B_89.1
B_90.1
B_91.1
B_92.1
B_93.1
Node
B_DM
B_89
B_90
B_91
B_92
B_93
B_94

DAYCARE PS

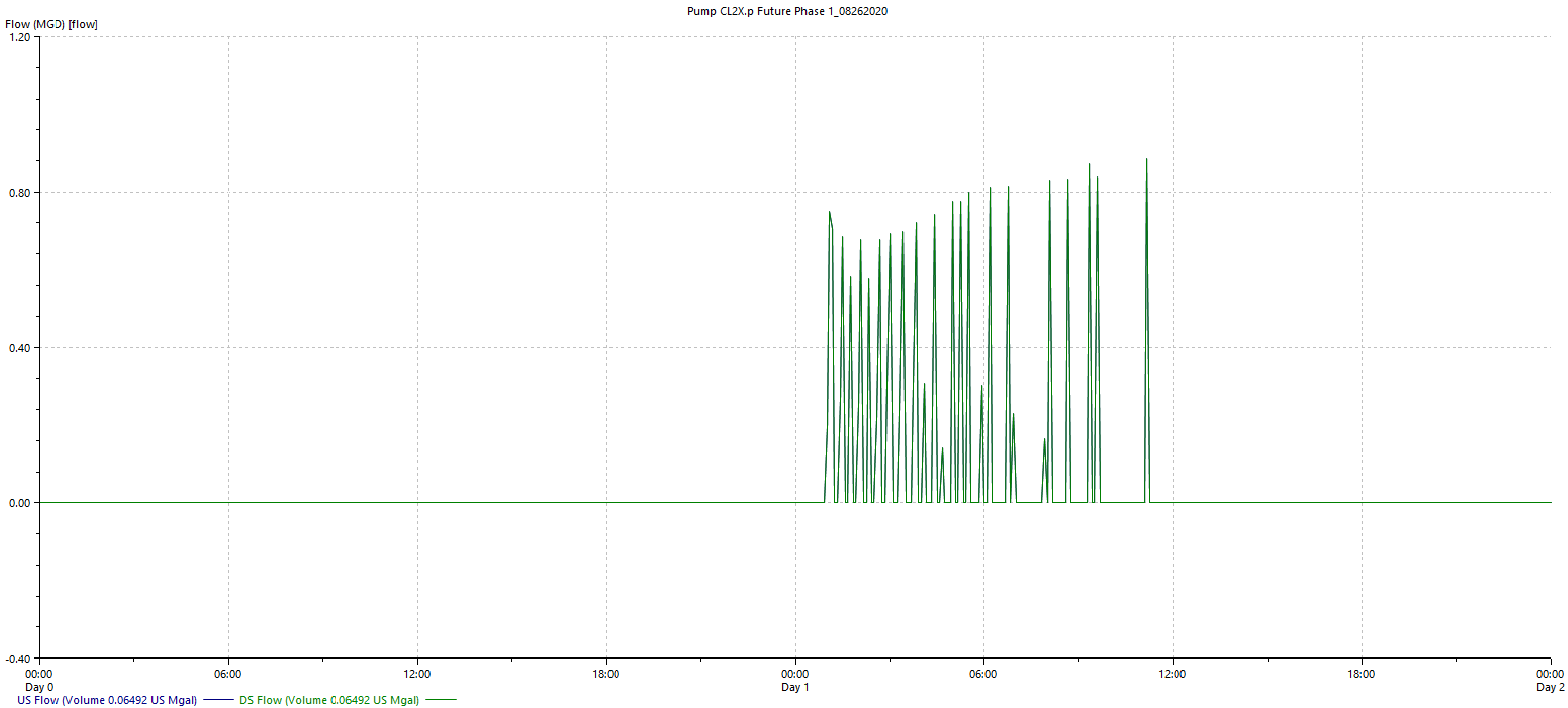


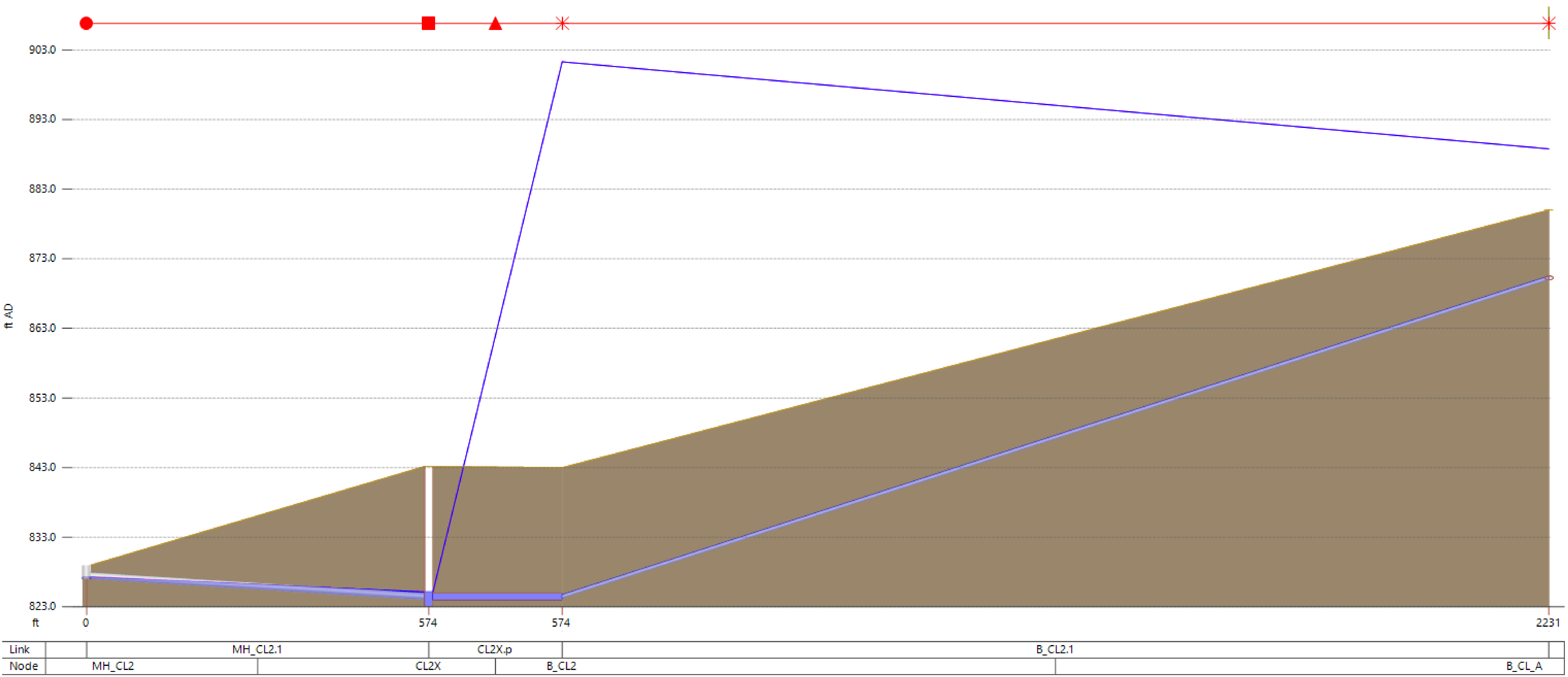
Pump DAYX.p Future Phase 1_08262020
Flow (MGD) [flow]
0.80
0.60
0.40
0.20
0.00
-0.20
00:00 Day 0
06:00
12:00
18:00
00:00 Day 1
06:00
12:00
18:00
00:00 Day 2
US Flow (Volume 0.10250 US Mgal)
DS Flow (Volume 0.10250 US Mgal)



983.0
963.0
943.0
923.0
903.0
883.0
863.0
843.0
823.0
803.0
783.0
ft AD
MH_SB1
DAYX
B_103
ft
0
1328
1328
3797
4336
6470
10462
Link
MH_SB1.1
-
B_DAY.1
B_94.1
B_95.1
B_103.1
Node
MH_SB1
DAYX
B_DAY
B_94
B_95
B_103
MH_104

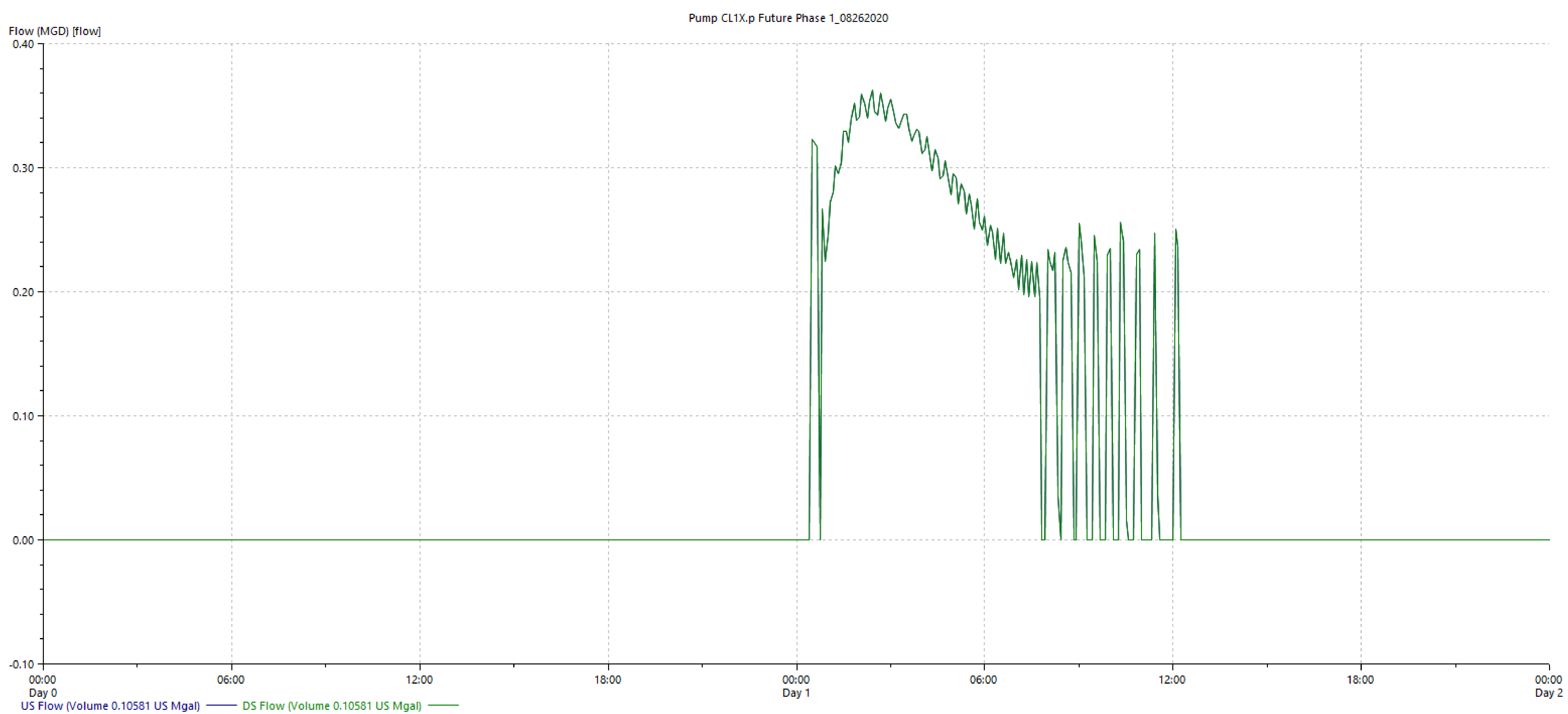
CEDAR LAKES 2 PS

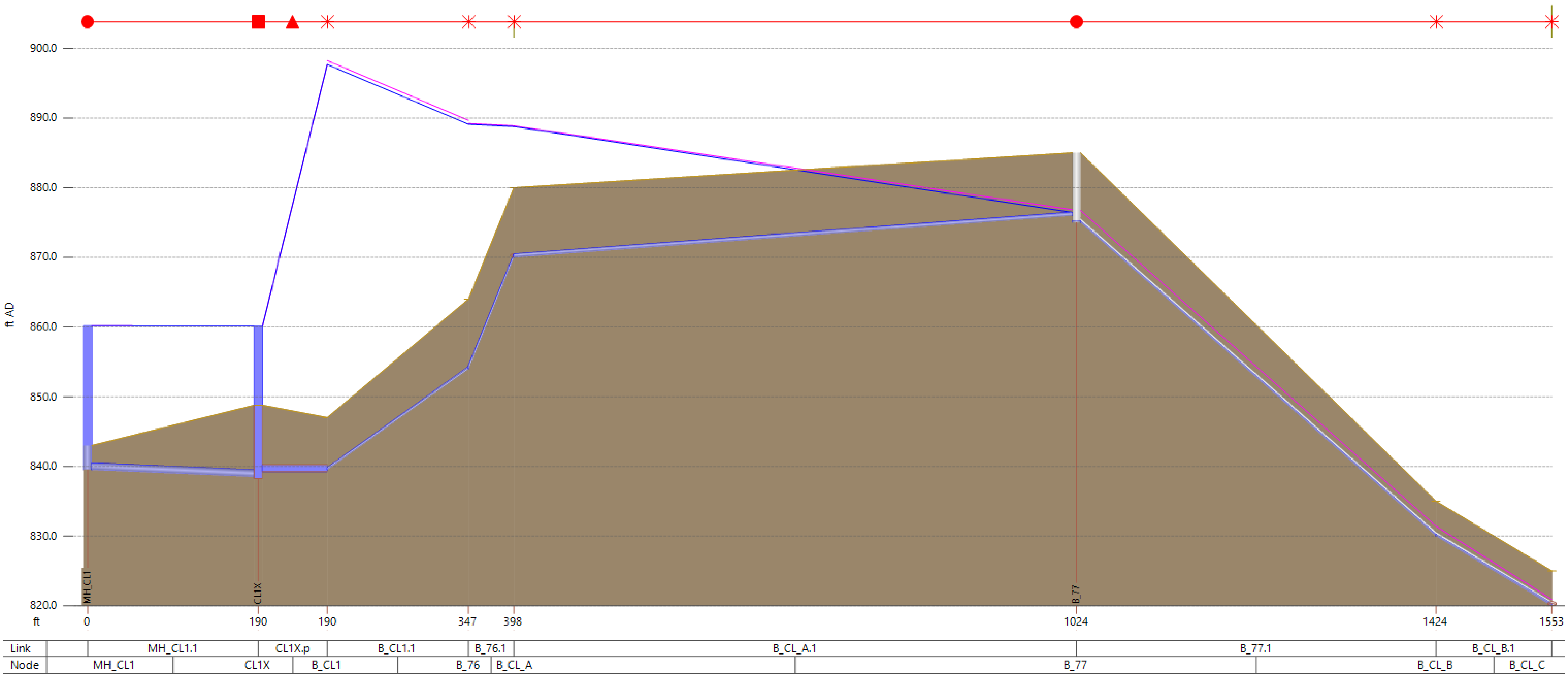




903.0
893.0
883.0
873.0
863.0
853.0
843.0
833.0
823.0
ft AD
ft
0
574
574
2231
Link
MH_CL2.1
CL2X.p
B_CL2.1
Node
MH_CL2
CL2X
B_CL2
B_CL_A

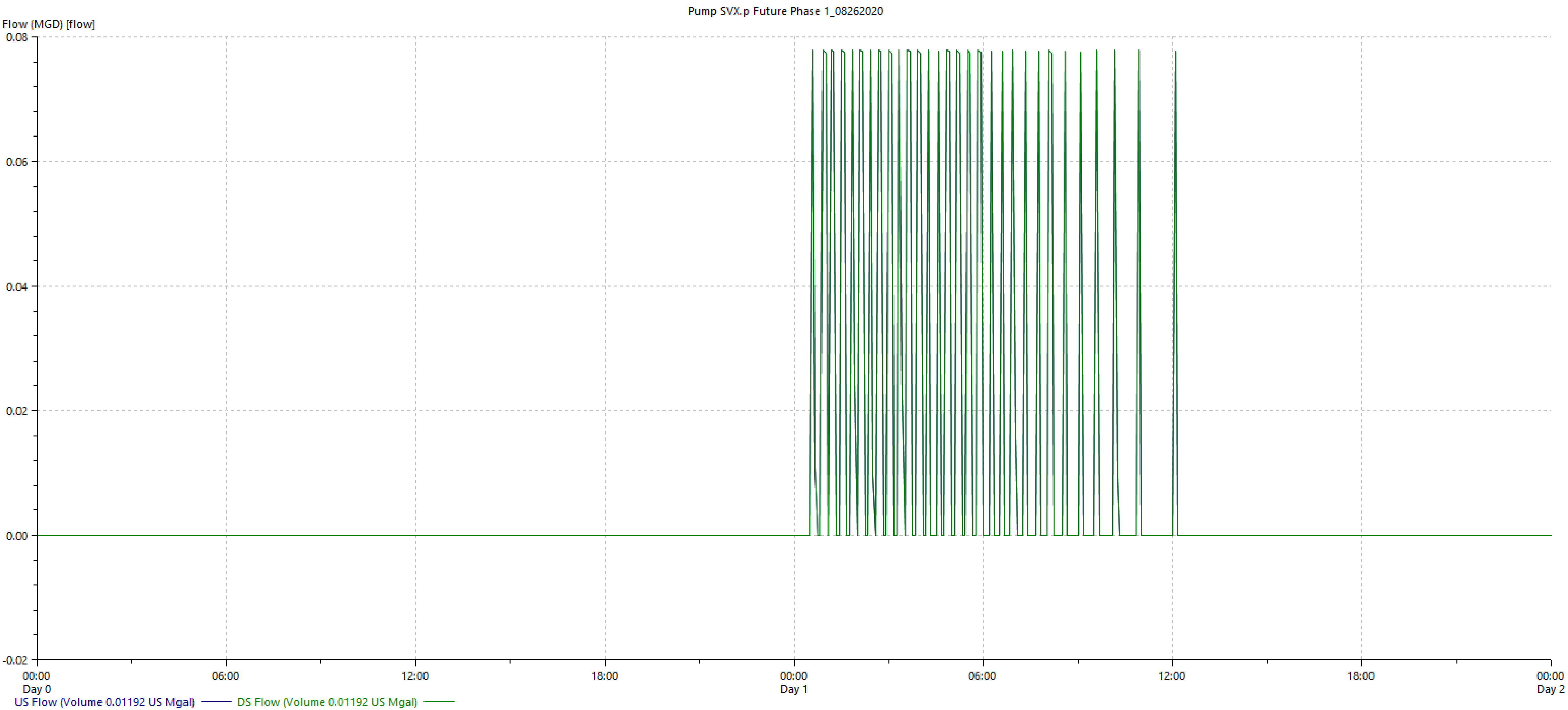
CEDAR LAKES 1 PS

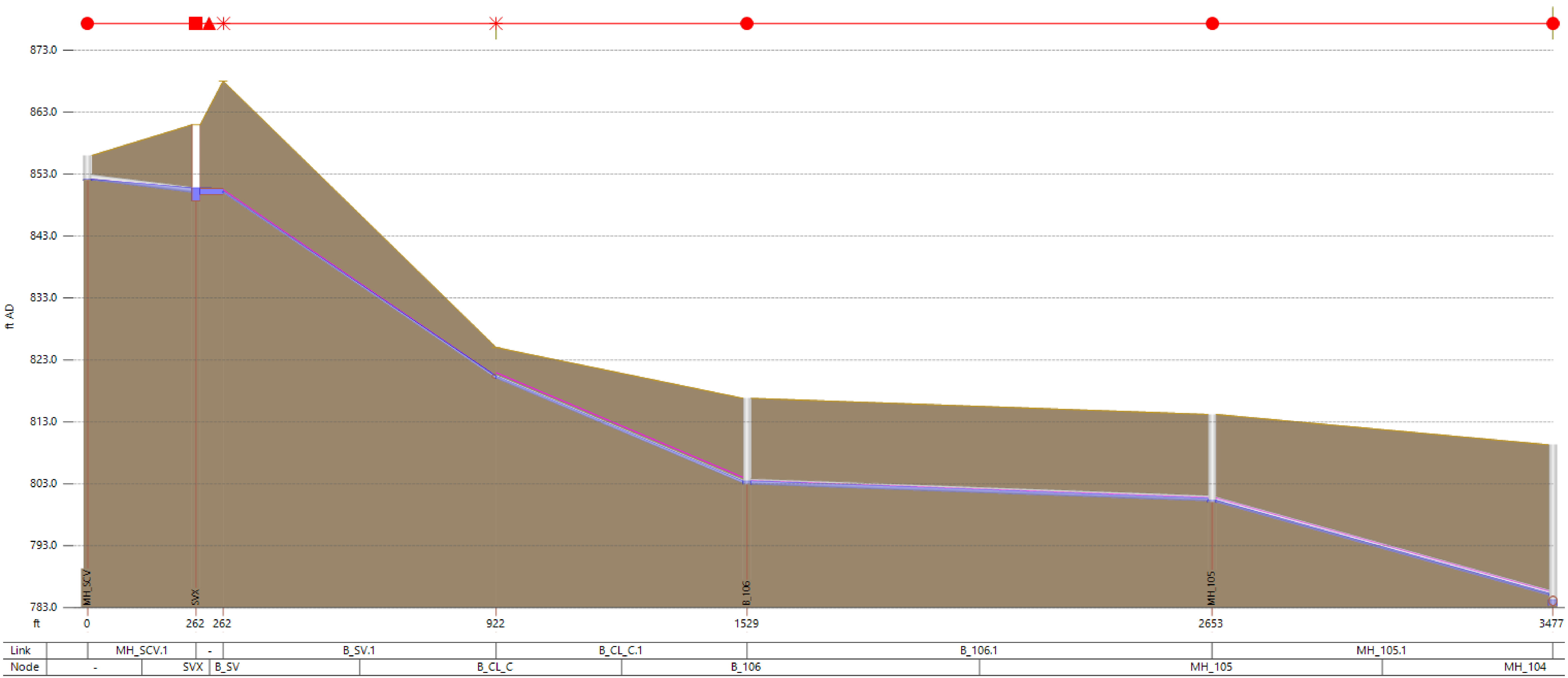




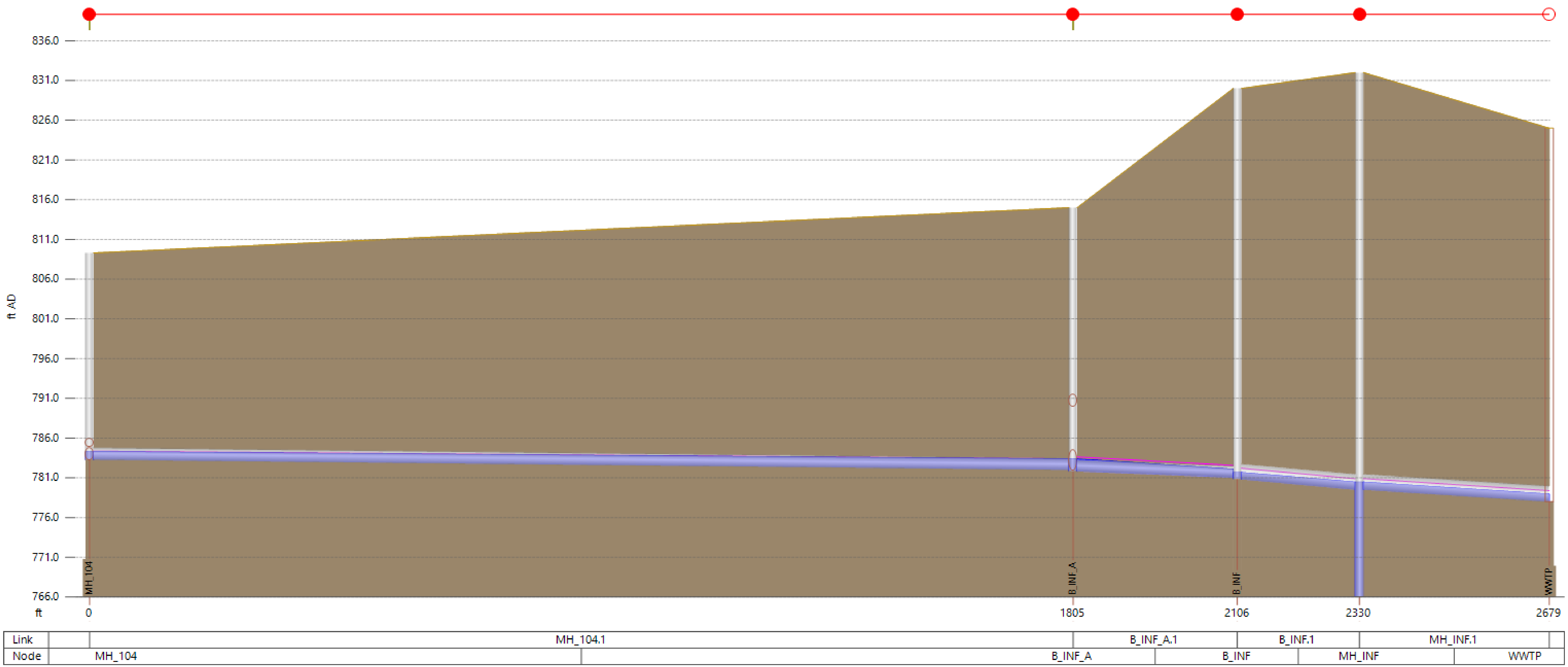
900.0
890.0
880.0
870.0
860.0
850.0
840.0
830.0
820.0
ft AD
MH_CL1
CL1X
B_77
ft
0
190
190
347
398
1024
1424
1553
Link
MH_CL1.1
CL1X.p
B_CL1.1
B_76.1
B_CL_A.1
B_77.1
B_CL_B.1
Node
MH_CL1
CL1X
B_CL1
B_76
B_CL_A
B_77
B_CL_B
B_CL_C

STONECREEK VILLAS PS





873.0
863.0
853.0
843.0
833.0
823.0
813.0
803.0
793.0
783.0
ft AD
MH_SCV
SVX
B_106
MH_105
ft
0
262
262
922
1529
2653
3477
Link
MH_SCV.1
-
B_SV.1
B_CL_C.1
B_106.1
MH_105.1
Node
-
SVX
B_SV
B_CL_C
B_106
MH_105
MH_104



836.0
831.0
826.0
821.0
816.0
811.0
806.0
801.0
796.0
791.0
786.0
781.0
776.0
771.0
766.0
ft AD
MH_104
B_INF_A
B_INF
WWTP
ft
0
1805
2106
2330
2679
Link
MH_104.1
B_INF_A.1
B_INF.1
MH_INF.1
Node
MH_104
B_INF_A
B_INF
MH_INF
WWTP

MODEL RESULTS FOR EXISTING SYSTEM
CITY OF SMITHVILLE, MISSOURI
FIGURE E-1

PATH: G:\CITY OF SMITHVILLE\WW MASTER PLAN\WORKING_BH\SMITHVILLE EXHIBITS - FULL MAP.MXD - USER: BRHESS - DATE: 1/8/2021

0 300 600 1,200 1,800
Feet

FDR SMITHVILLE missouri THRIVING AHEAD

PROPOSED TEN YEAR IMPROVEMENTS WITH PROJECTED TEN YEAR FLOW RATES
CITY OF SMITHVILLE, MISSOURI
FIGURE E-2

FDR | SMITHVILLE missouri THRIVING AHEAD

0 300 600 1,200 1,800
Feet

PROPOSED ULTIMATE IMPROVEMENTS WITH PROJECTED ULTIMATE BUILD OUT
CITY OF SMITHVILLE, MISSOURI
FIGURE E-3

Appendix F. Pump Station Evaluation

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PUMP STATION INSPECTION FORM

City: Smithville	Date: 06/26/20
Project Name: WW Master Plan	Inspector: Brent Hess
Project Number: 10198427	Location: Campground Pump Station

Well Type (circle one)

Above ground Below ground

Pump Type (circle one)

Self-priming Submersible

Information/Nameplate Data:			
Pump Manufacturer	Hydromatic	Number of pumps	2
Model	HPGH500M3-2	VFDs?	No
Motor HP	5	Emergency Overflow?	
Motor Voltage	230		

Observations

	Severe	Moderate	Minor	None	Comments
Wet Well Grease Accumulation					
Wet Well Grit Accumulation					
Corrosion					

	Yes	No	Connection Diameter (IN)	Comments
Portable Pump Connection				

	Type	Comments
Level Control System		

Condition Assessment

Asset	CR	Installation Year	Comments
Pump No. 1		2019	Cutter pumps. Discharge pipe is 1.25 IN. 6.75 IN impeller.
Pump No. 2		2020	Cutter pumps. Discharge pipe is 1.25 IN. 6.75 IN impeller.
			Fenced in. Sufficient Access.

Condition Rating: *1 – New or Excellent* *2 – Minor Defect Only* *3 – Moderate Deterioration* *4 – Significant Deterioration* *5 – Virtually Unserviceable* *U – Unknown*

Drawdown Test

Pump Time[1]	7:06	Distance to "Pump On" position[3]	11 FT 3 IN
Refill Time[2]	4:00	Distance to "Pump Off" position[4]	12 FT 7 IN

Pumps Alternate? Yes_X__ No____

1. Record the time difference between the pump turning on and the pump turning off again
2. Record the time difference between the pump turning off and the pump turning on again
3. Record the distance from the top of the wetwell to the float position that turns the pump on
4. Record the distance from the top of the wetwell to the float position that turns the pump on

PUMP STATION INSPECTION FORM

City: Smithville	Date: 06/26/20
Project Name: WW Master Plan	Inspector: Brent Hess
Project Number: 10198427	Location: Bridge Street Pump Station

Well Type (circle one)

Above ground   Below ground

Pump Type (circle one)

Self-priming   Submersible

Information/Nameplate Data:			
Pump Manufacturer	Pentair	Number of pumps	2
Model	54LXP750EB	VFDs?	No
Motor HP	7.5	Emergency Overflow?	
Motor Voltage	230		

Observations

	Severe	Moderate	Minor	None	Comments
Wet Well Grease Accumulation					
Wet Well Grit Accumulation					
Corrosion					

	Yes	No	Connection Diameter (IN)	Comments
Portable Pump Connection				

	Type	Comments
Level Control System		

Condition Assessment

Asset	CR	Installation Year	Comments
			60 Hz, 3 phase, 1150 rpm. Full load 25A. 10.38 IN impeller
			Off main street. Fenced in. Light. No access issues. Large pumps

Condition Rating: *1 – New or Excellent* *2 – Minor Defect Only* *3 – Moderate Deterioration*
4 – Significant Deterioration *5 – Virtually Unserviceable* *U – Unknown*

Drawdown Test

Pump Time[1]	0:45	Distance to "Pump On" position[3]	14 FT 5 IN
Refill Time[2]	5:00	Distance to "Pump Off" position[4]	16 FT 10 IN

Pumps Alternate?   Yes_X__ No____

1. Record the time difference between the pump turning on and the pump turning off again
2. Record the time difference between the pump turning off and the pump turning on again
3. Record the distance from the top of the wetwell to the float position that turns the pump on
4. Record the distance from the top of the wetwell to the float position that turns the pump on

PUMP STATION INSPECTION FORM

City: Smithville	Date: 06/26/20
Project Name: WW Master Plan	Inspector: Brent Hess
Project Number: 10198427	Location: McDonalds Pump Station

Well Type (circle one)
Above ground   Below ground

Pump Type (circle one)
Self-priming   Submersible

Information/Nameplate Data:			
Pump Manufacturer	Hydromatic	Number of pumps	2
Model	HPGF500M3-4	VFDs?	No
Motor HP	5	Emergency Overflow?	
Motor Voltage	230		

Observations

	Severe	Moderate	Minor	None	Comments
Wet Well Grease Accumulation					
Wet Well Grit Accumulation					
Corrosion					

	Yes	No	Connection Diameter (IN)	Comments
Portable Pump Connection				

	Type	Comments
Level Control System		

Condition Assessment

Asset	CR	Installation Year	Comments
Pumps			60 Hz, 3 phase, 1750 rpm. Full load 15.3A. 10.13 IN impeller. Grinder pumps
			No enclosure/fence. Very slow refill – only serves McDonalds. Greasy.

Condition Rating: *1 – New or Excellent* *2 – Minor Defect Only* *3 – Moderate Deterioration*
4 – Significant Deterioration *5 – Virtually Unserviceable* *U – Unknown*

Drawdown Test

Pump Time[1]		Distance to "Pump On" position[3]	9 FT 8 IN
Refill Time[2]	>10:00	Distance to "Pump Off" position[4]	12 FT 10 IN

Pumps Alternate? Yes_X__ No____

1. Record the time difference between the pump turning on and the pump turning off again
2. Record the time difference between the pump turning off and the pump turning on again
3. Record the distance from the top of the wetwell to the float position that turns the pump on
4. Record the distance from the top of the wetwell to the float position that turns the pump on

PUMP STATION INSPECTION FORM

City: Smithville	Date: 06/26/20
Project Name: WW Master Plan	Inspector: Brent Hess
Project Number: 10198427	Location: Wildflower Pump Station

Well Type (circle one)

Above ground   Below ground

Pump Type (circle one)

Self-priming   Submersible

Information/Nameplate Data:			
Pump Manufacturer	Gorman Rupp	Number of pumps	2
Model		VFDs?	No.
Motor HP		Emergency Overflow?	
Motor Voltage			

Observations

	Severe	Moderate	Minor	None	Comments
Wet Well Grease Accumulation					
Wet Well Grit Accumulation					
Corrosion					

	Yes	No	Connection Diameter (IN)	Comments
Portable Pump Connection				

	Type	Comments
Level Control System		

Condition Assessment

Asset	CR	Installation Year	Comments
			Model: HK5215SR233R. 10 HP, 25.6A Full, 12.8A normal, 1760rpm, 3 phase
			No fence. Easy to walk to (no access road up to it). Above ground. Square concrete, large wetwell (wide)
			Doesn't have much retention. Only one large diameter pipe extending horizontal.

Condition Rating: *1 – New or Excellent* *2 – Minor Defect Only* *3 – Moderate Deterioration* *4 – Significant Deterioration* *5 – Virtually Unserviceable* *U – Unknown*

Drawdown Test

Pump Time[1]	1:29	Distance to "Pump On" position[3]	7 FT 5 IN
Refill Time[2]		Distance to "Pump Off" position[4]	10 FT 11 IN

Pumps Alternate? Yes_X__ No____

1. Record the time difference between the pump turning on and the pump turning off again
2. Record the time difference between the pump turning off and the pump turning on again
3. Record the distance from the top of the wetwell to the float position that turns the pump on
4. Record the distance from the top of the wetwell to the float position that turns the pump on

PUMP STATION INSPECTION FORM

City: Smithville	Date: 06/26/20
Project Name: WW Master Plan	Inspector: Brent Hess
Project Number: 10198427	Location: Harbor Lakes Pump Station

Well Type (circle one)

Above ground   Below ground

Pump Type (circle one)

Self-priming   Submersible

Information/Nameplate Data:

Pump Manufacturer		Number of pumps	2
Model		VFDs?	No. Has soft starts
Motor HP		Emergency Overflow?	
Motor Voltage			

Observations

	Severe	Moderate	Minor	None	Comments
Wet Well Grease Accumulation					
Wet Well Grit Accumulation					
Corrosion					

	Yes	No	Connection Diameter (IN)	Comments
Portable Pump Connection				

	Type	Comments
Level Control System		

Condition Assessment

Asset	CR	Installation Year	Comments
			Fenced in. Paved walking trail to access it. Large wetwell (wide). Few visits per year. Coagulated grease.

Condition Rating: *1 – New or Excellent* *2 – Minor Defect Only* *3 – Moderate Deterioration* *4 – Significant Deterioration* *5 – Virtually Unserviceable* *U – Unknown*

Drawdown Test

Pump Time[1]	6:25	Distance to "Pump On" position[3]	11 FT 10 IN
Refill Time[2]	>10:00	Distance to "Pump Off" position[4]	14 FT 7 IN

Pumps Alternate? Yes_X__ No____

1. Record the time difference between the pump turning on and the pump turning off again
2. Record the time difference between the pump turning off and the pump turning on again
3. Record the distance from the top of the wetwell to the float position that turns the pump on
4. Record the distance from the top of the wetwell to the float position that turns the pump on

Appendix G. MDNR Operating Permit

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Missouri Department of NATURAL RESOURCES dnr.mo.gov
Michael L. Parson, Governor Carol S. Comer, Director

DEC 3 2020

City of Smithville
107 West Main Street
Smithville, MO 64089

Dear Permittee:

Pursuant to the Federal Water Pollution Control Act, under the authority granted to the State of Missouri and in compliance with the Missouri Clean Water Law, we have issued and are enclosing your State Operating Permit to discharge from Smithville Wastewater Treatment Facility.

Please read your permit and attached Standard Conditions. They contain important information on monitoring requirements, effluent limitations, sampling frequencies and reporting requirements.

Monitoring reports required by the special conditions must be submitted on a periodic basis via the Department's electronic Discharge Monitoring Report (eDMR) system unless waived, or can be submitted on the enclosed forms if you are subject to an eDMR registration schedule as established in the permit. Upon registration, please access the eDMR system via the following link: https://edmr.dnr.mo.gov/edmr/E2/Shared/Pages/Main/Login.aspx. If you experience difficulties with using the eDMR system, you may contact edmr@dnr.mo.gov or call 855-789-3889 or 573-526-2082 for assistance.

This permit may include requirements with which you may not be familiar. If you would like the Missouri Department of Natural Resources to meet with you to discuss how to satisfy the permit requirements, an appointment can be set up by contacting the Kansas City Regional Office by phone at 816-251-0700, by email at KCRO@dnr.mo.gov, or by mail at 500 NE Colburn Road, Lee's Summit, MO 64086-4710. These visits are called Compliance Assistance Visits and focus on explaining the requirements to the permit holder.

This permit is both your Federal National Pollutant Discharge Elimination System Permit and your new Missouri State Operating Permit and replaces all previous State Operating Permits issued for this facility under this permit number. In all future correspondence regarding this facility, please refer to your State Operating Permit number and facility name as shown on page one of the permit.

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to Section 621.250, RSMo. To appeal, you must file a petition with the AHC within 30 days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Contact information for the AHC is: Administrative Hearing Commission, United States Post Office Building, Third Floor, 131 West High Street, P.O. Box 1557, Jefferson City, MO 65102, phone: 573-751-2422, fax: 573-751-5018, and website: www.oa.mo.gov/ahc.

Please be aware that this facility may also be subject to any applicable county or other local ordinances or restrictions.

If you have any questions concerning this permit, please do not hesitate to contact the Department's Water Protection Program at P.O. Box 176, Jefferson City, MO 65102, or by phone at 573-751-1300. Thank you.

Sincerely,

WATER PROTECTION PROGRAM

Chris Wieberg

Chris Wieberg
Director

CW/vs

Enclosure

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law (Chapter 644 RSMo, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No.:	MO-0055204
Owner:	City of Smithville
Address:	107 West Main Street, Smithville, MO 64089
Continuing Authority:	Same as above
Address:	Same as above
Facility Name:	Smithville Wastewater Treatment Facility
Facility Address:	0.4 miles NE of 2nd Creek Rd and Lowman Rd intersection, Smithville, MO 64089
Legal Description:	Sec. 22, T53N, R33W, Clay County
UTM Coordinates:	X = 363014, Y = 4361686
Receiving Stream:	Little Platte River (P)
First Classified Stream and ID:	Little Platte River (P) (315)
USGS Basin & Sub-watershed No.:	(10240012-0711)

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

Outfall #001 – POTW
The use or operation of this facility shall be by or under the supervision of a Certified B Operator.
Influent lift station / bar screen / Sequencing Batch Reactors (3 basins) / aerobic sludge digesters (2) / UV disinfection / biosolids are land applied
Design population equivalent is 7,500.
Design flow is 1.125 MGD. Actual flow is 999,000 gallons per day.
Design sludge production is 350 dry tons/year.

Permitted Feature INF – Influent Monitoring Location

This permit authorizes only wastewater and stormwater discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas.

December 1, 2020
Effective Date

Edward B. Galbraith, Director, Division of Environmental Quality

June 30, 2025
Expiration Date

Chris Wieberg, Director, Water Protection Program

OUTFALL <u>#001</u>	TABLE A-1. FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall number(s) as specified in the application for this permit. The final effluent limitations in **Table A-1** shall become effective on **<u>December 1, 2020</u>** and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

Limit Set: M

EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow	MGD	*		*	once/weekday***	24 hr. total
Biochemical Oxygen Demand$_5$	mg/L		45	30	once/month	composite**
Total Suspended Solids	mg/L		45	30	once/month	composite**
E. coli (**Note 1, Page 3**)	#/100mL		1,030	206	once/week	grab
Ammonia as N						
January – May	mg/L	*		*	once/month	composite**
June	mg/L	33.7		4.2	once/month	composite**
July	mg/L	33.7		3.5	once/month	composite**
August	mg/L	33.7		3.7	once/month	composite**
September	mg/L	40.1		5.5	once/month	composite**
October – December	mg/L	*		*	once/month	composite**
Total Phosphorus	mg/L	*		*	once/month	composite**
Total Kjeldahl Nitrogen	mg/L	*		*	once/month	composite**
Nitrite + Nitrate	mg/L	*		*	once/month	composite**

EFFLUENT PARAMETER(S)	UNITS	MINIMUM		MAXIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
pH – Units †	SU	6.0		9.0	once/month	grab

EFFLUENT PARAMETER(S)	UNITS	MONTHLY AVERAGE MINIMUM	MEASUREMENT FREQUENCY	SAMPLE TYPE
Biochemical Oxygen Demand$_5$ – Percent Removal (**Note 2, Page 2**)	%	85	once/month	calculated
Total Suspended Solids – Percent Removal (**Note 2, Page 2**)	%	85	once/month	calculated

MONITORING REPORTS SHALL BE SUBMITTED **<u>MONTHLY</u>**; THE FIRST REPORT IS DUE <u>JANUARY 28, 2021</u>. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

Limit Set: Q

EFFLUENT PARAMETER(S)	UNITS	DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Oil & Grease	mg/L	*		*	once/quarter ‡	grab

MONITORING REPORTS SHALL BE SUBMITTED **<u>QUARTERLY</u>**; THE FIRST REPORT IS DUE <u>APRIL 28, 2021</u>. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

* Monitoring requirement only.

** A composite sample is to be made up from at least three samples collected during each decant event during a 24 hour period. One sample shall be conducted near the beginning of the decant event, the next sample shall be collected when the decant event is near 50% complete, and the third sample collected near the end of the decant event. Samples can be collected by an automatic sampler or as a grab sample and then composited.

*** Once each weekday means: Monday, Tuesday, Wednesday, Thursday, and Friday except nine Federal legal holidays (New Years, Martin Luther King Day, Presidents Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving, and Christmas).

† pH is measured in pH units and is not to be averaged.

‡ See table on Page 3 for quarterly sampling requirements.

Quarterly Minimum Sampling Requirements			
Quarter	**Months**	**Quarterly Effluent Parameters**	**Report is Due**
First	January, February, March	Sample at least once during any month of the quarter	April 28th
Second	April, May, June	Sample at least once during any month of the quarter	July 28th
Third	July, August, September	Sample at least once during any month of the quarter	October 28th
Fourth	October, November, December	Sample at least once during any month of the quarter	January 28th

Note 1 – Effluent limitations and monitoring requirements for *E. coli* are applicable only during the recreational season from April 1 through October 31. The Monthly Average Limit for *E. coli* is expressed as a geometric mean.

Note 2 – Influent sampling for BOD_5 and TSS is not required when the facility does not discharge effluent during the reporting period. Samples are to be collected prior to any treatment process. Calculate Percent Removal by using the following formula: [(Average Influent –Average Effluent) / Average Influent] x 100% = Percent Removal. Influent and effluent samples are to be taken during the same month. The Average Influent and Average Effluent values are to be calculated by adding the respective values together and dividing by the number of samples taken during the month. Influent samples are to be collected as a 24-hour composite sample, composed of 48 aliquots (subsamples) collected at 30 minute intervals by an automatic sampling device.

OUTFALL <u>#001</u>	TABLE A-2. WHOLE EFFLUENT TOXICITY FINAL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS					
The permittee is authorized to discharge from outfall number(s) as specified in the application for this permit. The final effluent limitations in **Table A-2** shall become effective on **<u>December 1, 2020</u>** and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:						
EFFLUENT PARAMETER(S)	**UNITS**	**FINAL EFFLUENT LIMITATIONS**			**MONITORING REQUIREMENTS**	
		DAILY MAXIMUM	**WEEKLY AVERAGE**	**MONTHLY AVERAGE**	**MEASUREMENT FREQUENCY**	**SAMPLE TYPE**
Limit Set: WA						
Acute Whole Effluent Toxicity (**Note 3**)	TU_a	*			once/year	composite**
ACUTE WET TEST MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE JANUARY 28, 2022.						
Limit Set: WC						
Chronic Whole Effluent Toxicity (**Note 4**)	TU_c	*			once/permit cycle	composite**
CHRONIC WET TEST REPORTS SHALL BE SUBMITTED **<u>ONCE PER PERMIT CYCLE</u>**; THE FIRST REPORT IS DUE <u>JANUARY 28, 2025</u>.						

* Monitoring requirement only.

** A composite sample is to be made up from at least three samples collected during each decant event during a 24 hour period. One sample shall be conducted near the beginning of the decant event, the next sample shall be collected when the decant event is near 50% complete, and the third sample collected near the end of the decant event. Samples can be collected by an automatic sampler or as a grab sample and then composited

Note 3 – The Acute WET test shall be conducted once per year during the years 2021, 2022, 2023, and 2025. See Special Condition #15 for additional requirements.

Note 4 –The Chronic WET test shall be conducted once per permit cycle during the year 2024. An Acute WET test is not required during the year of the Chronic test. See Special Condition #16 for additional requirements.

PERMITTED FEATURE INF	TABLE B-1. INFLUENT MONITORING REQUIREMENTS

The monitoring requirements in **Table B-1** shall become effective on **December 1, 2020** and remain in effect until expiration of the permit. The influent wastewater shall be monitored by the permittee as specified below:

PARAMETER(S)	UNITS	MONITORING REQUIREMENTS				
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Limit Set: IM						
Biochemical Oxygen Demand$_5$ (**Note 2**)	mg/L			*	once/month	composite**
Total Suspended Solids (**Note 2**)	mg/L			*	once/month	composite**
Ammonia as N	mg/L	*		*	once/month	composite**
Total Phosphorus	mg/L	*		*	once/month	composite**
Total Kjeldahl Nitrogen	mg/L	*		*	once/month	composite**
Nitrite + Nitrate	mg/L	*		*	once/month	composite**
MONITORING REPORTS SHALL BE SUBMITTED **MONTHLY**; THE FIRST REPORT IS DUE JANUARY 28, 2021.						

* Monitoring requirement only.

** A 24-hour composite sample is composed of 48 aliquots (subsamples) collected at 30 minute intervals by an automatic sampling device.

Note 2 – Influent sampling for BOD$_5$ and TSS is not required when the facility does not discharge effluent during the reporting period. Samples are to be collected prior to any treatment process. Calculate Percent Removal by using the following formula: [(Average Influent –Average Effluent) / Average Influent] x 100% = Percent Removal. Influent and effluent samples are to be taken during the same month. The Average Influent and Average Effluent values are to be calculated by adding the respective values together and dividing by the number of samples taken during the month. Influent samples are to be collected as a 24-hour composite sample, composed of 48 aliquots (subsamples) collected at 30 minute intervals by an automatic sampling device.

Quarterly Minimum Sampling Requirements			
Quarter	**Months**	**Quarterly Influent Parameters**	**Report is Due**
First	January, February, March	Sample at least once during any month of the quarter	April 28th
Second	April, May, June	Sample at least once during any month of the quarter	July 28th
Third	July, August, September	Sample at least once during any month of the quarter	October 28th
Fourth	October, November, December	Sample at least once during any month of the quarter	January 28th

C. STANDARD CONDITIONS

In addition to specified conditions stated herein, this permit is subject to the attached Parts I, II, & III standard conditions dated August 1, 2014, May 1, 2013, and August 1, 2019, and hereby incorporated as though fully set forth herein.

D. SPECIAL CONDITIONS

1. Electronic Discharge Monitoring Report (eDMR) Submission System. Per 40 CFR Part 127 National Pollutant Discharge Elimination System (NPDES) Electronic Reporting Rule, reporting of effluent monitoring data and any report required by the permit (unless specifically directed otherwise by the permit) shall be submitted by the permittee via an electronic system to ensure timely, complete, accurate, and nationally consistent set of data about the NPDES program.

   (a) eDMR Registration Requirements. The permittee must register with the Department's eDMR system through the Missouri Gateway for Environmental Management (MoGEM) before the first report is due. Registration and other information regarding MoGEM can be found at https://dnr.mo.gov/mogem. Information about the eDMR system can be found at https://dnr.mo.gov/env/wpp/edmr.htm. The first user shall register as an Organization Official and the association to the facility must be approved by the Department. Regarding Standard Conditions Part I, Section B, #7, the eDMR system is currently the only Department approved reporting method for this permit unless a waiver is granted by the Department. See paragraph (c) below.
   (b) Electronic Submissions. To access the eDMR system, use the following link in your web browser: https://apps5.mo.gov/mogems/welcome.action. If you experience difficulties with using the eDMR system you may contact edmr@dnr.mo.gov or call 855-789-3889 or 573-526-2082 for assistance.
   (c) Waivers from Electronic Reporting. The permittee must electronically submit compliance monitoring data and reports unless a waiver is granted by the Department in compliance with 40 CFR Part 127. Only permittees with an approved waiver request may submit monitoring data and reports on paper to the Department for the period that the approved electronic reporting waiver is effective. The permittee may obtain an electronic reporting waiver by first submitting an eDMR Waiver Request Form: http://dnr.mo.gov/forms/780-2692-f.pdf. The Department will either approve or deny this electronic reporting waiver request within 120 calendar days.

2. The full implementation of this operating permit, which includes implementation of any applicable schedules of compliance, shall constitute compliance with all applicable federal and state statutes and regulations in accordance with §644.051.16, RSMo, and the Clean Water Act (CWA) section 402(k); however, this permit may be reopened and modified, or alternatively revoked and reissued:
   (a) To comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) of the CWA, if the effluent standard or limitation so issued or approved:
      (1) contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
      (2) controls any pollutant not limited in the permit.
   (b) To incorporate an approved pretreatment program or modification thereto pursuant to 40 CFR 403.8(c) or 40 CFR 403.18(e), respectively.

3. All outfalls must be clearly marked in the field.

4. Report as no-discharge when a discharge does not occur during the report period.

5. Reporting of Non-Detects:
   (a) An analysis conducted by the permittee or their contracted laboratory shall be conducted in such a way that the precision and accuracy of the analyzed result can be enumerated.
   (b) The permittee shall not report a sample result as "Non-Detect" without also reporting the detection limit of the test. Reporting as "Non Detect" without also including the detection limit will be considered failure to report, which is a violation of this permit.
   (c) The permittee shall provide the "Non-Detect" sample result using the less than sign and the minimum detection limit (e.g. <10).
   (d) Where the permit contains a Minimum Level (ML) and the permittee is granted authority in the permit to report zero in lieu of the < ML for a specified parameter (conventional, priority pollutants, metals, etc.), then zero (0) is to be reported for that parameter.
   (e) See Standard Conditions Part I, Section A, #4 regarding proper detection limits used for sample analysis.
   (f) When a parameter is not detected above ML, the permittee must report the data qualifier signifying less than ML for that parameter (e.g., < 50 μg/L, if the ML for the parameter is 50 μg/L). For reporting an average based on a mix of values detected and not detected, assign a value of "0" for all non-detects for that reporting period and report the average of all the results.

D. SPECIAL CONDITIONS (continued)

6. It is a violation of the Missouri Clean Water Law to fail to pay fees associated with this permit (644.055 RSMo).

7. The permittee shall comply with any applicable requirements listed in 10 CSR 20-9, unless the facility has received written notification that the Department has approved a modification to the requirements. The monitoring frequencies contained in this permit shall not be construed by the permittee as a modification of the monitoring frequencies listed in 10 CSR 20-9. To request a modification of the operational control testing requirements listed in 10 CSR 20-9, the permittee shall submit a permit modification application and fee to the Department requesting a deviation from the operational control monitoring requirements. Upon approval of the request, the Department will modify the permit.

8. The permittee shall develop and implement a program for maintenance and repair of its collection system. The permittee may compare collection system performance results and other data with the benchmarks used in the Departments' Capacity, Management, Operation, And Maintenance (CMOM) Model located at http://dnr.mo.gov/env/wpp/permits/docs/cmom-template.doc. Additional information regarding the Departments' CMOM Model is available at http://dnr.mo.gov/pubs/pub2574.htm.

   The permittee shall also submit a report via the Electronic Discharge Monitoring Report (eDMR) Submission System annually, by January 28th, for the previous calendar year. The report shall contain the following information:
   (a) A summary of the efforts to locate and eliminate specific sources of excessive infiltration and inflow into the collection system serving the facility for the previous year.
   (b) A summary of the general maintenance and repairs to the collection system serving the facility for the previous year.
   (c) A summary of any planned maintenance and repairs to the collection system serving the facility for the upcoming calendar year. This list shall include locations (GPS, 911 address, manhole number, etc.) and actions to be taken.

9. Bypasses are not authorized at this facility unless they meet the criteria in 40 CFR 122.41(m). If a bypass occurs, the permittee shall report in accordance to 40 CFR 122.41(m)(3), and with Standard Condition Part I, Section B, subsection 2. Bypasses are to be reported to the Kansas City Regional Office during normal business hours or by using the online Sanitary Sewer Overflow/Facility Bypass Application located at: https://dnr.mo.gov/mogem/ or the Environmental Emergency Response spill-line at 573-634-2436 outside of normal business hours. Once an electronic reporting system compliant with 40 CFR Part 127, the National Pollutant Discharge Elimination System (NPDES) Electronic Reporting Rule, is available all bypasses must be reported electronically via the new system. Blending, which is the practice of combining a partially-treated wastewater process stream with a fully-treated wastewater process stream prior to discharge, is not considered a form of bypass. If the permittee wishes to utilize blending, the permittee shall file an application to modify this permit to facilitate the inclusion of appropriate monitoring conditions.

10. The facility must be sufficiently secured to restrict entry by children, livestock and unauthorized persons as well as to protect the facility from vandalism.

11. An Operation and Maintenance (O & M) manual shall be maintained by the permittee and made available to the operator. The O & M manual shall include key operating procedures and a brief summary of the operation of the facility.

12. An all-weather access road to the treatment facility shall be maintained.

13. The outfall sewer shall be protected and maintained against the effects of floodwater, ice, or other hazards as to reasonably insure its structural stability, freedom from stoppage, and that a sample of the effluent can be obtained at a point after the final treatment process and before the discharge mixes with the receiving waters.

14. Expanded Effluent Testing
    Permittee must sample and analyze for the pollutants listed in Form B2 – Application for Operating Permit for Facilities That Receive Primarily Domestic Waste And Have A Design Flow More Than 100,000 Gallons Per Day (MO-780-1805 dated 02-19), Part D – Expanded Effluent Testing Data, #18. The permittee shall provide this data with the permit renewal application. A minimum of three samples taken within four and one-half years prior to the date of the permit application must be provided. Samples must be representative of the seasonal variation in the discharge from each outfall. Approved and sufficiently sensitive testing methods listed in 40 CFR 136.3 must be utilized. A method is "sufficiently sensitive" when; 1) The method minimum level is at or below the level of the applicable water quality criterion for the measured pollutant or pollutant parameter; or 2) the method minimum level is above the applicable water quality criterion, but the amount of the pollutant or pollutant parameter in a facility's discharge is high enough that the method detects and quantifies the level of the pollutant or pollutant parameter in the discharge; or 3) the method has the lowest minimum level of the analytical methods approved under 40 CFR part 136. These methods are also required for parameters listed as monitoring only, as the data collected may be used to determine if numeric limitations need to be established.

D. SPECIAL CONDITIONS (continued)

15. Acute Whole Effluent Toxicity (WET) tests shall be conducted as follows:
    (a) Freshwater Species and Test Methods: Species and short-term test methods for estimating the acute toxicity of NPDES effluents are found in the most recent edition of *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* (EPA/821/R-02/012; Table IA, 40 CFR Part 136). The permittee shall concurrently conduct 48-hour, static, non-renewal toxicity tests with the following species:
        i. The fathead minnow, *Pimephales promelas* (Acute Toxicity EPA Test Method 2000.0).
        ii. The daphnid, *Ceriodaphnia dubia* (Acute Toxicity EPA Test Method 2002.0).
    (b) Chemical and physical analysis of the upstream control sample and effluent sample shall occur immediately upon being received by the laboratory, prior to any manipulation of the effluent sample beyond preservation methods consistent with federal guidelines for WET testing that are required to stabilize the sample during shipping. Where upstream receiving water is not available or known to be toxic, other approved control water may be used.
    (c) Test conditions must meet all test acceptability criteria required by the EPA Method used in the analysis.
    (d) The laboratory shall not chemically dechlorinate the sample.
    (e) The Allowable Effluent Concentration (AEC) is 96%; the dilution series is: 100%, 96%, 48%, 24%, and 12%.
    (f) All chemical and physical analysis of the effluent sample performed in conjunction with the WET test shall be performed at the 100% effluent concentration.
    (g) The facility must submit a full laboratory report for all toxicity testing. The report must include a quantification of acute toxic units ($TU_a = 100/LC_{50}$) reported according to the test methods manual chapter on report preparation and test review. The Lethal Concentration 50 Percent (LC_{50}) is the effluent concentration that would cause death in 50 percent of the test organisms at a specific time.

16. Chronic Whole Effluent Toxicity (WET) tests shall be conducted as follows:
    (a) Freshwater Species and Test Methods: Species and short-term test methods for estimating the chronic toxicity of NPDES effluents are found in the most recent edition of *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA/821/R-02/013; Table IA, 40 CFR Part 136).* The permittee shall concurrently conduct 7-day, static renewal toxicity tests with the following species:
        i. The fathead minnow, *Pimephales promelas* (Survival and Growth Test Method 1000.0).
        ii. The daphnid, *Ceriodaphnia dubia* (Survival and Reproduction Test Method 1002.0).
    (b) Chemical and physical analysis of the upstream control sample and effluent sample shall occur immediately upon being received by the laboratory, prior to any manipulation of the effluent sample beyond preservation methods consistent with federal guidelines for WET testing that are required to stabilize the sample during shipping. Where upstream receiving water is not available or known to be toxic, other approved control water may be used.
    (c) Test conditions must meet all test acceptability criteria required by the EPA Method used in the analysis.
    (d) The laboratory shall not chemically dechlorinate the sample.
    (e) The Allowable Effluent Concentration (AEC) is 70%, the dilution series is: 100%, 70%, 37.5%, 18.25%, and 6.25%.
    (f) All chemical and physical analysis of the effluent sample performed in conjunction with the WET test shall be performed at the 100% effluent concentration.
    (g) The facility must submit a full laboratory report for all toxicity testing. The report must include a quantification of chronic toxic units ($TU_c = 100/IC_{25}$) reported according to the *Methods for Measuring the Chronic Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms* chapter on report preparation and test review. The 25 percent Inhibition Effect Concentration (IC_{25}) is the toxic or effluent concentration that would cause 25 percent reduction in mean young per female or in growth for the test populations.

17. Stormwater Pollution Prevention Plan (SWPPP): SWPPP must be implemented upon permit issuance. Through implementation of the SWPPP, the permittee shall minimize the release of pollutants in stormwater from the facility to the waters of the state. The SWPPP shall be developed in consultation with the concepts and methods described in the following document: Developing Your Stormwater Pollution Prevention Plan, A Guide for Industrial Operators, (Document number EPA 833-B-09-002) published by the United States Environmental Protection Agency (USEPA) in June 2015.
    (a) The SWPPP must identify any stormwater outfall from the facility and Best Management Practices (BMPs) used to prevent or reduce the discharge of contaminants in stormwater. The stormwater outfalls shall either be marked in the field or clearly marked on a map and maintained with the SWPPP.
    (b) The SWPPP must include a schedule and procedures for a once per month routine site inspection.
        (1) The monthly routine inspection shall be documented in a brief written report, which shall include:
            i. The person(s) conducting the inspection.
            ii. The inspection date and time.
            iii. Weather information for the day of the inspection.
            iv. Precipitation information for the entire period since the last inspection.
            v. Description of the discharges observed, including visual quality of the discharges (sheen, turbid, etc.).

D. SPECIAL CONDITIONS (continued)

vi. Condition of BMPs
vii. If BMPs were replaced or repaired.
viii. Observations and evaluations of BMP effectiveness.

(2) Any deficiency observed during the routine inspection must be corrected within seven (7) days and the actions taken to correct the deficiencies shall be included with the written report.
(3) The routine inspection reports must be kept onsite with the SWPPP and maintained for a period of five (5) years.
(4) The routine inspection reports shall be made available to Department personnel upon request.

(c) The SWPPP must include a schedule and procedures for a once per year comprehensive site inspection.
(1) The annual comprehensive inspection shall be documented in a written report, which shall include:
i. The person(s) conducting the inspection.
ii. The inspection date and time.
iii. Findings from the areas of your facility that were examined;
iv. All observations relating to the implementation of your control measures including:
1. Previously unidentified discharges from the site,
2. Previously unidentified pollutants in existing discharges,
3. Evidence of, or the potential for, pollutants entering the drainage system;
4. Evidence of pollutants discharging to receiving waters at all facility outfall(s), and the condition of and around the outfall, and
5. Additional control measures needed to address any conditions requiring corrective action identified during the inspection.
v. Any required revisions to the SWPPP resulting from the inspection;
vi. Any incidence of noncompliance observed or a certification stating that the facility is in compliance with Special Condition D.16.

(2) Any deficiency observed during the comprehensive inspection must be corrected within seven (7) days and the actions taken to correct the deficiencies shall be included with the written report.
(3) The comprehensive inspection reports must be kept onsite with the SWPPP and maintained for a period of five (5) years.
(4) The comprehensive inspection reports shall be made available to Department personnel upon request.

(d) The SWPPP must be kept on-site and should not be sent to the Department unless specifically requested.
(e) The SWPPP must be reviewed and updated at a minimum once per permit cycle, as site conditions or control measures change.

18. The permittee shall select, install, use, operate, and maintain the Best Management Practices prescribed in the SWPPP.

(a) Permittee shall adhere to the following minimum Best Management Practices (BMPs):
(1) Minimize the exposure of industrial material storage areas, loading and unloading areas, dumpsters and other disposal areas, maintenance activities, and fueling operations to rain, snow, snowmelt, and runoff, by locating industrial materials and activities inside or protecting them with storm resistant coverings, if warranted and practicable.
(2) Provide good housekeeping practices on the site to prevent potential pollution sources from coming into contact with stormwater and provide collection facilities and arrange for proper disposal of waste products, including sludge.
(3) Implement a maintenance program to ensure that the structural control measures and industrial equipment is kept in good operating condition and to prevent or minimize leaks and other releases of pollutants.
(4) Prevent or minimize the spillage or leaks of fluids, oil, grease, fuel, etc. from equipment and vehicle maintenance, equipment and vehicle cleaning, or activities.
(5) Provide sediment and erosion control sufficient to prevent or control sediment loss off of the property. This could include the use of straw bales, silt fences, or sediment basins, if needed.
(6) Provide stormwater runoff controls to divert, infiltrate, reuse, contain, or otherwise minimize pollutants in the stormwater discharge.
(7) Enclose or cover storage piles of salt or piles containing salt, used for deicing or other commercial or industrial purposes.
(8) Provide training to all employees who; work in areas where industrial materials or activities are exposed to stormwater, are responsible for stormwater inspections, are members of the Pollution Prevention Team. Training must cover the specific control measures and monitoring, inspection, planning, reporting and documentation requirements of this permit. Training is recommended annually for any applicable staff and whenever a new employee is hired who meets the description above.
(9) Eliminate and prevent unauthorized non-stormwater discharges at the facility.
(10) Minimize generation of dust and off-site tracking of raw, final, or waste materials by implementing appropriate control measures.

E. NOTICE OF RIGHT TO APPEAL

If you were adversely affected by this decision, you may be entitled to pursue an appeal before the administrative hearing commission (AHC) pursuant to Sections 621.250 and 644.051.6 RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: https://ahc.mo.gov

MISSOURI DEPARTMENT OF NATURAL RESOURCES
FACT SHEET
FOR THE PURPOSE OF RENEWAL
OF
MO-0055204
SMITHVILLE WASTEWATER TREATMENT FACILITY

The Federal Water Pollution Control Act ("Clean Water Act" Section 402 Public Law 92-500 as amended) established the National Pollutant Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States, and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the "Clean Water Act"). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (MSOPs) are issued by the Director of the Missouri Department of Natural Resources (Department) under an approved program, operating in accordance with federal and state laws (Federal "Clean Water Act" and "Missouri Clean Water Law" Section 644 as amended). MSOPs are issued for a period of five (5) years unless otherwise specified.

As per [40 CFR Part 124.8(a)] and [10 CSR 20-6.020(1)(A)2.], a Factsheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the Missouri State Operating Permit (operating permit) listed below.

A Factsheet is not an enforceable part of an operating permit.

This Factsheet is for a Minor facility.

Part I – Facility Information

Facility Type: POTW

Facility Description: Influent lift station / bar screen / Sequencing Batch Reactors (3 basins) / aerobic sludge digesters (2) / UV disinfection / biosolids are land applied

Have any changes occurred at this facility or in the receiving water body that affects effluent limit derivation?
✓ No.

Application Date: 11/22/19
Expiration Date: 06/30/20

OUTFALL(S) TABLE:

OUTFALL	DESIGN FLOW (CFS)	TREATMENT LEVEL	EFFLUENT TYPE
#001	1.74	Secondary	Domestic

Facility Performance History:
This facility was last inspected on August 7, 2018. The inspection showed the following unsatisfactory features: the outfall was eroding severely and failure to submit the 2017 annual sludge report.

A review of Discharge Monitoring Reports for the last five years shows the following exceedances (month/year):
- *E. coli*: 4/16, 6/16, 7/16, 8/16, 4/19
- Oil & Grease: 2/16, 2/17
- TSS: 4/16

Comments:
Changes in this permit include the addition of monthly influent nutrient monitoring and increased effluent nutrient monitoring (quarterly to monthly), the reduction of Oil & Grease from monthly limits to quarterly monitoring, the revision of final effluent limits for Ammonia, and the removal of instream monitoring requirements. See Part VI of the Fact Sheet for further information regarding the addition, revision, and removal of effluent parameters. Special conditions were updated to include the Electronic Discharge Monitoring Report (eDMR) Submission System.

Part II – Operator Certification Requirements

✓ This facility is required to have a certified operator.

As per [10 CSR 20-6.010(8) Terms and Conditions of a Permit], the permittee shall operate and maintain facilities to comply with the Missouri Clean Water Law and applicable permit conditions and regulations. Operators at regulated wastewater treatment facilities shall be certified in accordance with [10 CSR 20-9.020(2)] and any other applicable state law or regulation. As per [10 CSR 20-9.020(2)(A)], requirements for operation by certified personnel shall apply to all wastewater treatment systems, if applicable, as listed below:

Owned or operated by or for a

☒ - Municipalities
☐ - County
☐ - Public Sewer District
☐ - State agency
☐ - Public Water Supply Districts
☐ - Private Sewer Company regulated by the Public Service Commission

Each of the above entities are only applicable if they have a Population Equivalent greater than two hundred (200).

This facility currently requires a chief operator with a B Certification Level. Please see **Appendix - Classification Worksheet.** Modifications made to the wastewater treatment facility may cause the classification to be modified.

Operator's Name: Robert Lemley
Certification Number: 5428
Certification Level: WW-A

The listing of the operator above only signifies that staff drafting this operating permit have reviewed appropriate Department records and determined that the name listed on the operating permit application has the correct and applicable Certification Level.

Part III – Operational Control Testing Requirements

Missouri Clean Water Commission regulation 10 CSR 20-9.010 requires certain publicly owned treatment works and privately owned facilities regulated by the Public Service Commission to conduct internal operational control monitoring to further ensure proper operation of the facility and to be a safeguard or early warning for potential plant upsets that could affect effluent quality. This requirement is only applicable if the publicly owned treatment works and privately owned facilities regulated by the Public Service Commission has a Population Equivalent greater than two hundred (200).

10 CSR 20-9.010(3) allows the Department to modify the monitoring frequency required in the rule based upon the Department's judgement of monitoring needs for process control at the specified facility.

✓ As per [10 CSR 20-9.010(4))], the facility is required to conduct operational monitoring. These operational monitoring reports are to be submitted to the Department along with the MSOP discharge monitoring reports.

  ✓ The facility is a mechanical plant and is required to conduct operational control monitoring as follows:

Operational Monitoring Parameter	**Frequency**
Precipitation	Daily (M-F)
Flow – Influent or Effluent	Daily (M-F)
pH – Influent	Daily (M-F)
Temperature (Aeration basin)	Daily (M-F)
TSS – Influent	Weekly
TSS – Mixed Liquor	Weekly
Settleability – Mixed Liquor	Daily (M-F)
Dissolved Oxygen – Mixed Liquor	Daily (M-F)
Dissolved Oxygen – Aerobic Digester	Daily (M-F)

Part IV – Receiving Stream Information

RECEIVING STREAM(S) TABLE: OUTFALL #001

WATER-BODY NAME	CLASS	WBID	DESIGNATED USES*	12-DIGIT HUC	DISTANCE TO CLASSIFIED SEGMENT (MI)
Little Platte River	P	315	AQL, HHP, IRR, LLW, SCR, WBC-B	10240012-0711	Direct Discharge

*As per 10 CSR 20-7.031 Missouri Water Quality Standards, the Department defines the Clean Water Commission's water quality objectives in terms of "water uses to be maintained and the criteria to protect those uses." The receiving stream and 1st classified receiving stream's beneficial water uses to be maintained are in the receiving stream table in accordance with [10 CSR 20-7.031(1)(C)].

Uses found in the receiving streams table, above:

10 CSR 20-7.031(1)(C)1.:

AQL = Protection of aquatic life (Current narrative use(s) are defined to ensure the protection and propagation of fish shellfish and wildlife, which is further subcategorized as: WWH = Warm Water Habitat; **CDF** = Cold-water fishery (Current narrative use is cold-water habitat.); **CLF** = Cool-water fishery (Current narrative use is cool-water habitat); EAH = Ephemeral Aquatic Habitat; MAH = Modified Aquatic Habitat; LAH = Limited Aquatic Habitat. This permit uses AQL effluent limitations in 10 CSR 20-7.031 Table A for all habitat designations unless otherwise specified.)

10 CSR 20-7.031(1)(C)2.: Recreation in and on the water

WBC = Whole Body Contact recreation where the entire body is capable of being submerged;
WBC-A = Whole body contact recreation that supports swimming uses and has public access;
WBC-B = Whole body contact recreation that supports swimming;
SCR = Secondary Contact Recreation (like fishing, wading, and boating).

10 CSR 20-7.031(1)(C)3. to 7.:

HHP (formerly HHF) = Human Health Protection as it relates to the consumption of fish;
IRR = Irrigation for use on crops utilized for human or livestock consumption;
LWW = Livestock and wildlife watering (Current narrative use is defined as LWP = Livestock and Wildlife Protection);
DWS = Drinking Water Supply;
IND = Industrial water supply

10 CSR 20-7.031(1)(C)8-11.: Wetlands (10 CSR 20-7.031 Table A currently does not have corresponding habitat use criteria for these defined uses)

WSA = Storm- and flood-water storage and attenuation; WHP = Habitat for resident and migratory wildlife species; WRC = Recreational, cultural, educational, scientific, and natural aesthetic values and uses; WHC = Hydrologic cycle maintenance.

10 CSR 20-7.031(6): **GRW** = Groundwater

RECEIVING STREAM(S) LOW-FLOW VALUES:

RECEIVING STREAM	LOW-FLOW VALUES (CFS)*		
	1Q10	7Q10	30Q10
Little Platte River	1.76	2.99	5.22

* Data from USGS Gauge Station 06821150 located on the Little Platte River at Smithville, MO.

MIXING CONSIDERATIONS TABLE:

MIXING ZONE (CFS) [10 CSR 20-7.031(5)(A)4.B.(II)(a)]			ZONE OF INITIAL DILUTION (CFS) [10 CSR 20-7.031(5)(A)4.B.(II)(b)]		
1Q10	7Q10	30Q10	1Q10	7Q10	30Q10
0.44	0.7475	1.305	0.044	0.07475	0.1305

RECEIVING STREAM MONITORING REQUIREMENTS:

No receiving water monitoring requirements recommended at this time.

<u>Receiving Water Body's Water Quality</u>

Currently, the Department has not conducted a stream survey for this waterbody. When a stream survey is conducted, more information may be available about the receiving stream.

Part V – Rationale and Derivation of Effluent Limitations & Permit Conditions

ALTERNATIVE EVALUATIONS FOR NEW FACILITIES:
As per [10 CSR 20-7.015(4)(A)], discharges to losing streams shall be permitted only after other alternatives including land application, discharges to a gaining stream, and connection to a regional wastewater treatment facility have been evaluated and determined to be unacceptable for environmental and/or economic reasons.

✓ The facility does not discharge to a Losing Stream as defined by [10 CSR 20-2.010(40)] & [10 CSR 20-7.031(1)(O)], or is an existing facility.

ANTI-BACKSLIDING:
A provision in the Federal Regulations [CWA §303(d)(4); CWA §402(o); 40 CFR Part 122.44(l)] that requires a reissued permit to be as stringent as the previous permit with some exceptions.

✓ Limitations in this operating permit for the reissuance of this permit conform to the anti-backsliding provisions of Section 402(o) of the Clean Water Act, and 40 CFR Part 122.44.

  ✓ Information is available which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of a less stringent effluent limitation at the time of permit issuance.

- **Ammonia as N**. Effluent limitations were re-calculated for Ammonia. The Department previously followed the 2007 Ammonia Guidance method for derivation of ammonia limits. However, the EPA's Technical Support Document for Water Quality-based Toxic Controls (TSD) establishes other alternatives to limit derivation. The Department has determined that the approach established in Section 5.4.2 of the TSD, which allows for direct application of both the acute and chronic wasteload allocations (WLA) as permit limits for toxic pollutants, is more appropriate limit derivation approach. Using this method for a discharge to a waterbody where mixing is not allowed, the criterion continuous concentration (CCC) and the criterion maximum concentration (CMC) will equal the chronic and acute WLA respectively. The WLAs are then applied as effluent limits, per Section 5.4.2 of the TSD, where the CMC is the Daily Maximum and the CCC is the Monthly Average. The direct application of both acute and chronic criteria as WLA is also applicable for facilities that discharge into receiving waterbodies with mixing considerations. The CCC and CMC will need to be calculated into WLA with mixing considerations using the mass-balance equation. The newly established limitations are still protective of water quality.

- **Instream Total Phosphorus and Total Nitrogen Monitoring**. The previous permit contained upstream instream monitoring requirements for Total Phosphorus and Total Nitrogen. The Department has made a determination that monitoring of background nutrients is not needed. This permit is still protective of water quality and this determination will be reassessed at the time of renewal.

- **Oil and Grease**. The previous permit had final effluent limits of 15 mg/L as a daily maximum and 10 mg/L as a monthly average. During the drafting of this permit, the permit writer reviewed Discharge Monitoring Reports submitted by the permittee and the facility has not disclosed any other information related to the characteristics of the discharge which has the potential to cause or contribute to an excursion of the Water Quality Standard (WQS). Additionally, no excursion of the WQS has been observed by the Department. As a result, monitoring requirements have been included in this permit to determine if the discharge has the reasonable potential to cause or contribute to an excursion of the WQS for Oil & Grease. The permit is still protective of water quality and this determination will be reassessed at the time of renewal.

  ✓ The Department determines that technical mistakes or mistaken interpretations of law were made in issuing the permit under section 402(a)(1)(b).

- **General Criteria**. The previous permit contained a special condition which described a specific set of prohibitions related to general criteria found in 10 CSR 20-7.031(4). In order to comply with 40 CFR 122.44(d)(1), the permit writer has conducted reasonable potential determinations for each general criterion and established numeric effluent limitations where reasonable potential exists. While the removal of the previous permit special condition creates the appearance of backsliding, since this permit establishes numeric limitations where reasonable potential to cause or contribute to an excursion of the general criteria exists the permit maintains sufficient effluent limitations and monitoring requirements in order to protect water quality, this permit is equally protective as compared to the previous permit. Therefore, given this new information, and the fact that the previous permit special condition was not consistent with 40 CFR 122.44(d)(1), an error occurred in the establishment of the general criteria as a special condition of the previous permit. Please see Part VI – Effluent Limits Determination for more information regarding the reasonable potential determinations for each general criterion related to this facility.

ANTIDEGRADATION:
In accordance with Missouri's Water Quality Standard [10 CSR 20-7.031(3)], for domestic wastewater discharge with new, altered, or expanding discharges, the Department is to document by means of Antidegradation Review that the use of a water body's available assimilative capacity is justified. In accordance with Missouri's water quality regulations for antidegradation [10 CSR 20-7.031(3)], degradation may be justified by documenting the socio-economic importance of a discharge after determining the necessity of the discharge. Facilities must submit the antidegradation review request to the Department prior to establishing, altering, or expanding discharges. See http://dnr.mo.gov/env/wpp/permits/antideg-implementation.htm

✓ No degradation proposed and no further review necessary. Facility did not apply for authorization to increase pollutant loading or to add additional pollutants to their discharge.

For stormwater discharges, the stormwater BMP chosen for the facility, through the antidegradation analysis performed by the facility, must be implemented and maintained at the facility. Failure to implement and maintain the chosen BMP alternative is a permit violation; see SWPPP.

✓ The facility must review and maintain stormwater BMPs as appropriate.

AREA-WIDE WASTE TREATMENT MANAGEMENT & CONTINUING AUTHORITY:
As per [10 CSR 20-6.010(2)(C)], …An applicant may utilize a lower preference continuing authority by submitting, as part of the application, when a higher level authority is available, must submit information to the Department for review and approval, provided it does not conflict with any area-wide management plan approved under section 208 of the Federal Clean Water Act or any other regional sewage service and treatment plan approved for higher preference authority by the Department.

BIOSOLIDS & SEWAGE SLUDGE:
Biosolids are solid materials resulting from domestic wastewater treatment that meet federal and state criteria for beneficial uses (i.e. fertilizer). Sewage sludge is solids, semi-solids, or liquid residue generated during the treatment of domestic sewage in a treatment works; including but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and a material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works.

✓ Permittee is authorized to land apply biosolids in accordance with Standard Conditions III.

COMPLIANCE AND ENFORCEMENT:
Enforcement is the action taken by the Water Protection Program (WPP) to bring an entity into compliance with the Missouri Clean Water Law, its implementing regulations, and/or any terms and conditions of an operating permit. The primary purpose of the enforcement activity in the WPP is to resolve violations and return the entity to compliance.

✓ The facility is not currently under Water Protection Program enforcement action.

ELECTRONIC DISCHARGE MONITORING REPORT (EDMR) SUBMISSION SYSTEM:
The U.S. Environmental Protection Agency (EPA) promulgated a final rule on October 22, 2015, to modernize Clean Water Act reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system. This final rule requires regulated entities and state and federal regulators to use information technology to electronically report data required by the National Pollutant Discharge Elimination System (NPDES) permit program instead of filing paper reports. To comply with the federal rule, the Department is requiring all permittees to begin submitting discharge monitoring data and reports online. In an effort to aid facilities in the reporting of applicable information electronically, the Department has created several new forms including operational control monitoring forms and an I&I location and reduction form. These forms are optional and found on the Department's website at the following locations:

Operational Monitoring Lagoon: http://dnr.mo.gov/forms/780-2801-f.pdf
Operational Monitoring Mechanical: http://dnr.mo.gov/forms/780-2800-f.pdf
I&I Report: http://dnr.mo.gov/forms/780-2690-f.pdf

Per 40 CFR 127.15 and 127.24, permitted facilities may request a temporary waiver for up to 5 years or a permanent waiver from electronic reporting from the Department. To obtain an electronic reporting waiver, a permittee must first submit an eDMR Waiver Request Form: http://dnr.mo.gov/forms/780-2692-f.pdf. Each facility must make a request. If a single entity owns or operates more than one facility, then the entity must submit a separate request for each facility based on its specific circumstances. An approved waiver is non-transferable.

The Department must review and notify the facility within 120 calendar days of receipt if the waiver request has been approved or rejected [40 CFR 124.27(a)]. During the Department review period as well as after a waiver is granted, the facility must continue submitting a hard-copy of any reports required by their permit. The Department will enter data submitted in hard-copy from those facilities allowed to do so and electronically submit the data to the EPA on behalf of the facility.

✓ The permittee/facility is currently using the eDMR data reporting system.

NUMERIC LAKE NUTRIENT CRITERIA

✓ This facility does not discharge into a lake watershed where numeric lake nutrient criteria are applicable.

PRETREATMENT PROGRAM:

The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a Publicly Owned Treatment Works [40 CFR Part 403.3(q)].

Pretreatment programs are required at any POTW (or combination of POTW operated by the same authority) and/or municipality with a total design flow greater than 5.0 MGD and receiving industrial wastes that interfere with or pass through the treatment works or are otherwise subject to the pretreatment standards. Pretreatment programs can also be required at POTWs/municipals with a design flow less than 5.0 MGD if needed to prevent interference with operations or pass through.

Several special conditions pertaining to the permittee's pretreatment program may be included in the permit, and are as follows:

- Implementation and enforcement of the program,
- Annual pretreatment report submittal,
- Submittal of list of industrial users,
- Technical evaluation of need to establish local limitations, and
- Submittal of the results of the evaluation

✓ The permittee, at this time, is not required to have a Pretreatment Program or does not have an approved pretreatment program.

REASONABLE POTENTIAL ANALYSIS (RPA):

Federal regulation [40 CFR Part 122.44(d)(1)(i)] requires effluent limitations for all pollutants that are or may be discharged at a level that will cause or have the reasonable potential to cause or contribute to an in-stream excursion above narrative or numeric water quality standard.

In accordance with [40 CFR Part 122.44(d)(1)(iii)] if the permit writer determines that any given pollutant has the reasonable potential to cause, or contribute to an in-stream excursion above the WQS, the permit must contain effluent limits for that pollutant.

✓ An RPA was conducted on appropriate parameters. Please see **APPENDIX – RPA RESULTS.**

REMOVAL EFFICIENCY:

Removal efficiency is a method by which the Federal Regulations define Secondary Treatment and Equivalent to Secondary Treatment, which applies to Biochemical Oxygen Demand 5-day (BOD_5) and Total Suspended Solids (TSS) for Publicly Owned Treatment Works (POTWs)/municipals.

✓ Secondary Treatment is 85% removal [40 CFR Part 133.102(a)(3) & (b)(3)].

SANITARY SEWER OVERFLOWS (SSO) AND INFLOW AND INFILTRATION (I&I):

Sanitary Sewer Overflows (SSOs) are defined as untreated sewage releases and are considered bypassing under state regulation [10 CSR 20-2.010(12)] and should not be confused with the federal definition of bypass. SSOs result from a variety of causes including blockages, line breaks, and sewer defects that can either allow wastewater to backup within the collection system during dry weather conditions or allow excess stormwater and groundwater to enter and overload the collection system during wet weather conditions. SSOs can also result from lapses in sewer system operation and maintenance, inadequate sewer design and construction, power failures, and vandalism. SSOs include overflows out of manholes, cleanouts, broken pipes, and other into waters of the state and onto city streets, sidewalks, and other terrestrial locations.

Inflow and Infiltration (I&I) is defined as unwanted intrusion of stormwater or groundwater into a collection system. This can occur from points of direct connection such as sump pumps, roof drain downspouts, foundation drains, and storm drain cross-connections or through cracks, holes, joint failures, faulty line connections, damaged manholes, and other openings in the collection system itself. I&I results from a variety of causes including line breaks, improperly sealed connections, cracks caused by soil erosion/settling, penetration of vegetative roots, and other sewer defects. In addition, excess stormwater and groundwater entering the collection system from line breaks and sewer defects have the potential to negatively impact the treatment facility.

Missouri RSMo §644.026.1.(13) mandates that the Department issue permits for discharges of water contaminants into the waters of this state, and also for the operation of sewer systems. Such permit conditions shall ensure compliance with all requirements as established by sections 644.006 to 644.141. Standard Conditions Part I, referenced in the permit, contains provisions requiring proper operation and maintenance of all facilities and systems of treatment and control. Missouri RSMo §644.026.1.(15) instructs the Department to require proper maintenance and operation of treatment facilities and sewer systems and proper disposal of residual waste from all such facilities. To ensure that public health and the environment are protected, any noncompliance which may endanger public health or the environment must be reported to the Department within 24 hours of the time the permittee becomes aware of the noncompliance. Standard Conditions Part I, referenced in the permit, contains the reporting requirements for the permittee when bypasses and upsets occur. The permit also contains requirements for permittees to develop and implement a program for maintenance and repair of the collection system. The permit requires that the permittee submit an annual report to the Department for the previous calendar year that contains a summary of efforts taken by the permittee to locate and eliminate sources of excess I & I, a summary of general maintenance and repairs to the collection system, and a summary of any planned maintenance and repairs to the collection system for the upcoming calendar year.

✓ At this time, the Department recommends the US EPA's Guide for Evaluating Capacity, Management, Operation and Maintenance (CMOM) Programs at Sanitary Sewer Collection Systems (Document # EPA 305-B-05-002) or the Departments' CMOM Model located at http://dnr.mo.gov/env/wpp/permits/docs/cmom-template.doc. For additional information regarding the Departments' CMOM Model, see the CMOM Plan Model Guidance document at http://dnr.mo.gov/pubs/pub2574.htm. The CMOM identifies some of the criteria used to evaluate a collection system's management, operation, and maintenance and was intended for use by the EPA, state, regulated community, and/or third party entities. The CMOM is applicable to small, medium, and large systems; both public and privately owned; and both regional and satellite collection systems. The CMOM does not substitute for the Clean Water Act, the Missouri Clean Water Law, and both federal and state regulations, as it is not a regulation.

SCHEDULE OF COMPLIANCE (SOC):

Per 644.051.4 RSMo, a permit may be issued with a Schedule of Compliance (SOC) to provide time for a facility to come into compliance with new state or federal effluent regulations, water quality standards, or other requirements. Such a schedule is not allowed if the facility is already in compliance with the new requirement, or if prohibited by other statute or regulation. A SOC includes an enforceable sequence of interim requirements (actions, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. *See also* Section 502(17) of the Clean Water Act, and 40 CFR §122.2. For new effluent limitations, the permit may include interim monitoring for the specific parameter to demonstrate the facility is not already in compliance with the new requirement. Per 40 CFR § 122.47(a)(1), 10 CSR 20-7.031(11), and 10 CSR 20-7.015(9), compliance must occur as soon as possible. If the permit provides a schedule for meeting new water quality based effluent limits, a SOC must include an enforceable, final effluent limitation in the permit even if the SOC extends beyond the life of the permit.

A SOC is not allowed:

- For effluent limitations based on technology-based standards established in accordance with federal requirements, if the deadline for compliance established in federal regulations has passed. 40 CFR § 125.3.
- For a newly constructed facility in most cases. Newly constructed facilities must meet applicable effluent limitations when discharge begins, because the facility has installed the appropriate control technology as specified in a permit or antidegradation review. A SOC is allowed for a new water quality based effluent limit that was not included in a previously public noticed permit or antidegradation review, which may occur if a regulation changes during construction.
- To develop a TMDL, UAA, or other study that may result in site-specific criteria or alternative effluent limits. A facility is not prohibited from conducting these activities, but a SOC may not be granted for conducting these activities.

In order to provide guidance to Permit Writers in developing SOCs, and attain a greater level of consistency, on April 9, 2015 the Department issued an updated policy on development of SOCs. This policy provides guidance to Permit Writers on the standard time frames for schedules for common activities, and guidance on factors that may modify the length of the schedule such as a Cost Analysis for Compliance.

✓ This permit does not contain an SOC.

SEWER EXTENSION AUTHORITY SUPERVISED PROGRAM:

In accordance with [10 CSR 20-6.010(6)(A)], the Department may grant approval of a permittee's Sewer Extension Authority Supervised Program. These approved permittees regulate and approve construction of sanitary sewers and pump stations, which are tributary to this wastewater treatment facility. The permittee shall act as the continuing authority for the operation, maintenance, and modernization of the constructed collection system. See http://dnr.mo.gov/env/wpp/permits/sewer-extension.htm.

✓ The permittee does not have a Department approved Sewer Extension Authority Supervised Program.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):
In accordance with 40 CFR 122.44(k) *Best Management Practices (BMPs)* to control or abate the discharge of pollutants when: (1) Authorized under section 304(e) of the Clean Water Act (CWA) for the control of toxic pollutants and hazardous substances from ancillary industrial activities: (2) Authorized under section 402(p) of the CWA for the control of stormwater discharges; (3) Numeric effluent limitations are infeasible; or (4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA.

In accordance with the EPA's *Developing Your Stormwater Pollution Prevention Plan, A Guide for Industrial Operators*, (Document number EPA 833-B-09-002) [published by the United States Environmental Protection Agency (USEPA) in June 2015], BMPs are measures or practices used to reduce the amount of pollution entering (regarding this operating permit) waters of the state. BMPs may take the form of a process, activity, or physical structure.

Additionally in accordance with the Stormwater Management, a SWPPP is a series of steps and activities to (1) identify sources of pollution or contamination, and (2) select and carry out actions which prevent or control the pollution of stormwater discharges. The purpose of a SWPPP is to comply with all applicable stormwater regulations by creating an adaptive management plan to control and mitigate stream pollution from stormwater runoff. Developing a SWPPP provides opportunities to employ appropriate BMPs to minimize the risk of pollutants being discharged during storm events. The following paragraph outlines the general steps the permittee should take to determine which BMPs will work to achieve the benchmark values or limits in the permit. This section is not intended to be all encompassing or restrict the use of any physical BMP or operational and maintenance procedure assisting in pollution control. Additional steps or revisions to the SWPPP may be required to meet the requirements of the permit.

Areas which should be included in the SWPPP are identified in 40 CFR 122.26(b)(14). Once the potential sources of stormwater pollution have been identified, a plan should be formulated to best control the amount of pollutant being released and discharged by each activity or source. This should include, but is not limited to, minimizing exposure to stormwater, good housekeeping measures, proper facility and equipment maintenance, spill prevention and response, vehicle traffic control, and proper materials handling. Once a plan has been developed the facility will employ the control measures determined to be adequate to achieve the benchmark values discussed above. The facility will conduct monitoring and inspections of the BMPs to ensure they are working properly and re-evaluate any BMP not achieving compliance with permitting requirements. For example, if sample results from an outfall show values of TSS above the benchmark value, the BMP being employed is deficient in controlling stormwater pollution. Corrective action should be taken to repair, improve, or replace the failing BMP. This internal evaluation is required at least once per month but should be continued more frequently if BMPs continue to fail. If failures do occur, continue this trial and error process until appropriate BMPs have been established.

For new, altered, or expanded stormwater discharges, the SWPPP shall identify reasonable and effective BMPs while accounting for environmental impacts of varying control methods. The antidegradation analysis must document why no discharge or no exposure options are not feasible. The selection and documentation of appropriate control measures shall serve as an alternative analysis of technology and fulfill the requirements of antidegradation [10 CSR 20-7.031(3)]. For further guidance, consult the antidegradation implementation procedure (http://dnr.mo.gov/env/wpp/docs/AIP050212.pdf).

Alternative Analysis (AA) evaluation of the BMPs is a structured evaluation of BMPs that are reasonable and cost effective. The AA evaluation should include practices that are designed to be: 1) non-degrading; 2) less degrading; or 3) degrading water quality. The glossary of AIP defines these three terms. The chosen BMP will be the most reasonable and effective management strategy while ensuring the highest statutory and regulatory requirements are achieved and the highest quality water attainable for the facility is discharged. The AA evaluation must demonstrate why "no discharge" or "no exposure" is not a feasible alternative at the facility. This structured analysis of BMPs serves as the antidegradation review, fulfilling the requirements of 10 CSR 20-7.031(3) Water Quality Standards and *Antidegradation Implementation Procedure* (AIP), Section II.B.

If parameter-specific numeric exceedances continue to occur and the permittee feels there are no practicable or cost-effective BMPs which will sufficiently reduce a pollutant concentration in the discharge to the benchmark values established in the permit, the permittee can submit a request to re-evaluate the benchmark values. This request needs to include 1) a detailed explanation of why the facility is unable to comply with the permit conditions and unable to establish BMPs to achieve the benchmark values; 2) financial data of the company and documentation of cost associated with BMPs for review and 3) the SWPPP, which should contain adequate documentation of BMPs employed, failed BMPs, corrective actions, and all other required information. This will allow the Department to conduct a cost analysis on control measures and actions taken by the facility to determine cost-effectiveness of BMPs. The request shall be submitted in the form of an operating permit modification; the application is found at: http://dnr.mo.gov/forms/index.html.

✓ 10 CSR 20-6.200 and 40 CFR 122.26(b)(14)(ix) includes treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated to the disposal of sewage sludge that is located within the confines of the facility, with a design flow of 1.0 MGD or more, or are required to have an approved pretreatment program under 40 CFR part 403, as an industrial activity in which permit coverage is required. In lieu of requiring sampling in the site-specific permit, the facility is required to develop and implement a Stormwater Pollution Prevention Plan (SWPPP).

A facility can apply for conditional exclusion for "no exposure" of industrial activities and materials to stormwater by submitting a permit modification via Form B2 (http://dnr.mo.gov/forms/780-1805-f.pdf) appropriate application filing fees and a completed No Exposure Certification for Exclusion from NPDES Stormwater Permitting under Missouri Clean Water Law (https://dnr.mo.gov/forms/780-2828-f.pdf) to the Department's Water Protection Program, Operating Permits Section. Upon approval of the No Exposure Certification, the permit will be modified and the Special Condition to develop and implement a SWPPP will be removed.

VARIANCE:
As per the Missouri Clean Water Law § 644.061.4, variances shall be granted for such period of time and under such terms and conditions as shall be specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law §§644.006 to 644.141 or any standard, rule or regulation promulgated pursuant to Missouri Clean Water Law §§644.006 to 644.141.

✓ This operating permit is not drafted under premises of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITS:
As per [10 CSR 20-2.010(86)], the amount of pollutant each discharger is allowed by the Department to release into a given stream after the Department has determined total amount of pollutant that may be discharged into that stream without endangering its water quality.

✓ Wasteload allocations were calculated where applicable using water quality criteria or water quality model results and the dilution equation below:

$$Ce = \frac{(Qe + Qs)C - (Qs \times Cs)}{(Qe)} \quad \text{(EPA/505/2-90-001, Section 4.5.5)}$$

Where C = downstream concentration | Ce = effluent concentration
Cs = upstream concentration | Qe = effluent flow
Qs = upstream flow

Chronic wasteload allocations were determined using applicable chronic water quality criteria (CCC: criteria continuous concentration) and stream volume of flow at the edge of the mixing zone (MZ). Acute wasteload allocations were determined using applicable water quality criteria (CMC: criteria maximum concentration) and stream volume of flow at the edge of the zone of initial dilution (ZID).

Water quality based maximum daily and average monthly effluent limitations were calculated using methods and procedures outlined in USEPA's "Technical Support Document For Water Quality-based Toxics Control" (EPA/505/2-90-001).

Number of Samples "n":
Additionally, in accordance with the TSD for water quality-based permitting, effluent quality is determined by the underlying distribution of daily values, which is determined by the Long Term Average (LTA) associated with a particular Wasteload Allocation (WLA) and by the Coefficient of Variation (CV) of the effluent concentrations. Increasing or decreasing the monitoring frequency does not affect this underlying distribution or treatment performance, which should be, at a minimum, be targeted to comply with the values dictated by the WLA. Therefore, it is recommended that the actual planned frequency of monitoring normally be used to determine the value of "n" for calculating the AML. However, in situations where monitoring frequency is once per month or less, a higher value for "n" must be assumed for AML derivation purposes. Thus, the statistical procedure being employed using an assumed number of samples is "n = 4" at a minimum. For Total Ammonia as Nitrogen, "n = 30" is used.

WLA MODELING:
There are two general types of effluent limitations, technology-based effluent limits (TBELs) and water quality based effluent limits (WQBELs). If TBELs do not provide adequate protection for the receiving waters, then WQBEL must be used.

✓ A WLA study was either not submitted or determined not applicable by Department staff.

WHOLE EFFLUENT TOXICITY (WET) TEST:
A WET test is a quantifiable method of determining if a discharge from a facility may be causing toxicity to aquatic life by itself, in combination with or through synergistic responses when mixed with receiving stream water.

Under the federal Clean Water Act (CWA) §101(a)(3), requiring WET testing is reasonably appropriate for site-specific Missouri State Operating Permits for discharges to waters of the state issued under the National Pollutant Discharge Elimination System (NPDES). WET testing is also required by 40 CFR 122.44(d)(1). WET testing ensures that the provisions in the 10 CSR 20-6.010(8)(A) and the Water Quality Standards 10 CSR 20-7.031(4)(D),(F),(G),(J)2.A & B are being met. Under [10 CSR 20-6.010(8)(B)], the Department may require other terms and conditions that it deems necessary to assure compliance with the Clean Water Act and related regulations of the Missouri Clean Water Commission. In addition the following MCWL apply: §§§644.051.3 requires the Department to set permit conditions that comply with the MCWL and CWA; 644.051.4 specifically references toxicity as an item we must consider in writing permits (along with water quality-based effluent limits, pretreatment, etc…); and 644.051.5 is the basic authority to require testing conditions. WET test will be required by facilities meeting the following criteria:

- ☒ Facility is a designated Major.
- ☐ Facility continuously or routinely exceeds its design flow.
- ☐ Facility that exceeds its design population equivalent (PE) for BOD_5 whether or not its design flow is being exceeded.
- ☐ Facility (whether primarily domestic or industrial) that alters its production process throughout the year.
- ☐ Facility handles large quantities of toxic substances, or substances that are toxic in large amounts.
- ☐ Facility has Water Quality-based Effluent Limitations for toxic substances (other than NH_3)
- ☒ Facility is a municipality with a Design Flow ≥ 22,500 gpd.
- ☐ Other – please justify.

✓ The permittee is required to conduct WET test for this facility.

40 CFR 122.41(M) - BYPASSES:
The federal Clean Water Act (CWA), Section 402 prohibits wastewater dischargers from "bypassing" untreated or partially treated sewage (wastewater) beyond the headworks. A bypass is defined as an intentional diversion of waste streams from any portion of a treatment facility, [40 CFR 122.41(m)(1)(i)]. Additionally, Missouri regulation 10 CSR 20-7.015(9)(G) states a bypass means the intentional diversion of waste streams from any portion of a treatment facility, except in the case of blending, to waters of the state. Only under exceptional and specified limitations do the federal regulations allow for a facility to bypass some or all of the flow from its treatment process. Bypasses are prohibited by the CWA unless a permittee can meet all of the criteria listed in 40 CFR 122.41(m)(4)(i)(A), (B), & (C). Any bypasses from this facility are subject to the reporting required in 40 CFR 122.41(l)(6) and per Missouri's Standard Conditions I, Section B, part 2.b. Additionally, Anticipated Bypasses include bypasses from peak flow basins or similar devices designed for peak wet weather flows.

✓ This facility does not anticipate bypassing.

303(d) LIST & TOTAL MAXIMUM DAILY LOAD (TMDL):
Section 303(d) of the federal Clean Water Act requires that each state identify waters that are not meeting water quality standards and for which adequate water pollution controls have not been required. Water quality standards protect such beneficial uses of water as whole body contact (such as swimming), maintaining fish and other aquatic life, and providing drinking water for people, livestock and wildlife. The 303(d) list helps state and federal agencies keep track of waters that are impaired but not addressed by normal water pollution control programs.

A TMDL is a calculation of the maximum amount of a given pollutant that a body of water can absorb before its water quality is affected. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan will be developed that shall include the TMDL calculation

✓ This facility does not discharge to a 303(d) listed stream or to a stream with an EPA approved TMDL.

Part VI – Effluent Limits Determination

OUTFALL #001 – MAIN FACILITY OUTFALL

Effluent limitations derived and established in the below Effluent Limitations Table are based on current operations of the facility. Future permit action due to facility modification may contain new operating permit terms and conditions that supersede the terms and conditions, including effluent limitations, of this operating permit.

EFFLUENT LIMITATIONS TABLE:

PARAMETER	Unit	Basis for Limits	Daily Maximum	Weekly Average	Monthly Average	Previous Permit Limit	Sampling Frequency	Reporting Frequency	Sample Type ****
Flow	MGD	1	*		*	*/*	1/weekday	monthly	T
BOD_5	mg/L	1		45	30	45/30	1/month	monthly	C
TSS	mg/L	1		45	30	45/30	1/month	monthly	C
*Escherichia coli***	#/100mL	1, 3		1,030	206	1,030/206	1/month	monthly	G
Ammonia as N (January) (February) (March) (April) (May) (June) (July) (August) (September) (October) (November) (December)	mg/L	2, 3	 * * * * * 33.7 33.7 33.7 40.1 * * *		 * * * * * 4.2 3.5 3.7 5.5 * * *	Apr – Sep: 11.5/2.5 Oct - Mar: 12.4/3.0	1/month	monthly	C
Total Phosphorus	mg/L	1	*		*	*/*	1/month	monthly	C
Total Kjeldahl Nitrogen	mg/L	1	*		*	*/*	1/month	monthly	C
Nitrite + Nitrate	mg/L	1	*		*	*/*	1/month	monthly	C
Oil & Grease	mg/L	7	*		*	15/10	1/quarter	quarterly	G
Acute Whole Effluent Toxicity	TUa	1, 9	*			Pass/ Fail	1/year	annually	C
Chronic Whole Effluent Toxicity	TUc	1, 9	*			***	1/permit cycle	1/permit cycle	C
PARAMETER	Unit	Basis for Limits	Minimum		Maximum	Previous Permit Limit	Sampling Frequency	Reporting Frequency	Sample Type
pH	SU	1	6.0		9.0	6.0-9.0	1/month	monthly	G
PARAMETER	Unit	Basis for Limits	Daily Minimum		Monthly Avg. Min	Previous Permit Limit	Sampling Frequency	Reporting Frequency	Sample Type
BOD_5 Percent Removal	%	1			85	85	1/month	monthly	M
TSS Percent Removal	%	1			85	85	1/month	monthly	M

* - Monitoring requirement only.
** - #/100mL; the Monthly Average for *E. coli* is a geometric mean.
*** - Parameter not previously established in previous state operating permit.

**** - C = 24-hour composite
G = Grab
T = 24-hr. total
M = Measured/calculated

Basis for Limitations Codes:

1. State or Federal Regulation/Law
2. Water Quality Standard (includes RPA)
3. Water Quality Based Effluent Limits
4. Antidegradation Review
5. Antidegradation Policy
6. Water Quality Model
7. Best Professional Judgment
8. TMDL or Permit in lieu of TMDL
9. WET Test Policy
10. Multiple Discharger Variance
11. Nutrient Criteria Implementation Plan

OUTFALL #001 – DERIVATION AND DISCUSSION OF LIMITS:

- **Flow**. In accordance with [40 CFR Part 122.44(i)(1)(ii)] the volume of effluent discharged from each outfall is needed to assure compliance with permitted effluent limitations. If the permittee is unable to obtain effluent flow, then it is the responsibility of the permittee to inform the Department, which may require the submittal of an operating permit modification.

- **Biochemical Oxygen Demand (BOD_5)**. Operating permit retains 45 mg/L as a Weekly Average and 30 mg/L as a Monthly Average from the previous permit. Effluent limits were established in accordance with 10 CSR 20-7.015(8) for discharges to All Other Waters.

- **Total Suspended Solids (TSS)**. Operating permit retains 45 mg/L as a Weekly Average and 30 mg/L as a Monthly Average from the previous permit. Effluent limits were established in accordance with 10 CSR 20-7.015(8) for discharges to All Other Waters.

- ***Escherichia coli (E. coli)***. Monthly average of 206 per 100 mL as a geometric mean and Weekly Average of 1,030 per 100 mL as a geometric mean during the recreational season (April 1 – October 31), for discharges within two miles upstream of segments or lakes with Whole Body Contact Recreation (B) designated use of the receiving stream, as per 10 CSR 20-7.015(9)(B). An effluent limit for both monthly average and weekly average is required by 40 CFR 122.45(d). The Geometric Mean is calculated by multiplying all of the data points and then taking the nth root of this product, where n = # of samples collected. For example: Five *E. coli* samples were collected with results of 1, 4, 6, 10, and 5 (#/100mL). Geometric Mean = 5^{th} root of (1)(4)(6)(10)(5) = 5^{th} root of 1,200 = 4.1 #/100mL.

- **Total Ammonia Nitrogen**. Early Life Stages Present Total Ammonia Nitrogen criteria apply [10 CSR 20-7.031(5)(B)7.C. & Table B3]. Background total ammonia nitrogen = 0.01 mg/L.

  The Department previously followed the 2007 Ammonia Guidance method for derivation of ammonia limits. However, the EPA's Technical Support Document for Water Quality-based Toxic Controls (TSD) establishes other alternatives to limit derivation. The Department has determined that the approach established in Section 5.4.2 of the TSD, which allows for direct application of both the acute and chronic wasteload allocations (WLA) as permit limits for toxic pollutants, is more appropriate limit derivation approach. Using this method for a discharge to a waterbody where mixing is not allowed, the criterion continuous concentration (CCC) and the criterion maximum concentration (CMC) will equal the chronic and acute WLA respectively. The WLAs are then applied as effluent limits, per Section 5.4.2 of the TSD, where the CMC is the Daily Maximum and the CCC is the Monthly Average. The direct application of both acute and chronic criteria as WLA is also applicable for facilities that discharge into receiving waterbodies with mixing considerations. The CCC and CMC will need to be calculated into WLA with mixing considerations using the mass-balance equation:

$$Ce = \frac{(Qe + Qs)C - (Qs \times Cs)}{(Qe)}$$

Where C = downstream concentration; Ce = effluent concentration
Cs = upstream concentration; Qe = effluent flow
Qs = upstream flow

In the event that mixing considerations derive an AML less stringent than the MDL, the AML and MDL will be equal and based on the MDL.

Month	Temp (°C)*	Mixed ZID pH (SU)**	Mixed MZ pH (SU)**	Total Ammonia Nitrogen CCC (mg/L)	Total Ammonia Nitrogen CMC (mg/L)
January	2.3	7.4	7.5	4.3	23.0
February	2.7	7.2	7.3	5.0	29.5
March	9.1	6.9	7.1	5.6	39.2
April	15.8	7.0	7.2	4.9	36.1
May	20.3	7.1	7.3	3.5	32.9
June	26.0	7.1	7.3	2.4	32.9
July	28.8	7.1	7.3	2.0	32.9
August	28.1	7.1	7.3	2.1	32.9
September	23.6	6.9	7.1	3.2	39.2
October	16.1	7.4	7.5	3.9	23.0
November	10.3	7.5	7.6	3.9	19.9
December	4.0	7.4	7.5	4.3	23.0

* Ecoregion data (Western Corn Belt Plains)
** A mixing zone study was submitted by HDR, Inc. on August 27, 2020. The recommended pH values from the study were used in these calculations.

January – May; October - December
Monitoring only for months of January, February, March, April, May, October, November, and December. The reasonable potential analysis determined that Ammonia in this facility's discharge is unlikely to exceed water quality standards for Ammonia in the above designated months.

June
Chronic WLA:
$C_e = ((1.74 + 1.305)2.4 – (1.305 * 0.015))/1.74 = 4.2$ mg/L

Acute WLA:
$C_e = ((1.74 + 0.044)32.9 – (0.044 * 0.015))/1.74 = 33.7$ mg/L

Chronic WLA = AML = **4.2** mg/L
Acute WLA = MDL = **33.7** mg/L

July
Chronic WLA:
$C_e = ((1.74 + 1.305)2.4 – (1.305 * 0.015))/1.74 = 3.5$ mg/L

Acute WLA:
$C_e = ((1.74 + 0.044)32.9 – (0.044 * 0.015))/1.74 = 33.7$ mg/L

Chronic WLA = AML = **3.5** mg/L
Acute WLA = MDL = **33.7** mg/L

August
Chronic WLA:
$C_e = ((1.74 + 1.305)2.1 – (1.305 * 0.015))/1.74 = 3.7$ mg/L

Acute WLA:
$C_e = ((1.74 + 0.044)32.9 – (0.044 * 0.015))/1.74 = 33.7$ mg/L

Chronic WLA = AML = **3.7** mg/L
Acute WLA = MDL = **33.7** mg/L

September
Chronic WLA:
$C_e = ((1.74 + 1.305)3.2 – (1.305 * 0.015))/1.74 = 5.5$ mg/L

Acute WLA:
$C_e = ((1.74 + 0.044)39.2 – (0.044 * 0.015))/1.74 = 40.1$ mg/L

Chronic WLA = AML = **5.5** mg/L
Acute WLA = MDL = **40.1** mg/L

- **Oil & Grease**. Conventional pollutant, monitoring only for protection of aquatic life.

- **Total Phosphorus and Total Nitrogen (Speciated)**. Effluent monitoring for Total Phosphorus, Total Kjeldahl Nitrogen, and Nitrite + Nitrate are required per 10 CSR 20-7.015(9)(D)8.

- **pH**. 6.0-9.0 SU. pH limitations [10 CSR 20-7.015] are protective of the water quality standard [10 CSR 20-7.031(5)(E)], due to the assimilative capacity of the receiving stream.

- **Biochemical Oxygen Demand (BOD_5) Percent Removal**. In accordance with 40 CFR Part 133, removal efficiency is a method by which the Federal Regulations define Secondary Treatment and Equivalent to Secondary Treatment, which applies to BOD_5 and TSS for Publicly Owned Treatment Works (POTWs)/municipals. This facility is required to meet 85% removal efficiency for BOD_5.

- **Total Suspended Solids (TSS) Percent Removal**. In accordance with 40 CFR Part 133, removal efficiency is a method by which the Federal Regulations define Secondary Treatment and Equivalent to Secondary Treatment, which applies to BOD_5 and TSS for Publicly Owned Treatment Works (POTWs)/municipals. This facility is required to meet 85% removal efficiency for TSS.

Whole Effluent Toxicity

- **Acute Whole Effluent Toxicity**. Monitoring requirement only. Monitoring is required to determine if reasonable potential exists for this facility's discharge to exceed water quality standards.

  ✓ Classified P with other than default Mixing Considerations, the AEC% is determined as follows:

  Acute AEC% = $\{[(1.74 + 0.07475) / 1.74]^{-1}\} \times 100 =$ **96%**

- **Chronic Whole Effluent Toxicity**. Monitoring requirement only. Monitoring is required to determine if reasonable potential exists for this facility's discharge to exceed water quality standards.

  - Classified P with other than default Mixing Considerations, the AEC% is determined as follows:

    Chronic AEC% = $\{[(1.74 + 0.7475) / 1.74]^{-1}\} \times 100 =$ **70%**

Parameters Removed.

- **Instream Total Phosphorus and Total Nitrogen Monitoring**. The previous permit contained upstream instream monitoring requirements for Total Phosphorus and Total Nitrogen. The Department has made a determination that monitoring of background nutrients is not needed. This permit is still protective of water quality and this determination will be reassessed at the time of renewal.

Sampling Frequency Justification: The Department has determined that previously established sampling and reporting frequency is sufficient to characterize the facility's effluent and be protective of water quality. Weekly sampling is required for *E. coli*, per 10 CSR 20-7.015(9)(D)7.A.

WET Test Sampling Frequency Justification. WET Testing schedules and intervals are established in accordance with the Department's Permit Manual; Section 5.2 *Effluent Limits / WET Testing for Compliance Bio-monitoring.* It is recommended that WET testing be conducted during the period of lowest stream flow.

Acute Whole Effluent Toxicity

✓ No less than ONCE/YEAR:
- Facility is designated as a Major facility or has a design flow ≥ 1.0 MGD.

Chronic Whole Effluent Toxicity

✓ No less than ONCE/PERMIT CYCLE:
- POTW facilities with a design flow of greater than 1.0 million gallons per day, but less than 10 million gallons per day, shall conduct and submit to the Department a chronic WET test no less than once per five years. No less than

Sampling Type Justification: As per 10 CSR 20-7.015, samples collected for mechanical plants shall be a 24 hour modified composite sample. Grab samples, however, must be collected for pH, *E. coli*, and Oil & Grease accordance with recommended analytical methods. For further information on sampling and testing methods please review 10 CSR 20-7.015(9)(D) 2.

PERMITTED FEATURE INF – INFLUENT MONITORING

The monitoring requirements established in the below Monitoring Requirements Table are based on current operations of the facility. Future permit action due to facility modification may contain new operating permit terms and conditions that supersede the terms and conditions, including the monitoring requirements listed in this table.

INFLUENT MONITORING TABLE:

PARAMETER	Unit	Basis for Limits	Daily Maximum	Weekly Average	Monthly Average	Previous Permit Limit	Sampling Frequency	Reporting Frequency	Sample Type ****
BOD_5	mg/L	1			*	***	1/month	monthly	C
TSS	mg/L	1			*	***	1/month	monthly	C
Ammonia as N	mg/L	1	*		*	***	1/month	monthly	C
Total Phosphorus	mg/L	1	*		*	***	1/month	monthly	C
Total Kjeldahl Nitrogen	mg/L	1	*		*	***	1/month	monthly	C
Nitrite + Nitrate	mg/L	1	*		*	***	1/month	monthly	C

* - Monitoring requirement only.
**** - C = Composite
*** - Parameter not previously established in previous state operating permit

Basis for Limitations Codes:

1. State or Federal Regulation/Law
2. Water Quality Standard (includes RPA)
3. Water Quality Based Effluent Limits
4. Antidegradation Review
5. Antidegradation Policy
6. Water Quality Model
7. Best Professional Judgment
8. TMDL or Permit in lieu of TMDL
9. WET Test Policy
10. Multiple Discharger Variance
11. Nutrient Criteria Implementation Plan

Influent Parameters

- **Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS)**. An influent sample is required to determine the removal efficiency. In accordance with 40 CFR Part 133, removal efficiency is a method by which the Federal Regulations define Secondary Treatment and Equivalent to Secondary Treatment, which applies to BOD_5 and TSS for Publicly Owned Treatment Works (POTWs)/municipals.

- **Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia**. Influent monitoring for Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia required per 10 CSR 20-7.015(9)(D)8.

Sampling Frequency Justification: The sampling and reporting frequencies for Total Phosphorus and Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia parameters were established to match the required sampling frequency of these parameters in the effluent, per [10 CSR 20-7.015(9)(D)8.]. The sampling and reporting frequencies for influent BOD_5 and TSS have been established to match the required sampling frequency of these parameters in the effluent.

Sampling Type Justification: Sample types for influent parameters were established to match the required sampling type of these parameters in the effluent. Samples should be analyzed as soon as possible after collection and/or properly preserved according to method requirements.

OUTFALL #001 – GENERAL CRITERIA CONSIDERATIONS:
In accordance with 40 CFR 122.44(d)(1), effluent limitations shall be placed into the permit for those pollutants which have been determined to cause, have the reasonable potential to cause, or contribute to an excursion above any State water quality standard, including State narrative criteria for water quality. The rule further states that pollutants which have been determined to cause, have the reasonable potential to cause, or contribute to an excursion above a narrative criterion within an applicable State water quality standard, the permit shall contain a numeric effluent limitation to protect that narrative criterion. In order to comply with this regulation, the permit writer will complete reasonable potential determinations on whether the discharge will violate any of the general criteria listed in 10 CSR 20-7.031(4). These specific requirements are listed below followed by derivation and discussion (the lettering matches that of the rule itself, under 10 CSR 20-7.031(4)). It should also be noted that Section 644.076.1, RSMo as well as Section D – Administrative Requirements of Standard Conditions Part I of this permit states that it shall be unlawful for any person to cause or permit any discharge of water contaminants from any water contaminant or point source located in Missouri that is in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law or any standard, rule or regulation promulgated by the commission.

(A) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses. The discharge from this facility is made up of treated domestic wastewater. Based upon review of the Report of Compliance Inspection for the inspection conducted on August 7, 2018, no evidence of an excursion of this criterion has been observed by the Department in the past and the facility has not disclosed any other information related to the characteristics of the discharge on their permit application which has the potential to cause or contribute to an excursion of this narrative criterion. Additionally, this facility utilizes secondary treatment technology and is currently in compliance with secondary treatment technology based effluent limits established in 40 CFR 133 and there has been no indication to the Department that the stream has had issues maintaining beneficial uses as a result of this discharge. Based on the information reviewed during the drafting of this permit, these final effluent limitations appear to have protected against the excursion of this criterion in the past. Therefore, the discharge does not have the reasonable potential to cause or contribute to an excursion of this criterion.
(B) Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses. Please see (A) above as justification is the same.
(C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses. Please see (A) above as justification is the same.
(D) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life. This permit contains final effluent limitations which are protective of both acute and chronic toxicity for various pollutants that are either expected to be discharged by domestic wastewater facilities or that were disclosed by this facility on the application for permit coverage. Based on the information reviewed during the drafting of this permit, it has been determined if the facility meets final effluent limitations established in this permit, there is no reasonable potential for the discharge to cause an excursion of this criterion.
(E) Waters shall provide for the attainment and maintenance of water quality standards downstream including waters of another state. Please see (D) above as justification is the same.
(F) There shall be no significant human health hazard from incidental contact with the water. Please see (D) above as justification is the same.
(G) There shall be no acute toxicity to livestock or wildlife watering. Please see (D) above as justification is the same.
(H) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community. Please see (A) above as justification is the same.
(I) Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid Waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted

pursuant to section 260.200-260.247. The discharge from this facility is made up of treated domestic wastewater. No evidence of an excursion of this criterion has been observed by the Department in the past and the facility has not disclosed any other information related to the characteristics of the discharge on their permit application which has the potential to cause or contribute to an excursion of this narrative criterion. Additionally, any solid wastes received or produced at this facility are wholly contained in appropriate storage facilities, are not discharged, and are disposed of offsite. This discharge is subject to Standard Conditions Part III, which contains requirements for the management and disposal of sludge to prevent its discharge. Therefore, this discharge does not have reasonable potential to cause or contribute to an excursion of this criterion.

Part VII – Cost Analysis for Compliance

Pursuant to Section 644.145, RSMo, when issuing permits under this chapter that incorporate a new requirement for discharges from publicly owned combined or separate sanitary or storm sewer systems or publicly owned treatment works, or when enforcing provisions of this chapter or the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., pertaining to any portion of a publicly owned combined or separate sanitary or storm sewer system or [publicly owned] treatment works, the Department of Natural Resources shall make a "finding of affordability" on the costs to be incurred and the impact of any rate changes on ratepayers upon which to base such permits and decisions, to the extent allowable under this chapter and the Federal Water Pollution Control Act. This process is completed through a cost analysis for compliance. Permits that do not include new requirements may be deemed affordable.

✓ The Department is required to determine "findings of affordability" because the permit applies to a combined or separate sanitary sewer system for a publicly-owned treatment works.

Cost Analysis for Compliance - The Department has made a reasonable search for empirical data indicating the permit is affordable. The search consisted of a review of Department records that might contain economic data on the community, a review of information provided by the applicant as part of the application, and public comments received in response to public notices of this draft permit. If the empirical cost data was used by the permit writer, this data may consist of median household income, any other ongoing projects that the Department has knowledge, and other demographic financial information that the community provided as contemplated by Section 644. 145.3.

The following table summarizes the results of the cost analysis. See **Appendix – Cost Analysis for Compliance** for detailed information.

Summary Table. Cost Analysis for Compliance Summary for the City of Smithville

New Permit Requirements			
Monthly influent sampling for Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia as N; and increased effluent sampling (quarterly to monthly) for Total Phosphorus, Total Kjeldahl Nitrogen, and Nitrite + Nitrate			
Estimated Annual Cost	Annual Median Household Income (MHI)	Estimated Monthly User Rate	User Rate as a Percent of MHI
$2,180	$80,470	$37.30	0.56%

Part VIII – Administrative Requirements

On the basis of preliminary staff review and the application of applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the operating permit. The proposed determinations are tentative pending public comment.

WATER QUALITY STANDARD REVISION:
In accordance with section 644.058, RSMo, the Department is required to utilize an evaluation of the environmental and economic impacts of modifications to water quality standards of twenty-five percent or more when making individual site-specific permit decisions.

✓ This operating permit does not contain requirements for a water quality standard that has changed twenty-five percent or more since the previous operating permit.

PERMIT SYNCHRONIZATION:
The Department of Natural Resources is currently undergoing a synchronization process for operating permits. Permits are normally issued on a five-year term, but to achieve synchronization many permits will need to be issued for less than the full five years allowed by regulation. The intent is that all permits within a watershed will move through the Watershed Based Management (WBM) cycle together will all expire in the same fiscal year. This will allow further streamlining by placing multiple permits within a smaller geographic area on public notice simultaneously, thereby reducing repeated administrative efforts. This will also allow the Department to explore a watershed based permitting effort at some point in the future. Renewal applications must continue to be submitted within 180 days of expiration, however, in instances where effluent data from the previous renewal is less than 4 years old, that data may be re-submitted to meet the requirements of the renewal application. If the permit provides a schedule of compliance for meeting new water quality based effluent limits beyond the expiration date of the permit, the time remaining in the schedule of compliance will be allotted in the renewed permit. With permit synchronization, this permit will expire in the 2nd Quarter of calendar year 2025.

PUBLIC NOTICE:
The Department shall give public notice that a draft permit has been prepared and its issuance is pending. Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest in and water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and permittee must be notified of the denial in writing. The Department must issue public notice of a pending operating permit or of a new or reissued statewide general permit. The public comment period is the length of time not less than 30 days following the date of the public notice which interested persons may submit written comments about the proposed permit. For persons wanting to submit comments regarding this proposed operating permit, then please refer to the Public Notice page located at the front of this draft operating permit. The Public Notice page gives direction on how and where to submit appropriate comments.

✓ The Public Notice period for this operating permit was from October 15, 2020 to November 16, 2020. No comments received.

DATE OF FACT SHEET: SEPTEMBER 2, 2020

COMPLETED BY:

**ASHLEY KEELY, ENVIRONMENTAL SPECIALIST III
MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
OPERATING PERMITS SECTION - DOMESTIC WASTEWATER UNIT
(573) 751-7326
ASHLEY.KEELY@DNR.MO.GOV**

Appendices

APPENDIX - CLASSIFICATION WORKSHEET:

Item	Points Possible	Points Assigned
Maximum Population Equivalent (P.E.) served , peak day	1 pt./10,000 PE or major fraction thereof. (Max 10 pts.)	1
Design Flow (avg. day) or peak month's flow (avg. day) whichever is larger	1 pt. / MGD or major fraction thereof. (Max 10 pts.)	3
Effluent Discharge		
Missouri or Mississippi River	0	
All other stream discharges except to losing streams and stream reaches supporting whole body contact recreation	1	
Discharge to lake or reservoir outside of designated whole body contact recreational area	2	
Discharge to losing stream, or stream, lake or reservoir area supporting whole body contact recreation	3	3
Direct reuse or recycle of effluent	6	
Land Application/Irrigation		
Drip Irrigation	3	
Land application/irrigation	5	
Overland flow	4	
Variation in Raw Wastes (highest level only)		
Variations do not exceed those normally or typically expected	0	
Reoccurring deviations or excessive variations of 100 to 200 percent in strength and/or flow	2	2
Reoccurring deviations or excessive variations of more than 200 percent in strength and/or flow	4	
Department-approved pretreatment program	6	
Preliminary Treatment		
STEP systems (operated by the permittee)	3	
Screening and/or comminution	3	3
Grit removal	3	
Plant pumping of main flow	3	3
Flow equalization	5	
Primary Treatment		
Primary clarifiers	5	
Chemical addition (except chlorine, enzymes)	4	
Secondary Treatment		
Trickling filter and other fixed film media with or without secondary clarifiers	10	
Activated sludge (including aeration, oxidation ditches, sequencing batch reactors, membrane bioreactors, and contact stabilization)	15	15
Stabilization ponds without aeration	5	
Aerated lagoon	8	
Advanced Lagoon Treatment – Aerobic cells, anaerobic cells, covers, or fixed film	10	
Biological, physical, or chemical	12	
Carbon regeneration	4	
Total from page **ONE (1)**	----	30

APPENDIX - CLASSIFICATION WORKSHEET (CONTINUED):

ITEM	POINTS POSSIBLE	POINTS ASSIGNED
Solids Handling		
Sludge Holding	5	
Anaerobic digestion	10	
Aerobic digestion	6	6
Evaporative sludge drying	2	
Mechanical dewatering	8	
Solids reduction (incineration, wet oxidation)	12	
Land application	6	6
Disinfection		
Chlorination or comparable	5	
On-site generation of disinfectant (except UV light)	5	
Dechlorination	2	
UV light	4	4
Required Laboratory Control Performed by Plant Personnel (highest level only)		
Lab work done outside the plant	0	
Push – button or visual methods for simple test such as pH, settleable solids	3	
Additional procedures such as DO, COD, BOD, titrations, solids, volatile content	5	5
More advanced determinations, such as BOD seeding procedures, fecal coliform, nutrients, total oils, phenols, etc.	7	
Highly sophisticated instrumentation, such as atomic absorption and gas chromatograph	10	
Total from page **TWO (2)**	----	21
Total from page **ONE (1)**	---	30
Grand Total	---	51

☐ - A: 71 points and greater
☒ - B: 51 points – 70 points
☐ - C: 26 points – 50 points
☐ - D: 0 points – 25 points

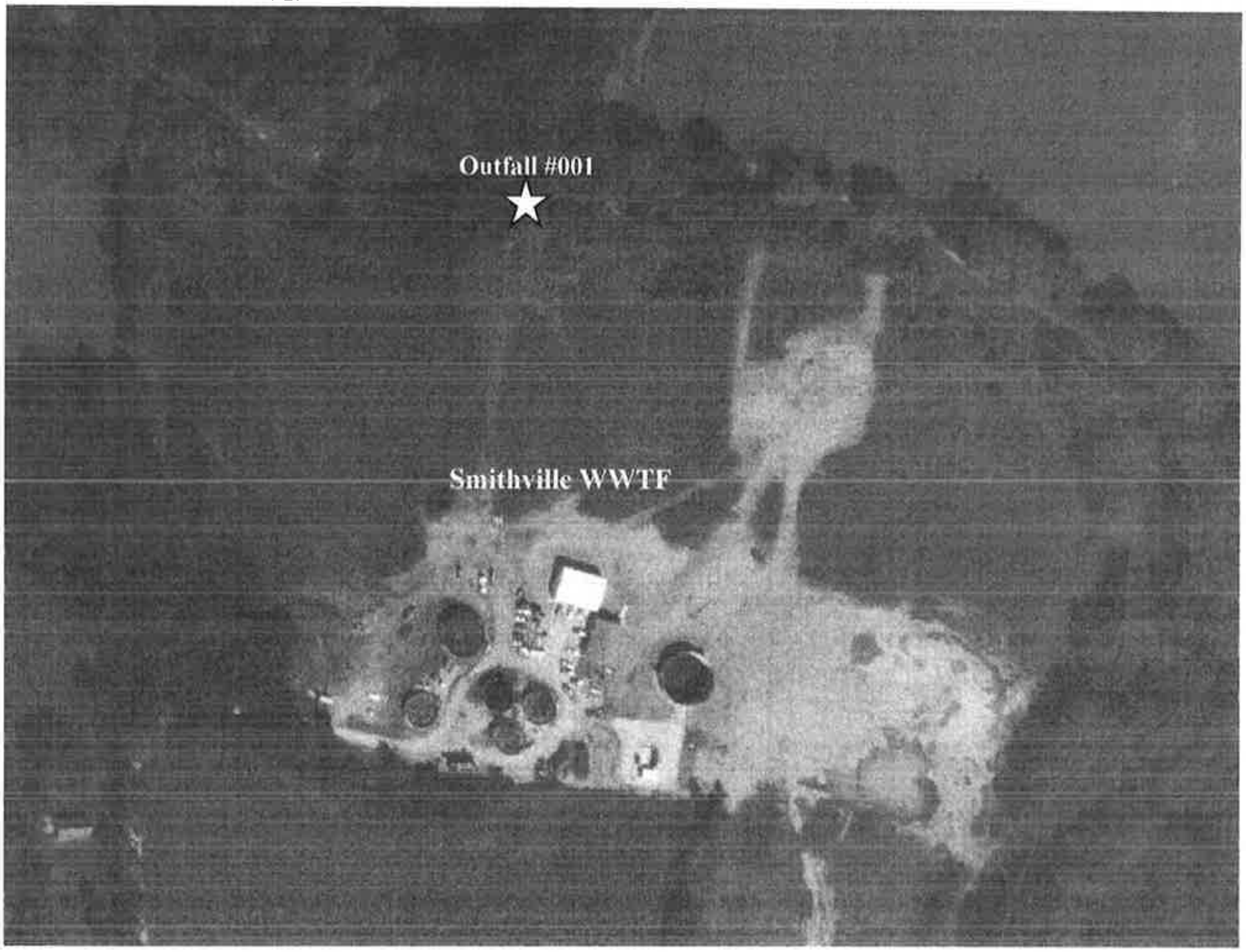
APPENDIX – RPA RESULTS:

Parameter	CMC*	RWC Acute*	CCC*	RWC Chronic*	n**	Range max/min	CV***	MF	RP Yes/No
Ammonia as N – January (mg/L)	23.0	0.46	4.3	0.33	4	0.1/0.05	0.60	4.70	NO
Ammonia as N – February (mg/L)	29.5	3.85	5.0	2.32	5	0.94/0.25	0.60	4.20	NO
Ammonia as N – March (mg/L)	39.2	3.99	5.6	2.40	4	0.87/0.05	0.60	4.70	NO
Ammonia as N – April (mg/L)	36.1	5.74	4.9	3.43	5	1.4/0.05	0.60	4.20	NO
Ammonia as N – May (mg/L)	32.9	3.78	3.5	2.28	5	0.923/0.05	0.60	4.20	NO
Ammonia as N – June (mg/L)	32.9	7.38	2.4	4.39	5	1.8/0.05	0.60	4.20	YES
Ammonia as N – July (mg/L)	32.9	9.63	2.0	5.71	4	2.1/0.05	0.60	4.70	YES
Ammonia as N – August (mg/L)	32.9	6.88	2.1	4.10	4	1.5/0.25	0.60	4.70	YES
Ammonia as N – September (mg/L)	39.2	9.17	3.2	5.44	4	2/0.05	0.60	4.70	YES
Ammonia as N – October (mg/L)	23.0	4.36	3.9	2.62	4	0.95/0.05	0.60	4.70	NO
Ammonia as N – November (mg/L)	19.9	5.05	3.9	3.02	4	1.1/0.05	0.60	4.70	NO
Ammonia as N – December (mg/L)	23.0	4.59	4.3	2.75	4	1/0.05	0.60	4.70	NO

N/A – Not Applicable
* - Units are (μg/L) unless otherwise noted.
** - If the number of samples is 10 or greater, then the CV value must be used in the WQBEL for the applicable constituent. If the number of samples is < 10, then the default CV value must be used in the WQBEL for the applicable constituent.
*** - Coefficient of Variation (CV) is calculated by dividing the Standard Deviation of the sample set by the Mean of the same sample set.
RWC – Receiving Water Concentration. It is the concentration of a toxicant or the parameter toxicity in the receiving water after mixing (if applicable).
n – Is the number of samples.
MF – Multiplying Factor. 99% Confidence Level and 99% Probability Basis.
RP – Reasonable Potential. It is where an effluent is projected or calculated to cause an excursion above a water quality standard based on a number of factors including, as a minimum, the four factors listed in 40 CFR 122.44(d)(1)(ii).

Reasonable Potential Analysis is conducted as per (TSD, EPA/505/2-90-001, Section 3.3.2). A more detailed version including calculations of this RPA is available upon request.

APPENDIX – ALTERNATIVE:



APPENDIX – COST ANALYSIS FOR COMPLIANCE:

Missouri Department of Natural Resources
Water Protection Program
Cost Analysis for Compliance
(In accordance with RSMo 644.145)

Smithville WWTF, Permit Renewal
City of Smithville
Missouri State Operating Permit #MO-0055204

Section 644.145 RSMo requires the Department of Natural Resources (Department) to make a "finding of affordability" when "issuing permits under" or "enforcing provisions of" state or federal clean water laws "pertaining to any portion of a combined or separate sanitary sewer system for publicly-owned treatment works." This cost analysis does not dictate how the permittee will comply with new permit requirements.

New Permit Requirements

The permit requires compliance with new influent monitoring requirements for Total Phosphorus, Total Kjeldahl Nitrogen, Nitrite + Nitrate, and Ammonia as N; and increased effluent sampling for Total Phosphorus, Total Kjeldahl Nitrogen, and Nitrite + Nitrate (quarterly to monthly).

Connections
The number of connections was obtained from the Department's fee tracking website.

Connection Type	Number
Residential	3,441
Commercial & Industrial	209
Total	**3,650**

Data Collection for this Analysis
This cost analysis is based on data available to the Department as provided by the permittee and data obtained from readily available sources. For the most accurate analysis, it is essential that the permittee provides the Department with current information about the City's financial and socioeconomic situation. The financial questionnaire available to permittees on the Department's website (http://dnr.mo.gov/forms/780-2511-f.pdf) is a required attachment to the permit renewal application. If the financial questionnaire is not submitted with the renewal application, the Department sends a request to complete the form with the welcome correspondence. Though the Department has made attempts to gather financial information from the City of Smithville; no information has been provided. The Department has relied heavily on readily available data to complete this analysis. If certain data was not provided by the permittee to the Department and the data is not obtainable through readily available sources, this analysis will state that the information is "unknown".

Eight Criteria of 644.145 RSMo
The Department must consider the eight (8) criteria presented in subsection 644.145 RSMo to evaluate the cost associated with new permit requirements.

(1) A community's financial capability and ability to raise or secure necessary funding;

Criterion 1 Table. Current Financial Information for the City of Smithville	
Current Monthly User Rates per 5,000 gallons*	$37.25
Median Household Income (MHI)[1]	$80,470
Current Annual Operating Costs (excludes depreciation)	Unknown

*User Rates were obtained from the 2020 Missouri Public Utility Alliance Water and Wastewater Rate Survey.

(2) Affordability of pollution control options for the individuals or households at or below the median household income level of the community;

The following tables outline the estimated costs of the new permit requirements:

Criterion 2A Table. Estimated Cost Breakdown of New Permit Requirements			
New Requirement	Frequency	Estimated Cost	Estimated Annual Cost
Total Phosphorus – Influent	Monthly	$24	$288
Total Kjeldahl Nitrogen – Influent	Monthly	$33	$396
Nitrate + Nitrite – Influent	Monthly	$40	$480
Ammonia – Influent	Monthly	$20	$240
Total Phosphorus – Effluent	Monthly	$24	$192
Total Kjeldahl Nitrogen – Effluent	Monthly	$33	$264
Nitrate + Nitrite – Effluent	Monthly	$40	$320
Total Estimated Annual Cost of New Permit Requirements			$2,180

Criterion 2B Table. Estimated Costs for New Permit Requirements		
(1)	Estimated Annual Cost	$2,180
(2)	Estimated Monthly User Cost for New Requirements [2]	$0.05
	Estimated Monthly User Cost for New Requirements as a Percent of MHI [3]	0.001%
(3)	Total Monthly User Cost*	$37.30
	Total Monthly User Cost as a Percent of MHI [4]	0.556%

* Current User Rate + Estimated Monthly Costs of New Sampling Requirements

Due to the minimal cost associated with new permit requirements, the Department anticipates an extremely low to no rate increase will be necessary, which could impact individuals or households of this community.

(3) An evaluation of the overall costs and environmental benefits of the control technologies;

This analysis is being conducted based on new requirements in the permit, which will not require the addition of new control technologies at the facility. However, the new sampling requirements are being established in order to provide data regarding the health of the receiving stream's aquatic life and to ensure that the existing permit limits are providing adequate protection of aquatic life. Improved wastewater provides benefits such as avoided health costs due to water-related illness, enhanced environmental ecosystem quality, and improved natural resources. The preservation of natural resources has been proven to increase the economic value and sustainability of the surrounding communities. Maintaining Missouri's water quality standards fulfills the goal of restoring and maintaining the chemical, physical, and biological integrity of the receiving stream; and, where attainable, it achieves a level of water quality that provides for the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water.

Nutrient Monitoring

Nutrients are mineral compounds that are required for organisms to grow and thrive. Of the six (6) elemental macronutrients, nitrogen and phosphorus are generally not readily available and limit growth of organisms. Excess nitrogen and phosphorus will cause a shift in the ecosystem's food web. Once excess nitrogen and phosphorus are introduced into a waterbody, some species' populations will dramatically increase, while other populations will not be able to sustain life. Competition and productivity are two factors in which nutrients can alter aquatic ecosystems and the designated uses of a waterbody. For example, designated uses, such as drinking water sources and recreational uses, become impaired when algal blooms take over a waterbody. These blooms can cause foul tastes and odors in the drinking water, unsightly appearance, and fish mortality in the waterbody. Some algae also produce toxins that may cause serious adverse health conditions such as liver damage, tumor promotion, paralysis, and kidney damage. The monitoring requirements for nitrogen and phosphorus have been added to the permit to provide data regarding the health of the receiving stream's aquatic life. A healthy ecosystem is beneficial as it provides reduced impacts on human and aquatic health as well as recreational opportunities.

(4) Inclusion of ongoing costs of operating and maintaining the existing wastewater collection and treatment system, including payments on outstanding debts for wastewater collection and treatment systems when calculating projected rates:

The community did not provide the Department with this information, nor could it be found through readily available data.

(5) An inclusion of ways to reduce economic impacts on distressed populations in the community, including but not limited to low and fixed income populations. This requirement includes but is not limited to:

(a) Allowing adequate time in implementation schedules to mitigate potential adverse impacts on distressed populations resulting from the costs of the improvements and taking into consideration local community economic considerations.
(b) Allowing for reasonable accommodations for regulated entities when inflexible standards and fines would impose a disproportionate financial hardship in light of the environmental benefits to be gained.

The following table characterizes the current overall socioeconomic condition of the community as compared to the overall socioeconomic condition of Missouri. The following information was compiled using the latest U.S. Census data.

Criterion 5 Table. Socioeconomic Data [1, 5-9] for the City of Smithville

No.	Administrative Unit	Smithville City	Missouri State	United States
1	Population (2018)	9,541	6,090,062	322,903,030
2	Percent Change in Population (2000-2018)	73.0%	8.8%	14.7%
3	2018 Median Household Income (in 2019 Dollars)	$80,470	$54,530	$61,385
4	Percent Change in Median Household Income (2000-2018)	-0.4%	-6.3%	-4.7%
5	Median Age (2018)	36.4	38.5	37.9
6	Change in Median Age in Years (2000-2018)	2.1	2.4	2.6
7	Unemployment Rate (2018)	7.0%	5.1%	5.9%
8	Percent of Population Below Poverty Level (2018)	5.2%	14.2%	14.1%
9	Percent of Household Received Food Stamps (2018)	5.5%	11.6%	12.2%
10	(Primary) County Where the Community Is Located	Clay County		

(6) An assessment of other community investments and operating costs relating to environmental improvements and public health protection;

The community did not report any other investments relating to environmental improvements.

(7) An assessment of factors set forth in the United States Environmental Protection Agency's guidance, including but not limited to the "Combined Sewer Overflow Guidance for Financial Capability Assessment and Schedule Development" that may ease the cost burdens of implementing wet weather control plans, including but not limited to small system considerations, the attainability of water quality standards, and the development of wet weather standards;

The new requirements associated with this permit will not impose a financial burden on the community, nor will they require the City of Smithville to seek funding from an outside source.

(8) An assessment of any other relevant local community economic conditions.

The community did not report any other relevant local economic conditions.

Conclusion and Finding
As a result of new regulations, the Department is proposing modifications to the current operating permit that may require the permittee to increase monitoring. The Department has considered the eight (8) criteria presented in subsection 644.145 RSMo to evaluate the cost associated with the new permit requirements.

This analysis examined whether the new sampling requirements affect the ability of an individual customer or household to pay a utility bill without undue hardship or unreasonable sacrifice in the essential lifestyle or spending patterns of the individual or household. After reviewing the above criteria, the Department finds that the new sampling requirements may result in a low burden with regard to the community's overall financial capability and a low financial impact for most individual customers/households; therefore, the new permit requirements are affordable.

References

1. (A) 2018 MHI in 2018 Dollar: United States Census Bureau. United States Census Bureau. 2014-2018 American Community Survey 5-Year Estimates, Table B19013: Median Household Income in the Past 12 Months (in 2018 Inflation-Adjusted Dollars). https://data.census.gov/cedsci/table?q=B19013&tid=ACSDT5Y2018.B19013&vintage=2018.
(B) 2000 MHI in 1999 Dollar: (1) For United States, United States Census Bureau (2003) 2000 Census of Population and Housing, Summary Social, Economic, and Housing Characteristics, PHC-2-1 Part 1. United States Summary, Table 5. Work Status and Income in 1999: 2000. Washington, DC. https://www.census.gov/prod/cen2000/phc-2-1-pt1.pdf. (2) For Missouri State, United States Census Bureau (2003) 2000 Census of Population and Housing, Summary Social, Economic, and Housing Characteristics, PHC-2-27, Missouri, Table 10. Work Status and Income in 1999: 2000, Washington, DC. https://www.census.gov/prod/cen2000/phc-2-27-pt1.pdf.
(C) 2019 CPI, 2018 CPI and 1999 CPI: U.S. Department of Labor Bureau of Labor Statistics (2019) Consumer Price Index - All Urban Consumers, U.S. City Average, All Items, 1982-84=100. http://data.bls.gov/timeseries/CUUR0000SA0?data_tool=Xgtable.
(D) 2018 MHI in 2019 Dollar = 2018 MHI in 2018 Dollar x 2019 CPI /2018 CPI; 2000 MHI in 2019 Dollar = 2000 MHI in 1999 Dollar x 2019 CPI /1999 CPI.
(E) Percent Change in Median Household Income (2000-2018) = (2018 MHI in 2019 Dollar - 2000 MHI in 2019 Dollar) / (2000 MHI in 2019 Dollar).
2. ($2,180/3,650)/12 = $0.05 (Estimated Monthly User Cost for New Requirements)
3. ($0.05/($80,470/12))100% = 0.001% (New Sampling Only)
4. ($37.30/($80,470/12))100% = 0.56% (Total User Cost)
5. (A) Total Population in 2018: United States Census Bureau. 2014-2018 American Community Survey 5-Year Estimates. Table B01003: Total Population - Universe: Total Population. https://data.census.gov/cedsci/table?q=B010003%20population&tid=ACSDT5Y2018.B01003&vintage=2018.
(B) Total Population in 2000: (1) For United States, United States Census Bureau (2002) 2000 Census of Population and Housing. Summary Social, Economic, and Housing Characteristics, PHC-1-1 Part 1. United States Summary, Table 1. Age and Sex: 2000, Washington, DC. https://www.census.gov/prod/cen2000/phc-1-1-pt1.pdf.
(2) For Missouri State, United States Census Bureau (2002) 2000 Census of Population and Housing, Summary Population and Housing Characteristics, PHC-1-27, Missouri, Table 2. Place of Birth, Residence in 1995, and Language: 2000, Washington, DC. http://www.census.gov/prod/cen2000/phc-2-27-pt1.pdf.
(C) Percent Change in Population (2000-2018) = (Total Population in 2018 - Total Population in 2000) / (Total Population in 2000).
6. (A) Median Age in 2018: United States Census Bureau. 2014-2018 American Community Survey 5-Year Estimates, Table B01002: Median Age by Sex - Universe: Total population. https://data.census.gov/cedsci/table?q=B01002&tid=ACSDT5Y2018.B01002&vintage=2018.
(B) Median Age in 2000: (1) For United States, United States Census Bureau (2002) 2000 Census of Population and Housing. Summary Social. Economic, and Housing Characteristics, PHC-1-1 Part 1. United States Summary, Table 1. Age and Sex: 2000, Washington, DC., Page 2. https://www.census.gov/prod/cen2000/phc-1-1-pt1.pdf.
(2) For Missouri State, United States Census Bureau (2002) 2000 Census of Population and Housing. Summary Population and Housing Characteristics, PHC-1-27, Missouri, Table 2. Place of Birth, Residence in 1995, and Language: 2000, Washington, DC. http://www.census.gov/prod/cen2000/phc-2-27-pt1.pdf.
(C) Change in Median Age in Years (2000-2018) = (Median Age in 2018 - Median Age in 2000).
7. United States Census Bureau. 2014-2018 American Community Survey 5-Year Estimates, B23025: Employment Status for the Population 16 Years and Over - Universe: Population 16 years and Over. https://data.census.gov/cedsci/table?q=B23025&tid=ACSDT5Y2018.B23025.
8. United States Census Bureau. 2014-2018 American Community Survey 5-Year Estimates, Table S1701: Poverty Status in the Past 12 Months. https://data.census.gov/cedsci/table?q=S1701&tid=ACSST5Y2018.S1701.
9. United States Census Bureau. 2014-2018 American Community Survey 5-Year Estimates, Table B22003: Receipt of Food Stamps/SNAP in the Past 12 Months by Poverty Status in the Past 12 Months for Households - Universe: Households. https://data.census.gov/cedsci/table?q=B22003&tid=ACSDT5Y2018.B22003.

STANDARD CONDITIONS FOR NPDES PERMITS
ISSUED BY
THE MISSOURI DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION
REVISED
AUGUST 1, 2014

These Standard Conditions incorporate permit conditions as required by 40 CFR 122.41 or other applicable state statutes or regulations. These minimum conditions apply unless superseded by requirements specified in the permit.

Part I – General Conditions
Section A – Sampling, Monitoring, and Recording

1. **Sampling Requirements.**
   a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity.
   b. All samples shall be taken at the outfall(s) or Missouri Department of Natural Resources (Department) approved sampling location(s), and unless specified, before the effluent joins or is diluted by any other body of water or substance.

2. **Monitoring Requirements.**
   a. Records of monitoring information shall include:
      i. The date, exact place, and time of sampling or measurements;
      ii. The individual(s) who performed the sampling or measurements;
      iii. The date(s) analyses were performed;
      iv. The individual(s) who performed the analyses;
      v. The analytical techniques or methods used; and
      vi. The results of such analyses.
   b. If the permittee monitors any pollutant more frequently than required by the permit at the location specified in the permit using test procedures approved under 40 CFR Part 136, or another method required for an industry-specific waste stream under 40 CFR subchapters N or O, the results of such monitoring shall be included in the calculation and reported to the Department with the discharge monitoring report data (DMR) submitted to the Department pursuant to Section B, paragraph 7.

3. **Sample and Monitoring Calculations.** Calculations for all sample and monitoring results which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in the permit.

4. **Test Procedures**. The analytical and sampling methods used shall conform to the reference methods listed in 10 CSR 20-7.015 unless alternates are approved by the Department. The facility shall use sufficiently sensitive analytical methods for detecting, identifying, and measuring the concentrations of pollutants. The facility shall ensure that the selected methods are able to quantify the presence of pollutants in a given discharge at concentrations that are low enough to determine compliance with Water Quality Standards in 10 CSR 20-7.031 or effluent limitations unless provisions in the permit allow for other alternatives. A method is "sufficiently sensitive" when; 1) the method minimum level is at or below the level of the applicable water quality criterion for the pollutant or, 2) the method minimum level is above the applicable water quality criterion, but the amount of pollutant in a facility's discharge is high enough that the method detects and quantifies the level of pollutant in the discharge, or 3) the method has the lowest minimum level of the analytical methods approved under 10 CSR 20-7.015. These methods are also required for parameters that are listed as monitoring only, as the data collected may be used to determine if limitations need to be established. A permittee is responsible for working with their contractors to ensure that the analysis performed is sufficiently sensitive.

5. **Record Retention.** Except for records of monitoring information required by the permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five (5) years (or longer as required by 40 CFR part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Department at any time.

6. **Illegal Activities.**
   a. The Federal Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under the permit shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than two (2) years, or both. If a conviction of a person is for a violation committed after a first conviction of such person under this paragraph, punishment is a fine of not more than $20,000 per day of violation, or by imprisonment of not more than four (4) years, or both.
   b. The Missouri Clean Water Law provides that any person or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained pursuant to sections 644.006 to 644.141 shall, upon conviction, be punished by a fine of not more than $10,000, or by imprisonment for not more than six (6) months, or by both. Second and successive convictions for violation under this paragraph by any person shall be punished by a fine of not more than $50,000 per day of violation, or by imprisonment for not more than two (2) years, or both.

Section B – Reporting Requirements

1. **Planned Changes.**
   a. The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility when:
      i. The alteration or addition to a permitted facility may meet one of the criteria for determining whether a facility is a new source in 40 CFR 122.29(b); or
      ii. The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification applies to pollutants which are subject neither to effluent limitations in the permit, nor to notification requirements under 40 CFR 122.42;
      iii. The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use or disposal sites not reported during the permit application process or not reported pursuant to an approved land application plan;
      iv. Any facility expansions, production increases, or process modifications which will result in a new or substantially different discharge or sludge characteristics must be reported to the Department 60 days before the facility or process modification begins. Notification may be accomplished by application for a new permit. If the discharge does not violate effluent limitations specified in the permit, the facility is to submit a notice to the Department of the changed discharge at least 30 days before such changes. The Department may require a construction permit and/or permit modification as a result of the proposed changes at the facility.

2. **Non-compliance Reporting.**
   a. The permittee shall report any noncompliance which may endanger health or the environment. Relevant information shall be provided orally or via the current electronic method approved by the Department, within 24 hours from the time the permittee becomes aware of the circumstances, and shall be reported to the appropriate Regional Office during normal business hours or the Environmental Emergency Response hotline at 573-634-2436 outside of normal business hours. A written submission shall also be provided within five (5) business days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

b. The following shall be included as information which must be reported within 24 hours under this paragraph.
   i. Any unanticipated bypass which exceeds any effluent limitation in the permit.
   ii. Any upset which exceeds any effluent limitation in the permit.
   iii. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Department in the permit required to be reported within 24 hours.

c. The Department may waive the written report on a case-by-case basis for reports under paragraph 2. b. of this section if the oral report has been received within 24 hours.

3. **Anticipated Noncompliance.** The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The notice shall be submitted to the Department 60 days prior to such changes or activity.

4. **Compliance Schedules.** Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later than 14 days following each schedule date. The report shall provide an explanation for the instance of noncompliance and a proposed schedule or anticipated date, for achieving compliance with the compliance schedule requirement.

5. **Other Noncompliance.** The permittee shall report all instances of noncompliance not reported under paragraphs 2, 3, and 6 of this section, at the time monitoring reports are submitted. The reports shall contain the information listed in paragraph 2. a. of this section.

6. **Other Information.** Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

7. **Discharge Monitoring Reports.**
   a. Monitoring results shall be reported at the intervals specified in the permit.
   b. Monitoring results must be reported to the Department via the current method approved by the Department, unless the permittee has been granted a waiver from using the method. If the permittee has been granted a waiver, the permittee must use forms provided by the Department.
   c. Monitoring results shall be reported to the Department no later than the 28th day of the month following the end of the reporting period.

Section C – Bypass/Upset Requirements

1. **Definitions.**
   a. *Bypass*: the intentional diversion of waste streams from any portion of a treatment facility, except in the case of blending.
   b. *Severe Property Damage*: substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
   c. *Upset*: an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

2. **Bypass Requirements.**
   a. Bypass not exceeding limitations. The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs 2. b. and 2. c. of this section.
   b. Notice.
      i. Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior notice, if possible at least 10 days before the date of the bypass.
      ii. Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in Section B – Reporting Requirements, paragraph 5 (24-hour notice).
   c. Prohibition of bypass.
      i. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless:
         1. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
         2. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
         3. The permittee submitted notices as required under paragraph 2. b. of this section.
      ii. The Department may approve an anticipated bypass, after considering its adverse effects, if the Department determines that it will meet the three (3) conditions listed above in paragraph 2. c. i. of this section.

3. **Upset Requirements.**
   a. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of paragraph 3. b. of this section are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.
   b. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
      i. An upset occurred and that the permittee can identify the cause(s) of the upset;
      ii. The permitted facility was at the time being properly operated; and
      iii. The permittee submitted notice of the upset as required in Section B – Reporting Requirements, paragraph 2. b. ii. (24-hour notice).
      iv. The permittee complied with any remedial measures required under Section D – Administrative Requirements, paragraph 4.
   c. Burden of proof. In any enforcement proceeding, the permittee seeking to establish the occurrence of an upset has the burden of proof.

Section D – Administrative Requirements

1. **Duty to Comply.** The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Missouri Clean Water Law and Federal Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.
   a. The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Federal Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the CWA within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if the permit has not yet been modified to incorporate the requirement.
   b. The Federal Clean Water Act provides that any person who violates section 301, 302, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any such sections in a permit issued under section 402, or any requirement imposed in a pretreatment program approved under sections 402(a)(3) or 402(b)(8) of the Act, is subject to a civil penalty not to exceed $25,000 per day for each violation. The Federal Clean Water Act provides that any person who negligently violates sections 301, 302, 306, 307, 308, 318, or 405 of the Act, or any condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, or any requirement

imposed in a pretreatment program approved under section 402(a)(3) or 402(b)(8) of the Act, is subject to criminal penalties of $2,500 to $25,000 per day of violation, or imprisonment of not more than one (1) year, or both. In the case of a second or subsequent conviction for a negligent violation, a person shall be subject to criminal penalties of not more than $50,000 per day of violation, or by imprisonment of not more than two (2) years, or both. Any person who knowingly violates such sections, or such conditions or limitations is subject to criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment for not more than three (3) years, or both. In the case of a second or subsequent conviction for a knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than six (6) years, or both. Any person who knowingly violates section 301, 302, 303, 306, 307, 308, 318 or 405 of the Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of the Act, and who knows at that time that he thereby places another person in imminent danger of death or serious bodily injury, shall, upon conviction, be subject to a fine of not more than $250,000 or imprisonment of not more than 15 years, or both. In the case of a second or subsequent conviction for a knowing endangerment violation, a person shall be subject to a fine of not more than $500,000 or by imprisonment of not more than 30 years, or both. An organization, as defined in section 309(c)(3)(B)(iii) of the CWA, shall, upon conviction of violating the imminent danger provision, be subject to a fine of not more than $1,000,000 and can be fined up to $2,000,000 for second or subsequent convictions.

c. Any person may be assessed an administrative penalty by the EPA Director for violating section 301, 302, 306, 307, 308, 318 or 405 of this Act, or any permit condition or limitation implementing any of such sections in a permit issued under section 402 of this Act. Administrative penalties for Class I violations are not to exceed $10,000 per violation, with the maximum amount of any Class I penalty assessed not to exceed $25,000. Penalties for Class II violations are not to exceed $10,000 per day for each day during which the violation continues, with the maximum amount of any Class II penalty not to exceed $125,000.

d. It is unlawful for any person to cause or permit any discharge of water contaminants from any water contaminant or point source located in Missouri in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law, or any standard, rule or regulation promulgated by the commission. In the event the commission or the director determines that any provision of sections 644.006 to 644.141 of the Missouri Clean Water Law or standard, rules, limitations or regulations promulgated pursuant thereto, or permits issued by, or any final abatement order, other order, or determination made by the commission or the director, or any filing requirement pursuant to sections 644.006 to 644.141 of the Missouri Clean Water Law or any other provision which this state is required to enforce pursuant to any federal water pollution control act, is being, was, or is in imminent danger of being violated, the commission or director may cause to have instituted a civil action in any court of competent jurisdiction for the injunctive relief to prevent any such violation or further violation or for the assessment of a penalty not to exceed $10,000 per day for each day, or part thereof, the violation occurred and continues to occur, or both, as the court deems proper. Any person who willfully or negligently commits any violation in this paragraph shall, upon conviction, be punished by a fine of not less than $2,500 nor more than $25,000 per day of violation, or by imprisonment for not more than one year, or both. Second and successive convictions for violation of the same provision of this paragraph by any person shall be punished by a fine of not more than $50,000 per day of violation, or by imprisonment for not more than two (2) years, or both.

2. **Duty to Reapply.**
   a. If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a new permit.
   b. A permittee with a currently effective site-specific permit shall submit an application for renewal at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Department. (The Department shall not grant permission for applications to be submitted later than the expiration date of the existing permit.)
   c. A permittees with currently effective general permit shall submit an application for renewal at least 30 days before the existing permit expires, unless the permittee has been notified by the Department that an earlier application must be made. The Department may grant permission for a later submission date. (The Department shall not grant permission for applications to be submitted later than the expiration date of the existing permit.)

3. **Need to Halt or Reduce Activity Not a Defense.** It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. **Duty to Mitigate.** The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

5. **Proper Operation and Maintenance.** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

6. **Permit Actions.**
   a. Subject to compliance with statutory requirements of the Law and Regulations and applicable Court Order, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:
      i. Violations of any terms or conditions of this permit or the law;
      ii. Having obtained this permit by misrepresentation or failure to disclose fully any relevant facts;
      iii. A change in any circumstances or conditions that requires either a temporary or permanent reduction or elimination of the authorized discharge; or
      iv. Any reason set forth in the Law or Regulations.
   b. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition.

7. **Permit Transfer.**
   a. Subject to 10 CSR 20-6.010, an operating permit may be transferred upon submission to the Department of an application to transfer signed by the existing owner and the new owner, unless prohibited by the terms of the permit. Until such time the permit is officially transferred, the original permittee remains responsible for complying with the terms and conditions of the existing permit.
   b. The Department may require modification or revocation and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under the Missouri Clean Water Law or the Federal Clean Water Act.
   c. The Department, within 30 days of receipt of the application, shall notify the new permittee of its intent to revoke or reissue or transfer the permit.

8. **Toxic Pollutants.** The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Federal Clean Water Act for toxic pollutants and with standards for sewage sludge use or disposal established under section 405(d) of the Federal Clean Water Act within the time provided in the regulations that establish these standards or prohibitions or standards for sewage sludge use or disposal, even if the permit has not yet been modified to incorporate the requirement.

9. **Property Rights.** This permit does not convey any property rights of any sort, or any exclusive privilege.

10. **Duty to Provide Information.** The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.

11. **Inspection and Entry.** The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the Department), upon presentation of credentials and other documents as may be required by law, to:
    a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;
    b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
    c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
    d. Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Federal Clean Water Act or Missouri Clean Water Law, any substances or parameters at any location.

12. **Closure of Treatment Facilities.**
    a. Persons who cease operation or plan to cease operation of waste, wastewater, and sludge handling and treatment facilities shall close the facilities in accordance with a closure plan approved by the Department.
    b. Operating Permits under 10 CSR 20-6.010 or under 10 CSR 20-6.015 are required until all waste, wastewater, and sludges have been disposed of in accordance with the closure plan approved by the Department and any disturbed areas have been properly stabilized. Disturbed areas will be considered stabilized when perennial vegetation, pavement, or structures using permanent materials cover all areas that have been disturbed. Vegetative cover, if used, shall be at least 70% plant density over 100% of the disturbed area.

13. **Signatory Requirement.**
    a. All permit applications, reports required by the permit, or information requested by the Department shall be signed and certified. (See 40 CFR 122.22 and 10 CSR 20-6.010)
    b. The Federal Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or non-compliance shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six (6) months per violation, or by both.
    c. The Missouri Clean Water Law provides that any person who knowingly makes any false statement, representation or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to sections 644.006 to 644.141 shall, upon conviction, be punished by a fine of not more than ten thousand dollars, or by imprisonment for not more than six months, or by both.

14. **Severability.** The provisions of the permit are severable, and if any provision of the permit, or the application of any provision of the permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of the permit, shall not be affected thereby.

STANDARD CONDITIONS FOR NPDES PERMITS
ISSUED BY
THE MISSOURI DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION
REVISED
MAY 1, 2013

PART II - SPECIAL CONDITIONS – PUBLICLY OWNED TREATMENT WORKS
SECTION A – INDUSTRIAL USERS

1. Definitions

Definitions as set forth in the Missouri Clean Water Laws and approved by the Missouri Clean Water Commission shall apply to terms used herein.

Significant Industrial User (SIU). Except as provided in the *General Pretreatment Regulation* 10 CSR 20-6.100, the term Significant Industrial User means:

1. All Industrial Users subject to Categorical Pretreatment Standards; and
2. Any other Industrial User that: discharges an average of 25,000 gallons per day or more of process wastewater to the Publicly-Owned Treatment Works (POTW) (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process wastestream which makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority on the basis that the Industrial User has a reasonable potential for adversely affecting the POTW's or for violating any Pretreatment Standard or requirement.

Clean Water Act (CWA) is the the federal Clean Water Act of 1972, 33 U.S.C. § 1251 et seq. (2002).

2. Identification of Industrial Discharges

Pursuant to 40 CFR 122.44(j)(1), all POTWs shall identify, in terms of character and volume of pollutants, any Significant Industrial Users discharging to the POTW subject to Pretreatment Standards under section 307(b) of the CWA and 40 CFR 403.

3. Application Information

Applications for renewal or modification of this permit must contain the information about industrial discharges to the POTW pursuant to 40 CFR 122.21(j)(6)

4. Notice to the Department

Pursuant to 40 CFR 122.42(b), all POTWs must provide adequate notice of the following:

1. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of CWA if it were directly discharging these pollutants; and
2. Any substantial change into the volume or character of pollutants being introduced into that POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.
3. For purposes of this paragraph, adequate notice shall include information on:
   i. the quality and quantity of effluent introduced into the POTW, and
   ii. any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

For POTWs without an approved pretreatment program, the notice of industrial discharges which was not included in the permit application shall be made as soon as practicable. For POTWs with an approved pretreatment program, notice is to be included in the annual pretreatment report required in the special conditions of this permit. Notice may be sent to:

Missouri Department of Natural Resources
Water Protection Program
Attn: Pretreatment Coordinator
P.O. Box 176
Jefferson City, MO 65102

STANDARD CONDITIONS FOR NPDES PERMITS
ISSUED BY
THE MISSOURI DEPARTMENT OF NATURAL RESOURCES
MISSOURI CLEAN WATER COMMISSION
August 1, 2019

PART III – BIOSOLIDS AND SLUDGE FROM DOMESTIC TREATMENT FACILITIES

SECTION A – GENERAL REQUIREMENTS

1. PART III Standard Conditions pertain to biosolids and sludge requirements under the Missouri Clean Water Law and regulations for domestic and municipal wastewater and also incorporates federal sludge disposal requirements under 40 CFR Part 503 for domestic wastewater. The Environmental Protection Agency (EPA) has principal authority for permitting and enforcement of the federal sludge regulations under 40 CFR Part 503 for domestic biosolids and sludge.
2. PART III Standard Conditions apply only to biosolids and sludge generated at domestic wastewater treatment facilities, including public owned treatment works (POTW) and privately owned facilities.
3. Biosolids and Sludge Use and Disposal Practices:
    a. The permittee is authorized to operate the biosolids and sludge generating, treatment, storage, use, and disposal facilities listed in the facility description of this permit.
    b. The permittee shall not exceed the design sludge/biosolids volume listed in the facility description and shall not use biosolids or sludge disposal methods that are not listed in the facility description, without prior approval of the permitting authority.
    c. For facilities operating under general operating permits that incorporate Standard Conditions PART III, the facility is authorized to operate the biosolids and sludge generating, treatment, storage, use and disposal facilities identified in the original operating permit application, subsequent renewal applications or subsequent written approval by the department.
4. Biosolids or Sludge Received from other Facilities:
    a. Permittees may accept domestic wastewater biosolids or sludge from other facilities as long as the permittee's design sludge capacity is not exceeded and the treatment facility performance is not impaired.
    b. The permittee shall obtain a signed statement from the biosolids or sludge generator or hauler that certifies the type and source of the sludge
5. Nothing in this permit precludes the initiation of legal action under local laws, except to the extent local laws are preempted by state law.
6. This permit does not preclude the enforcement of other applicable environmental regulations such as odor emissions under the Missouri Air Pollution Control Law and regulations.
7. This permit may (after due process) be modified, or alternatively revoked and reissued, to comply with any applicable biosolids or sludge disposal standard or limitation issued or approved under Section 405(d) of the Clean Water Act or under Chapter 644 RSMo.
8. In addition to Standard Conditions PART III, the Department may include biosolids and sludge limitations in the special conditions portion or other sections of a site specific permit.
9. Exceptions to Standard Conditions PART III may be authorized on a case-by-case basis by the Department, as follows:
    a. The Department may modify a site-specific permit following permit notice provisions as applicable under 10 CSR 20-6.020, 40 CFR § 124.10, and 40 CFR § 501.15(a)(2)(ix)(E).
    b. Exceptions cannot be granted where prohibited by the federal sludge regulations under 40 CFR Part 503.

Section B – Definitions

1. Best Management Practices are practices to prevent or reduce the pollution of waters of the state and include agronomic loading rates (nitrogen based), soil conservation practices, spill prevention and maintenance procedures and other site restrictions.
2. Biosolids means organic fertilizer or soil amendment produced by the treatment of domestic wastewater sludge.
3. Biosolids land application facility is a facility where biosolids are spread onto the land at agronomic rates for production of food, feed or fiber. The facility includes any structures necessary to store the biosolids until soil, weather, and crop conditions are favorable for land application.
4. Class A biosolids means a material that has met the Class A pathogen reduction requirements or equivalent treatment by a Process to Further Reduce Pathogens (PFRP) in accordance with 40 CFR Part 503.
5. Class B biosolids means a material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with 40 CFR Part 503.
6. Domestic wastewater means wastewater originating from the sanitary conveniences of residences, commercial buildings, factories and institutions; or co-mingled sanitary and industrial wastewater processed by a (POTW) or a privately owned facility.
7. Feed crops are crops produced primarily for consumption by animals.
8. Fiber crops are crops such as flax and cotton.
9. Food crops are crops consumed by humans which include, but is not limted to, fruits, vegetables and tobacco.
10. Industrial wastewater means any wastewater, also known as process wastewater, not defined as domestic wastewater. Per 40 CFR Part 122.2, process wastewater means any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product. Land application of industrial wastewater, residuals or sludge is not authorized by Standard Conditions PART III.
11. Mechanical treatment plants are wastewater treatment facilities that use mechanical devices to treat wastewater, including, sand filters, extended aeration, activated sludge, contact stabilization, trickling filters, rotating biological contact systems, and other similar facilities. It does not include wastewater treatment lagoons or constructed wetlands for wastewater treatment.
12. Plant Available Nitrogen (PAN) is nitrogen that will be available to plants during the growing seasons after biosolids application.
13. Public contact site is land with a high potential for contact by the public. This includes, but is not limited to, public parks, ball fields, cemeteries, plant nurseries, turf farms, and golf courses.
14. Sludge is the solid, semisolid, or liquid residue removed during the treatment of wastewater. Sludge includes septage removed from septic tanks or equivalent facilities. Sludge does not include carbon coal byproducts (CCBs), sewage sludge incinerator ash, or grit/screenings generated during preliminary treatment of domestic sewage.
15. Sludge lagoon is part of a mechanical wastewater treatment facility. A sludge lagoon is an earthen or concrete lined basin that receives sludge that has been removed from a wastewater treatment facility. It does not include a wastewater treatment lagoon or sludge treatment units that are not a part of a mechanical wastewater treatment facility.
16. Septage is the sludge pumped from residential septic tanks, cesspools, portable toilets, Type III marine sanitation devices, or similar treatment works such as sludge holding structures from residential wastewater treatment facilities with design populations of less than 150 people. Septage does not include grease removed from grease traps at a restaurant or material removed from septic tanks and other similar treatment works that have received industrial wastewater. The standard for biosolids from septage is different from other sludges. See Section H for more information.

Section C – Mechanical Wastewater Treatment Facilities

1. Biosolids or sludge shall be routinely removed from wastewater treatment facilities and handled according to the permit facility description and the requirements of Standard Conditions PART III or in accordance with Section A.3.c., above.
2. The permittee shall operate storage and treatment facilities, as defined by Section 644.016(23), RSMo, so that there is no biosolids or sludge discharged to waters of the state. Agricultural storm water discharges are exempt under the provisions of Section 644.059, RSMo.
3. Mechanical treatment plants shall have separate biosolids or sludge storage compartments in accordance with 10 CSR 20, Chapter 8. Failure to remove biosolids or sludge from these storage compartments on the required design schedule is a violation of this permit.

Section D – Biosolids or Sludge Disposed at Other Treatment Facility or by Contract Hauler

1. Permittees that use contract haulers, under the authority of their operating permit, to dispose of biosolids or sludge, are responsible for compliance with all the terms of this permit. Contract haulers that assume the responsibility of the final disposal of biosolids or sludge, including biosolids land application, must obtain a Missouri State Operating Permit unless the hauler transports the biosolids or sludge to another permitted treatment facility.
2. Testing of biosolids or sludge, other than total solids content, is not required if biosolids or sludge are hauled to a permitted wastewater treatment facility, unless it is required by the accepting facility.

SECTION E – INCINERATION OF SLUDGE

1. Please be aware that sludge incineration facilities may be subject to the requirements of 40 CFR Part 503 Subpart E, Missouri Air Conservation Commission regulations under 10 CSR 10, and solid waste management regulations under 10 CSR 80, as applicable.
2. Permittee may be authorized under the facility description of this permit to store incineration ash in lagoons or ash ponds. This permit does not authorize the disposal of incineration ash. Incineration ash shall be disposed in accordance with 10 CSR 80; or, if the ash is determined to be hazardous, with 10 CSR 25.
3. In addition to normal sludge monitoring, incineration facilities shall report the following as part of the annual report, mass of sludge incinerated and mass of ash generated. Permittee shall also provide the name of the ash disposal facility and permit number if applicable.

SECTION F – SURFACE DISPOSAL SITES AND BIOSOLIDS AND SLUDGE LAGOONS

1. Please be aware that surface disposal sites of biosolids or sludge from wastewater treatment facilities may be subject to other laws including the requirements in 40 CFR Part 503 Subpart C, Missouri Air Conservation Commission regulations under 10 CSR 10, and solid waste management regulations under 10 CSR 80, as applicable.
2. Biosolids or sludge storage lagoons are temporary facilities and are not required to obtain a permit as a solid waste management facility under 10 CSR 80. In order to maintain biosolids or sludge storage lagoons as storage facilities, accumulated biosolids or sludge must be removed routinely, but not less than once every two years unless an alternate schedule is approved in the permit. The amount of biosolids or sludge removed will be dependent on biosolids or sludge generation and accumulation in the facility. Enough biosolids or sludge must be removed to maintain adequate storage capacity in the facility.
   a. In order to avoid damage to the lagoon seal during cleaning, the permittee may leave a layer of biosolids or sludge on the bottom of the lagoon, upon prior approval of the Department; or
   b. Permittee shall close the lagoon in accordance with Section I.

SECTION G – LAND APPLICATION OF BIOSOLIDS

1. The permittee shall not land apply biosolids unless land application is authorized in the facility description, the special conditions of the issued NPDES permit, or in accordance with Section A.3.c., above.
2. This permit only authorizes "Class A" or "Class B" biosolids derived from domestic wastewater to be land applied onto grass land, crop land, timber, or other similar agricultural or silviculture lands at rates suitable for beneficial use as organic fertilizer and soil conditioner.
3. Class A Biosolids Requirements: Biosolids shall meet Class A requirements for application to public contact sites, residential lawns, home gardens or sold and/or given away in a bag or other container.
4. Class B biosolids that are land applied to agricultural and public contact sites shall comply with the following restrictions:
   a. Food crops that touch the biosolids/soil mixture and are totally above the land surface shall not be harvested for 14 months after application of biosolids.
   b. Food crops below the surface of the land shall not be harvested for 20 months after application of biosolids when the biosolids remain on the land surface for four months or longer prior to incorporation into the soil.
   c. Food crops below the surface of the land shall not be harvested for 38 months after application of biosolids when the biosolids remain on the land surface for less than four months prior to incorporation into the soil.
   d. Animal grazing shall not be allowed for 30 days after application of biosolids.
   e. Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of biosolids.
   f. Turf shall not be harvested for one year after application of biosolids if used for lawns or high public contact sites in close proximity to populated areas such as city parks or golf courses.
   g. After Class B biosolids have been land applied to public contact sites with high potential for public exposure, as defined in 40 CFR § 503.31, such as city parks or golf courses, access must be restricted for 12 months.
   h. After Class B biosolids have been land applied public contact sites with low potential for public exposure as defined in 40 CFR § 503.31, such as a rural land application or reclamation sites, access must be restricted for 30 days.

5. Pollutant limits
   a. Biosolids shall be monitored to determine the quality for regulated pollutants listed in Table 1, below. Limits for any pollutants not listed below may be established in the permit.
   b. The number of samples taken is directly related to the amount of biosolids or sludge produced by the facility (See Section J, below). Samples should be taken only during land application periods. When necessary, it is permissible to mix biosolids with lower concentrations of biosolids as well as other suitable Department approved material to achieve pollutant concentration below those identified in Table 1, below.
   c. Table 1 gives the ceiling concentration for biosolids. Biosolids which exceed the concentrations in Table 1 may not be land applied.

TABLE 1

Biosolids ceiling concentration	
Pollutant	Milligrams per kilogram dry weight
Arsenic	75
Cadmium	85
Copper	4,300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7,500

d. Table 2 below gives the low metal concentration for biosolids. Because of its higher quality, biosolids with pollutant concentrations below those listed in Table 2 can safely be applied to agricultural land, forest, public contact sites, lawns, home gardens or be given away without further analysis. Biosolids containing metals in concentrations above the low metals concentrations but below the ceiling concentration limits may be land applied but shall not exceed the annual loading rates in Table 3 and the cumulative loading rates in Table 4. The permittee is required to track polluntant loading onto application sites for parameters that have exceeded the low metal concentration limits.

TABLE 2

Biosolids Low Metal Concentration	
Pollutant	Milligrams per kilogram dry weight
Arsenic	41
Cadmium	39
Copper	1,500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2,800

e. Annual pollutant loading rate.

Table 3

Biosolids Annual Loading Rate	
Pollutant	Kg/ha (lbs./ac) per year
Arsenic	2.0 (1.79)
Cadmium	1.9 (1.70)
Copper	75 (66.94)
Lead	15 (13.39)
Mercury	0.85 (0.76)
Nickel	21 (18.74)
Selenium	5.0 (4.46)
Zinc	140 (124.96)

f. Cumulative pollutant loading rates.

Table 4

Biosolids Cumulative Pollutant Loading Rate	
Pollutant	Kg/ha (lbs./ac)
Arsenic	41 (37)
Cadmium	39 (35)
Copper	1500 (1339)
Lead	300 (268)
Mercury	17 (15)
Nickel	420 (375)
Selenium	100 (89)
Zinc	2800 (2499)

6. Best Management Practices. The permittee shall use the following best management practices during land application activities to prevent the discharge of biosolids to waters of the state.
   a. Biosolids shall not be applied to the land if it is likely to adversely affect a threatened or endangered species listed under § 4 of the Endangered Species Act or its designated critical habitat.
   b. Apply biosolids only at the agronomic rate of nitrogen needed (see 5.c. of this section).
   c. The applicator must document the Plant Available Nitrogen (PAN) loadings, available nitrogen in the soil, and crop

nitrogen removal when either of the following occurs: 1) When biosolids are greater than 50,000 mg/kgTN; or 2) When biosolids are land applied at an application rate greater than two dry tons per acre per year.

i. PAN can be determined as follows:

(Nitrate + nitrite nitrogen) + (organic nitrogen x 0.2) + (ammonia nitrogen x volatilization factor[1]).

[1] Volatilization factor is 0.7 for surface application and 1 for subsurface application. Alternative volitalization factors and mineralization rates can be utilized on a case-by-case basis.

ii. Crop nutrient production/removal to be based on crop specific nitrogen needs and realistic yield goals. **NOTE**: There are a number of reference documents on the Missouri Department of Natural Resources website that are informative to implement best management practices in the proper management of biosolids, including crop specific nitrogen needs, realistic yields on a county by county basis and other supporting references.

iii. Biosolids that are applied at agronomic rates shall not cause the annual pollutant loading rates identified in Table 3 to be exceeded.

d. Buffer zones are as follows:

i. 300 feet of a water supply well, sinkhole, water supply reservoir or water supply intake in a stream;

ii. 300 feet of a losing stream, no discharge stream, stream stretches designated for whole body contact recreation, wild and scenic rivers, Ozark National Scenic Riverways or outstandingstate resource waters as listed in the Water Quality Standards, 10 CSR 20-7.031;

iii. 150 feet of dwellings or public use areas;

iv. 100 feet (35 feet if biosolids application is down-gradient or the buffer zone is entirely vegetated) of lake, pond, wetlands or gaining streams (perennial or intermittent);

v. 50 feet of a property line. Buffer distances from property lines may be waived with written permission from neighboring property owner.

vi. For the application of dry, cake or liquid biosolids that are subsurface injected, buffer zones identified in 5.d.i. through 5.d.iii above, may be reduced to 100 feet. The buffer zone may be reduced to 35 feet if the buffer zone is permanently vegetated. Subsurface injection does not include methods or technology reflective of combination surface/shallow soil incorporation.

e. Slope limitation for application sites are as follows:

i. For slopes less than or equal to 6 percent, no rate limitation;

ii. Applied to a slope 7 to 12 percent, the applicator may apply biosolids when soil conservation practices are used to meet the minimum erosion levels;

iii. Slopes > 12 percent, apply biosolids only when grass is vegetated and maintained with at least 80 percent ground cover at a rate of two dry tons per acre per year or less.

iv. Dry, cake or liquid biosolids that are subsurface injected, may be applied on slopes not to exceed 20 percent. Subsurface injection does not include the use of methods or technology reflective of combination surface/shallow soil incorporation.

f. No biosolids may be land applied in an area that it is reasonably certain that pollutants will be transported into waters of the state.

g. Biosolids may be land applied to sites with soil that are snow covered, frozen, or saturated with liquid when site restrictions or other controls are provided to prevent pollutants from being discharged to waters of the state during snowmelt or stormwater runoff. During inclement weather or unfavorable soil conditions use the following management practices:

i. A maximum field slope of 6% and a minimum 300 feet grass buffer between the application site and waters of the state. A 35 feet grass buffer may be utilized for the application of dry, cake or liquid biosolids that are subsurface injected. Subsurface injection does not include the use of mthods or technology refletive of combination surface/shallow soil incorporation;

ii. A maximum field slope of 2% and 100 feet grass buffer between the application site and waters of the state. A 35 feet grass buffer may be used for the application of dry, cake or liquid biosolids that are subsurface injected. Subsurface injection does not included the use of methods or technology refletive of combination surface/shallow soil incorporation;

iii. Other best management practices approved by the Department.

SECTION H – SEPTAGE

1. Haulers that land apply septage must obtain a state permit. An operating permit is not required for septage haulers who transport septage to another permitted treatment facility for disposal.
2. Do not apply more than 30,000 gallons of septage per acre per year or the volume otherwise stipulated in the operating permit.
3. Septic tanks are designed to retain sludge for one to three years which will allow for a larger reduction in pathogens and vectors, as compared to mechanical treatment facilities.
4. Septage must comply with Class B biosolids regarding pathogen and vector attraction reduction requirements before it may be applied to crops, pastures or timberland. To meet required pathogen and vector reduction requirements, mix 50 pounds of hydrated lime for every 1,000 gallons of septage and maintain a septage pH of at least 12 pH standard units for 30 minutes or more prior to application.
5. Lime is to be added to the pump truck and not directly to the septic tanks, as lime would harm the beneficial bacteria of the septic tank.
6. As residential septage contains relatively low levels of metals, the testing of metals in septage is not required.

SECTION I– CLOSURE REQUIREMENTS

1. This section applies to all wastewater facilities (mechanical and lagoons) and sludge or biosolids storage and treatment facilities. It does not apply to land application sites.
2. Permittees of a domestic wastewater facility who plan to cease operation must obtain Department approval of a closure plan which addresses proper removal and disposal of all sludges and/or biosolids. Permittee must maintain this permit until the facility is closed in accordance with the approved closure plan per 10 CSR 20 – 6. 010 and 10 CSR 20 – 6.015.
3. Biosolids or sludge that are left in place during closure of a lagoon or earthen structure or ash pond shall not exceed the agricultural loading rates as follows:
   a. Biosolids and sludge shall meet the monitoring and land application limits for agricultural rates as referenced in Section G, above.
   b. If a wastewater treatment lagoon has been in operation for 15 years or more without sludge removal, the sludge in the lagoon qualifies as a Class B biosolids with respect to pathogens due to anaerobic digestion, and testing for fecal coliform is not required. For other lagoons, testing for fecal coliform is required to show compliance with Class B biosolids limitations. In order to reach Class B biosolids requirements, fecal coliform must be less than 2,000,000 colony forming units or 2,000,000 most probable number. All fecal samples must be presented as geometric mean per gram.
   c. The allowable nitrogen loading that may be left in the lagoon shall be based on the plant available nitrogen (PAN) loading. For a grass cover crop, the allowable PAN is 300 pounds/acre. Alternative, site-specific application rates may be included in the closure plan for department consideration.
      i. PAN can be determined as follows:
      (Nitrate + nitrite nitrogen) + (organic nitrogen x 0.2) + (ammonia nitrogen x volatilization factor[1]).
      [1] Volatilization factor is 0.7 for surface application and 1 for subsurface application. Alternative volitalization factors and mineralization rates can be utilized on a case-by-case basis
4. Domestic wastewater treatment lagoons with a design treatment capacity less than or equal to 150 persons, are "similar treatment works" under the definition of septage. Therefore the sludge within the lagoons may be treated as septage during closure activities. See Section B, above. Under the septage category, residuals may be left in place as follows:
   a. Testing for metals or fecal coliform is not required.
   b. If the wastewater treatment lagoon has been in use for less than 15 years, mix lime with the sludge at a rate of 50 pounds of hydrated lime per 1000 gallons (134 cubic feet) of sludge.
   c. The amount of sludge that may be left in the lagoon shall be based on the plant available nitrogen (PAN) loading. 100 dry tons/acre of sludge may be left in the basin without testing for nitrogen. If 100 dry tons/acre or more will be left in the lagoon, test for nitrogen and determine the PAN using the calculation above. Allowable PAN loading is 300 pounds/acre.
5. Biosolids or sludge left within the domestic lagoon shall be mixed with soil on at least a 1 to 1 ratio, and unless otherwise approved, the lagoon berm shall be demolished, and the site shall be graded and contain ≥70% vegetative density over 100% of the site so as to avoid ponding of storm water and provide adequate surface water drainage without creating erosion. Alternative biosolids or sludge and soil mixing ratios may be included in the closure plan for department consideration.
6. Lagoon and earthen structure closure activities shall obtain a storm water permit for land disturbance activities that equal or exceed one acre in accordance with 10 CSR 20-6.200.
7. When closing a mechanical wastewater plant, all biosolids or sludge must be cleaned out and disposed of in accordance with the Department approved closure plan before the permit for the facility can be terminated.
   a. Land must be stabilized which includes any grading, alternate use or fate upon approval by the Department, remediation, or other work that exposes sediment to stormwater per 10 CSR 20-6.200. The site shall be graded and contain ≥70% vegetative density over 100% of the site, so as to avoid ponding of storm water and provide adequate

surface water drainage without creating erosion.

b. Hazardous Waste shall not be land applied or disposed during mechanical plant closures unless in accordance with Missouri Hazardous Waste Management Law and Regulations pursuant to 10 CSR 25.

c. After demolition of the mechanical plant, the site must only contain clean fill defined in Section 260.200.1(6) RSMo as uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinderblocks, brick, minimal amounts of wood and metal, and inert solids as approved by rule or policy of the Department for fill, reclamation, or other beneficial use. Other solid wastes must be removed.

8. If biosolids or sludge from the domestic lagoon or mechanical treatment plant exceeds agricultural rates under Section G and/or I, a landfill permit or solid waste disposal permit must be obtained if the permittee chooses to seek authorization for on-site sludge disposal under the Missouri Solid Waste Management Law and regulations per 10 CSR 80, and the permittee must comply with the surface disposal requirements under 40 CFR Part 503, Subpart C.

SECTION J – MONITORING FREQUENCY

1. At a minimum, biosolids or sludge shall be tested for volume and percent total solids on a frequency that will accurately represent sludge quantities produced and disposed. Please see the table below.

TABLE 5

Biosolids or Sludge produced and disposed (Dry Tons per Year)	Monitoring Frequency (See Notes 1, and 2)		
	Metals, Pathogens and Vectors, Total Phosphorus, Total Potassium	Nitrogen TKN, Nitrogen PAN[1]	Priority Pollutants[2]
319 or less	1/year	1 per month	1/year
320 to 1650	4/year	1 per month	1/year
1651 to 16,500	6/year	1 per month	1/year
16,501+	12/year	1 per month	1/year

[1] Calculate plant available nitrogen (PAN) when either of the following occurs: 1) when biosolids are greater than 50,000 mg/kg TN; or 2) when biosolids are land applied at an application rate greater than two dry tons per acre per year.

[2] Priority pollutants (40 CFR 122.21, Appendix D, Tables II and III) are required only for permit holders that must have a pre-treatment program. Monitoring requirements may be modified and incorporated into the operating permit by the Department on a case-by-case basis.

Note 1: Total solids: A grab sample of sludge shall be tested one per day during land application periods for percent total solids. This data shall be used to calculate the dry tons of sludge applied per acre.
Note 2: Table 5 is not applicable for incineration and permit holders that landfill their sludge.

2. Permittees that operate wastewater treatment lagoons, peak flow equalization basins, combined sewer overflow basins or biosolids or sludge lagoons that are cleaned out once a year or less, may choose to sample only when the biosolids or sludge is removed or the lagoon is closed. Test one composite sample for each 319 dry tons of biosolids or sludge removed from the lagoon during the reporting year or during lagoon closure. Composite sample must represent various areas at one-foot depth.
3. Additional testing may be required in the special conditions or other sections of the permit.
4. Biosolids and sludge monitoring shall be conducted in accordance with federal regulation 40 CFR § 503.8, Sampling and analysis.

SECTION K – RECORD KEEPING AND REPORTING REQUIREMENTS

1. The permittee shall maintain records on file at the facility for at least five years for the items listed in Standard Conditions PART III and any additional items in the Special Conditions section of this permit. This shall include dates when the biosolids or sludge facility is checked for proper operation, records of maintenance and repairs and other relevant information.
2. Reporting period
   a. By February 19th of each year, applicable facilities shall submit an annual report for the previous calendar year period for all mechanical wastewater treatment facilities, sludge lagoons, and biosolids or sludge disposal facilities.
   b. Permittees with wastewater treatment lagoons shall submit the above annual report only when biosolids or sludge are removed from the lagoon during the report period or when the lagoon is closed.
3. Report Form. The annual report shall be prepared on report forms provided by the Department or equivalent forms approved by the Department.
4. Reports shall be submitted as follows:
Major facilities, which are those serving 10,000 persons or more or with a design flow equal to or greater than 1 million gallons per day or that are required to have an approved pretreatment program, shall report to both the Department and EPA if the facility land applied, disposed of biosolids by surface disposal, or operated a sewage sludge incinerator. All other facilities shall maintain their biosolids or sludge records and keep them available to Department personnel upon request. State reports shall be submitted to the address listed as follows:

DNR regional or other applicable office listed in the
permit (see cover letter of permit)
ATTN: Sludge Coordinator

Reports to EPA must be electronically submitted online via the Central Data Exchange at: https://cdx.epa.gov/ Additional information is available at: https://www.epa.gov/biosolids/compliance-and-annual-reporting-guidance-about-clean-water-act-laws

5. Annual report contents. The annual report shall include the following:
   a. Biosolids and sludge testing performed. If testing was conducted at a greater frequency than what is required by the permit, all test results must be included in the report.
   b. Biosolids or sludge quantity shall be reported as dry tons for the quantity produced and/or disposed.
   c. Gallons and % solids data used to calculate the dry ton amounts.
   d. Description of any unusual operating conditions.
   e. Final disposal method, dates, and location, and person responsible for hauling and disposal.
      i. This must include the name and address for the hauler and sludge facility. If hauled to a municipal wastewater treatment facility, sanitary landfill, or other approved treatment facility, give the name of that facility.
      ii. Include a description of the type of hauling equipment used and the capacity in tons, gallons, or cubic feet.
   f. Contract Hauler Activities:
      If using a contract hauler, provide a copy of a signed contract from the contractor. Permittee shall require the contractor to supply information required under this permit for which the contractor is responsible. The permittee shall submit a signed statement from the contractor that he has complied with the standards contained in this permit, unless the contract hauler has a separate biosolids or sludge use permit.
   g. Land Application Sites:
      i. Report the location of each application site, the annual and cumulative dry tons/acre for each site, and the landowners name and address. The location for each spreading site shall be given as a legal description for nearest ¼, ¼, Section, Township, Range, and county, or UTM coordinates. The facility shall report PAN when either of the following occurs: 1) When biosolids are greater than 50,000 mg/kg TN; or 2) when biosolids are land applied at an application rate greater than two dry tons per acre per year.
      ii. If the "Low Metals" criteria are exceeded, report the annual and cumulative pollutant loading rates in pounds per acre for each applicable pollutant, and report the percent of cumulative pollutant loading which has been reached at each site.
      iii. Report the method used for compliance with pathogen and vector attraction requirements.
      iv. Report soil test results for pH and phosphorus. If no soil was tested during the year, report the last date when tested and the results.