Midnite Mine Superfund Site

100~~90~~ Percent Design

Appendix J – Influent and Effluent Pipelines

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LIST OF ACRONYMS

bgs	below ground surface
BODR	Basis of Design Report
BMP	Best Management Practice
BPA	Backfilled Pit Areas
CD	Consent Decree
CSZ	Construction Support Zone
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
GSR	Green and Sustainable Remediation
HDPE	High Density Polyethylene
in	inches
LiDAR	light detection and ranging
NPDES	National Pollutant Discharge Elimination System
PCP	Pollution Control Pond
RA	Remedial Action
RAO	Remedial Action Objectives
RD	Remedial Design
ROD	Record of Decision
SOW	Scope of Work
SWMP	Storm Water Management Plan
Tribe	Spokane Tribe of Indians
WTP	Water Treatment Plant

J1.0 INTRODUCTION

This appendix to the *Midnite Mine Superfund Site Basis of Design Report* (BODR) presents the design details for the influent and effluent pipelines that will be used to convey impacted water from the backfilled pits to the new Water Treatment Plant (WTP) and treated water from the WTP to the Spokane River Arm of Lake Roosevelt. This appendix also includes the location and design for the diffuser that will be constructed at the terminal end of the pipeline to aid with mixing the treated effluent and lake water. A detailed discussion of the alignments and their design calculations are included in the Influent and Effluent Pipeline Hydraulic Calculations attachment (Attachment J-1).

This appendix contains:

- Demonstration that the design will attain the applicable Performance Standard identified in the Consent Decree's Statement of Work (CD SOW, EPA 2011b) and in Section J2.0 below
- Discussion of the proposed pipeline routes and alignment modifications.
- Influent and effluent pipeline design calculations, assumptions, and parameters
- Diffuser location and design
- Green and Sustainable Remediation (GSR) considerations

Currently, additional water quality data is being collect in support of the NPDES permit application process. On May 20, 2014, a letter was sent to the EPA requesting a delay in the design of the WTP since the design of the WTP cannot be finalized until the discharge limits for the reissued NPDES permit are known. As part of this request, a delay to the design of the effluent pipeline from the new WTP to Lake Roosevelt also was. ~~proposed for delayed.~~ The delay in the design of the effluent line was approved in a letter from EPA dated July 8, 2014. It must be noted that, although effluent sections have not been removed from this appendix, they have not been updated since the 60% Basis of Design Report (MWH, 2013b). ~~.~~ Headings in delayed portions of this document have been annotated with the text "Not Updated" so the reviewer understands the situation and status of each. Also, in *Volume II: Part 2 of 2 Design Drawing, Section 10 – Influent and Effluent Pipeline Designs*, the effluent pipeline drawings in the 100~~90~~% submittal have been annotated with a watermark indicating that the 60% effluent pipeline design has not been updated and the

note: "*The effluent pipeline drawings and design have not been updated in this design submittal. The effluent pipeline drawings will be revised concurrently with the new WTP design once the NPDES permit is reissued and the discharge limits are established"* has been added to the general notes section on Sheet 10-1. EPA's*known."* ~~This~~ letter approving the delay of the design is included in Attachment J-4: Letter Requesting Delay in Schedule.

It also should be noted that the existing WTP currently treats water from April through October and without winterization of the existing WTP, a new or winterized WTP must be in place by November 2019~~2018~~ because of issues related to water storage as the existing pits are backfilled and covered (given the anticipated construction schedule, which begins in 2016).~~)~~. This means that an alternative design for winterization of the existing WTP must begin *by November 2018~~2017~~* if the new WTP is not anticipated to be on-line by November 2019~~2018~~.

J2.0 COMPLIANCE WITH PERFORMANCE STANDARDS

The Performance Standards presented herein are defined in the CD SOW, and were developed to define attainment of the Remedial Action Objectives (RAOs) of the Selected Remedy. The Performance Standards include both general and specific standards applicable to the Selected Remedy work elements and associated work components. All of the Performance Standards associated with the Midnite Mine remedy are summarized on Table 4-6 of the 100~~90~~% Basis of Design Report (100~~90~~% BODR). This master table lists each performance standard, and summarizes where or how each is addressed in this BODR.~~, and gives their status in the proposed (90 percent) design stage.~~ The Performance Standards identified in the CD SOW for the influent and effluent pipelines are discussed below.

J2.1 INFLUENT PIPELINES

There~~With regard to the influent pipelines, there~~ two Performance Standards applicable to the influent pipeline as stated below:

2.3.24 *"All water requiring treatment shall be conveyed to and treated at the water treatment plant operating at the time of conveyance."*

2.4.3.3.2 B. *"Water collection and conveyance facilities shall be provided with capacities and in locations to be determined in the remedial design."*

This appendix depicts the proposed route of the influent pipelines at the beginning of construction, at the beginning of Phase 2 of construction, at the beginning of Phase 3 of construction, at the end of construction, and the final permanent configuration (post-remediation). Influent pipeline alignments are designed using groundwater flow rates presented in the Groundwater Investigations Report (MGC, 2011); although exact routes and sizing may be altered in the future as the RD progresses and flows from the individual groundwater sources are more reliably known.

This appendix provides calculations for capacities of the final influent pipelines and depicts the proposed routes of influent piping necessary at the beginning of each of the three phases of construction as well as the post-construction phase. The proposed influent pipeline alignments were selected, in part, to minimize habitat and environmental impacts by remaining entirely in the disturbed area. Alignments were also selected to avoid working areas, but are subject to change as more information is obtained throughout the life of the project.

J2.2 EFFLUENT PIPELINE – (NOT UPDATED)

With regard to the effluent pipeline, there is a single Performance Standard applicable to the effluent pipeline as stated below.

> *"The pipeline to the discharge location of the WTP and the discharge outfall shall be sited in coordination with the Tribe, shall not interfere with the functioning of existing structures (e.g. roads, culverts, bridges), and constructed as determined in RD."*

This appendix provides calculations for capacities of the effluent pipelines and depicts the proposed route of this pipeline.

Coordination with the Spokane Tribe - The proposed pipeline alignment has been coordinated with the Spokane Tribe of Indians (Tribe) as follows:

- The Tribe concurred with the Selected Remedy in the ROD, which includes long-term discharge of treated water to the Spokane River Arm of Lake Roosevelt via a conveyance pipeline aligned along Blue Creek.
- The Tribe participated in technical meetings where general and specific remedial design topics were discussed, including the proposed alignment of the effluent pipeline along Blue Creek.

- Prior to performing pre-design investigations along the proposed pipeline alignment, an application for a ground disturbance permit was submitted to the Spokane Tribal Heritage Protection Officer for review and approval. In addition, a Tribal~~tribal~~ representative was present for all pre-design excavation activities to confirm culturally significant items were not encountered or removed along the proposed pipeline alignment.
- The Tribe has reviewed the 30 percent effluent alignment and will review this 60 percent pipeline design submittal and provide feedback to the EPA and MWH.
- An access agreement to allow construction, monitoring and maintenance along the pipeline route is being discussed with the Tribe. These on-going negotiations to obtain a pipeline corridor access agreement are detailed in Appendix N.

The alignment was selected to avoid interference with existing structures and minimize habitat and environmental disruption. The selected alignment is designed to be within planned or existing unpaved roads along the majority of the alignment, thereby minimizing the required clearing and grubbing of native flora associated with the earthwork. The only section of the alignment that is not within an unpaved roadway is a short segment along the shoulder of the Ford-Wellpinit Road (West End Road) before it enters a small jeep road toward Blue Creek and at the mouth of Blue Creek were the pipeline will be buried adjacent to the Blue Creek channel above the low water level and will be place on the lake bottom below the low water level of Lake Roosevelt.

J3.0 PRE-DESIGN INVESTIGATIONS

In order to locate the best alignments and meet the requirements of the performance standards, initial investigations were performed. The investigations and how they relate to the influent and effluent pipelines is described below.

J3.1 INFLUENT PIPELINES

The influent pipelines will mostly traverse land that will be remediated (i.e., disturbed) and reclaimed at the end of remediation. As such, the influent pipes during construction will be temporary and frequently~~constantly will be~~ relocated throughout the remedial action (RA) process. Due to the highly variable nature of these pipelines~~pipes~~ and their alignments, much~~most~~ of the design of the intermediate pipelines will take place in the field as the land

surface changes. Because of this, no initial investigations have been planned for the influent pipelines.

J3.2 EFFLUENT PIPELINES – (NOT UPDATED)

During the fall of 2013, a geotechnical investigation was performed where 25 test pits were excavated along the proposed effluent pipeline alignment. The information from this investigation is summarized in a document titled, *Summary of 2013 Blue Creek Geotechnical Investigation Report* (Attachment J-2). Information and data include:

- Soil and rock depths along the corridor
- Groundwater depths within the proposed pipeline excavation
- Excavatability characteristics of materials encountered
- Compressibility and support characteristics of pipe foundation materials
- Suitability of excavated materials for pipe backfill

The report indicates that excavation will occur in alluvial and colluvial materials. The colluvium will be more difficult to excavate. Both materials will be suitable for backfill. It is also noted that large boulders may be encountered and could require other excavation equipment or design modifications. Such modifications will require the approval of the field engineer and an engineering change notice for EPA approval. The results of the report are covered in greater detail in section J6.2.2

J4.0 ENGINEERING DRAWINGS

The influent pipelines, effluent pipeline, and diffuser engineering drawings are contained in Volume II of the BODR and each drawing contains the information presented in the description and notes below. These drawings include:

Sheet Number	Description
10-1	Pipelines - General Sheet
10-2	Overall Final Pipelines Plan
10-3	Overall Influent Pipelines Plan – Start of Phase 1
10-4 through 10-86	Phase 1 Influent Pipelines Plan and Profiles
10-97	Overall Influent Pipelines Plan – Start of Phase 2
10-108 through 10-2723	Phase 2 Influent Pipelines Plan and Profiles
10-2824	Overall Influent Pipelines Plan – End of Phase 3
10-2925 through 10-4435	Start of Phase 3 Influent Pipelines Plan and Profiles
10-4536	Overall Influent Pipelines Plan – End of Phase 3
10-4637 through 10-5544	End of Phase 3 Influent Pipelines Plan and Profiles
10-5645	Influent Pipelines Plan – Permanent
10-5746 through 10-6255	Permanent Influent Pipelines Plan and Profiles
10-6356	Overall Effluent Pipeline Plan –Permanent
10-6457 through 10-8174	Permanent Effluent Pipeline Plan and Profiles
10-8275 through 10-9384	Typical Details and Sections

As noted in Section J11.1, the effluent pipeline and diffuser designs have been put on hold and are not updatedincluded in this submittal. TheAll drawings associated with the effluent pipeline design are not updatedincluded in the *Volume II: Part 2 of 2 Design DrawingsDrawing, Section 10 – Influent and Effluent Pipeline DesignDesigns* of the 90% BODR.

J5.0 PIPELINE ROUTE AND ALIGNMENT

J5.1 INFLUENT PIPELINES

Initially, mine-effected water will be piped directly from Pit 4, Pit 3, and the Backfilled Pit Areas (BPA) to the existing WTP for treatment. The existing WTP will be operated until the new WTP is operational.permitted and built. It is assumed that the new WTP will be constructed near the end of Phase 1 of the RA. This assumption however, this is baseddependent on the timely receipt of the reissued NPDES permit and finalization of the WTPnew treatment standards in the permit which could influence the processes used in the new WTP.

During much of the RA, influent pipelines will be temporary and located within the footprint of the RA, and will be relocated regularly as remediation progresses so their locations will be temporary in nature. Alignments for the temporary influent pipelines Final alignments cannot be

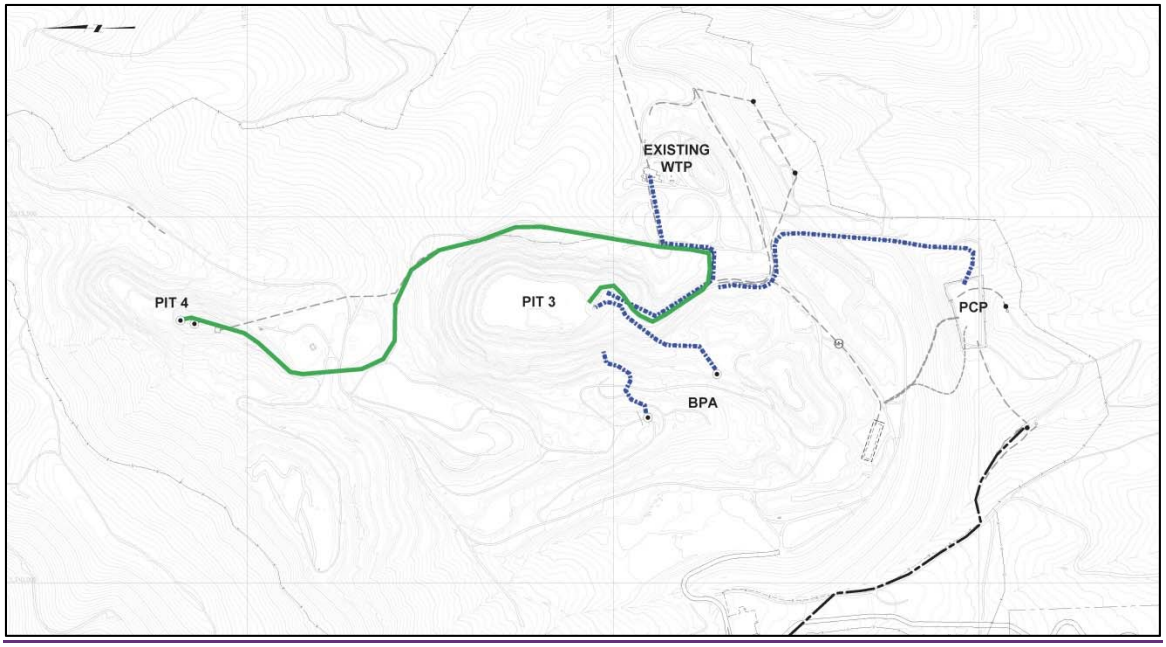
chosen accurately until the ~~final~~ topography is defined during construction. However, proposed alignments were selected for the influent pipelines at the beginning of each of the phases in order to portray~~design~~ the overall piping system as it evolves through three phases of construction. Temporary and final~~throughout the project. All~~ influent pipeline details are located in Section 10 of the drawings.

There are~~will be~~ three primary water sources that must be treated during construction and at the completion of~~following~~ the RA. These sources are: Pit 3, Pit 4, and one BPA well, as depicted on Figure J-1. Future ~~In addition, future~~ dewatering trenches in the Eastern, Western, and Central drainages are also ~~are~~ depicted on Figure J-1. The figure also shows the locations of the existing and the future WTPs.

Figure J-1 – Water Source Locations

J5.1.1 Influent Pipelines - Beginning of Construction/Start of Phase 1

Initially, the existing pipelines will be used to convey water from Pit 4 and Pit 3 to the existing WTP. At the beginning of construction, the mine-effected water in Pit 4 will be pumped directly to Pit 3 as shown in Figure J-2 to dewater the pit. Also, water will be piped directly from the BPA to Pit 3 and from the existing seep collection system to the Pollution Control Pond (PCP) and into Pit 3, as the system is currently operated. The water then will be pumped directly from Pit 3 to the existing WTP. The existing WTP will be operated until the new WTP is ~~permitted and~~ constructed near the end of the RA Phase 1. The layouts of the proposed pipeline configurations at the beginning of Phase 1 are shown in Figure J-2, below.



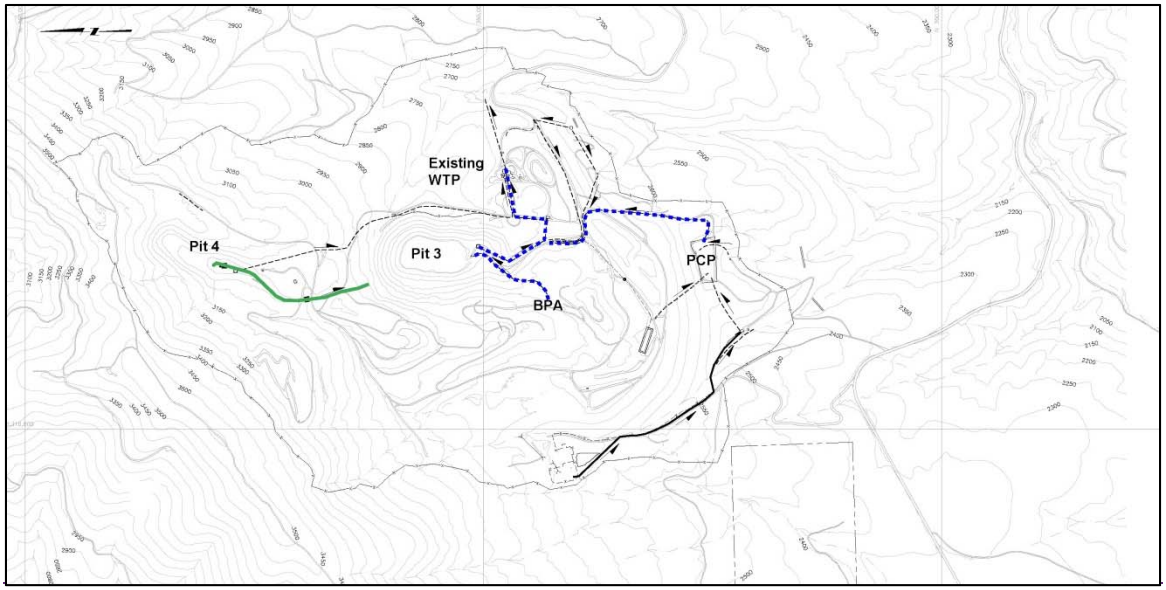


Figure J-2 – Start of Phase 1 Influent Pipelines

Figure J-2 shows the following influent water sources and pipelines:

- The existing lines to and from Pit 3 (shown in dashed blue) that will not require modification.
- The existing seep dewatering systems along the southern margin of the mined area to the PCP and from Pit 4 to the existing WTP (shown in dashed black).

- As construction begins, a new drain pipe (shown in dash-dot~~solid~~ black) to be installed from the collection sump in the Construction Support Zone (CSZ) down to the existing seep dewatering system. The pipeline will drain stormwater and runoff from the decontamination pad for treatment.
- As construction begins, a new influent pipeline (shown in green) to be installed from Pit 4. This pipeline will run up the Pit 4 access road and discharge into Pit 3 as Pit 4 is dewatered early in the construction process.

It is important to note that at the end of Phase 1, the South Storage Pond (South Pond) will be constructed. The~~ so that the Pit 3 backfilling can commence and there is sufficient~~ water storage capacity~~without use~~ of the South Pond will allow Pit 3 to be backfilled. Extraction~~Pit 3. Also extraction~~ trenches will be installed in the Eastern, Central, and Western drainages to dewater the shallow alluvial system downgradient from the mined area. Prior to Phase 2, pipelines to the South Pond from Pit 4, Pit 3, the BPA well, and the PCP ~~to the new South Pond also~~ will have to be installed.

J5.1.2 Influent Pipelines - Start of Phase 2

At the Start of Phase 2, Pit 4 will be backfilled and have its final cover, complete~~covered,~~ dewatering will begin in Pit 3, and mine-effected water will be piped directly to the newly constructed South Pond for storage, prior to treatment. The new alluvial groundwater extraction trenches in the Western, Central, and Eastern drainages also will be operating with~~and its~~ associated pipeline discharges to the PCP. Treatment will occur at the newly constructed WTP unless the NPDES permitting process causes a delay. Should the new WTP construction be delayed, the existing WTP will be utilized, as described in the Introduction - Section J1.0. Under either scenario, year-around treatment will be required. The layouts of the proposed influent pipelines at the beginning of Phase 2, assuming the new WTP is in operation, are shown in Figure J-3, below.

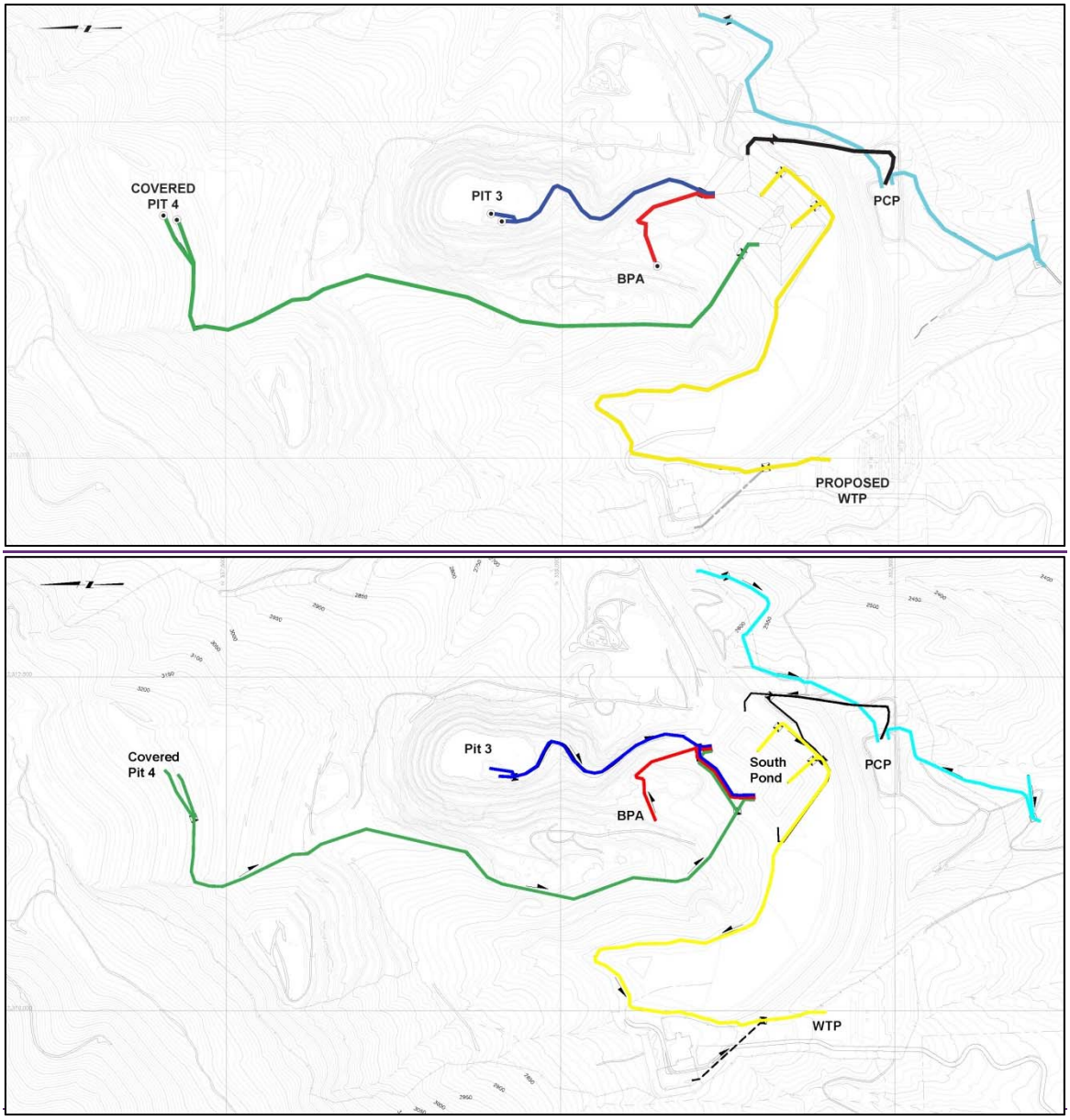


Figure J-3 – Start of Phase 2 Influent Pipelines

Figure J-3 shows the following influent water sources and pipelines:

- Water from the BPA well (shown in red) will be pumped directly to the new South Pond.
- A new pipe (shown in green) will be installed from the Pit 4 underdrain and waste rock dewatering wells (4 wells total) and will run along the west side of the pits down to the South Pond.

- The temporary Pit 3 pipeline from the underdrain and dewatering wells (shown in dark blue) will discharge ~~directly~~ into the South Pond.
- The new extraction trenches from each of the drainages (shown in light blue) will be routed to the PCP. The Central and Western Drainages will be pumped to a single wet well, and then to the PCP. The Eastern Drainage will be pumped directly to the PCP.
- Once all pit water has been collected into the South Pond, pumps will lift the water and carry it down a single pipeline (shown in yellow) to the new WTP.

It is important to note that at the end of Phase 2, the West Storage Pond (West Pond) will be constructed so that the South Pond and the mine wastes underlying the pond can be removed. A pipeline will be installed from the West Pond to the new WTP. Prior to Phase 3, pipelines from Pit 4, Pit 3, and the BPA well to the West Pond ~~also~~ will also have to be installed. The Eastern Drainage extraction trench ~~also~~ will be rerouted down to the extraction trench wet well where water from all three trenches will be pumped into the main influent pipeline from the West Pond. The pipeline from support zone collection sump ~~also~~ will also drain into this main line.

J5.1.3 Influent Pipelines - Start of Phase 3

As Phase 2 ends and Phase 3 starts, the South Pond will be replaced by a smaller West Pond as more areas are remediated. Precipitation ~~and precipitation~~ shed from these areas is clean which results in an overall decrease in the Site water storage requirements. The equalization pond at the WTP will receive water from the West Pond and ~~the new WTP~~ will ~~continue to~~ operate ~~throughout the~~ year-round. Pit 4 and the alluvial extraction trenches will be pumped ~~directly~~ to the West Pond. Pit 3 and the BPA pipelines join~~will be tied~~ together before entering the West Pond. The layouts of the proposed influent pipelines are shown in Figure J-4, below.

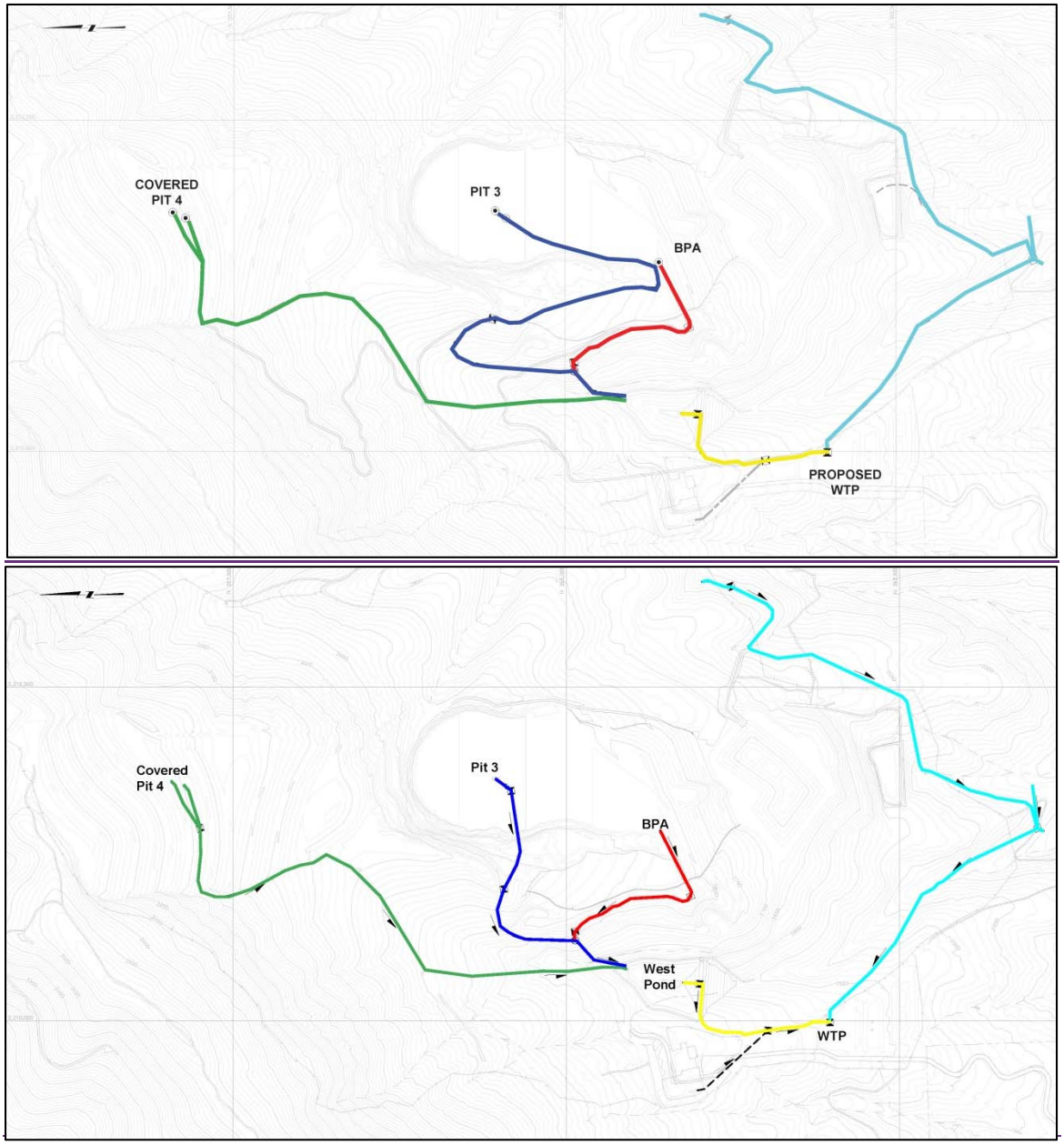


Figure J-4 – Start of Phase 3 Influent Pipelines

Figure J-4 depicts the following influent water sources and pipelines:

- The BPA well (shown in red) will connect to~~tie into~~ the Pit 3 pipeline (shown in dark blue) which runs to~~and run into~~ the West Pond. The Pit 3 pipeline will be modified to run up the west wall of the pit where the future Pit 3 cover access road will be located and then head~~run~~ to the West Pond.

- The Pit 4 pipeline (shown in green) will be installed along the cover access road from the Pit 4 wells and run toward the west side of the pit. The pipe will then turn south to the West Pond.
- The extraction trenches (shown in light blue) will be collected at~~into~~ a single wet well and pumped directly to the West Pond.
- Once all pit water has been conveyed to the West Pond, pumps will push the water down a single pipeline (shown in yellow) to the equalization pond at the new WTP.

J5.1.4 Influent Pipelines - End of Phase 3 (End of Construction Period)

At the end of Phase 3, the existing temporary influent pipelines will not require additional relocation~~movement~~. However, a new seepage collection system will be installed at the toe of the Pit 3 cover to drain via a gravity pipeline ~~down~~ to a new wet well. Water from this wet well will then be pumped ~~up~~ to the BPA wet well and then ~~where they will~~ drain by~~via~~ gravity to the West Pond. The West Pond will remain in place as long as necessary post remediation to contain possible seasonal fluctuations in surface water and groundwater flows and until the hydrogeology and character of all water sources can be verified. It is estimated that the West Pond could remain in place for 10 to 15 years following the end of the construction period. The layouts of the proposed pipelines are shown in Figure J-5, below.

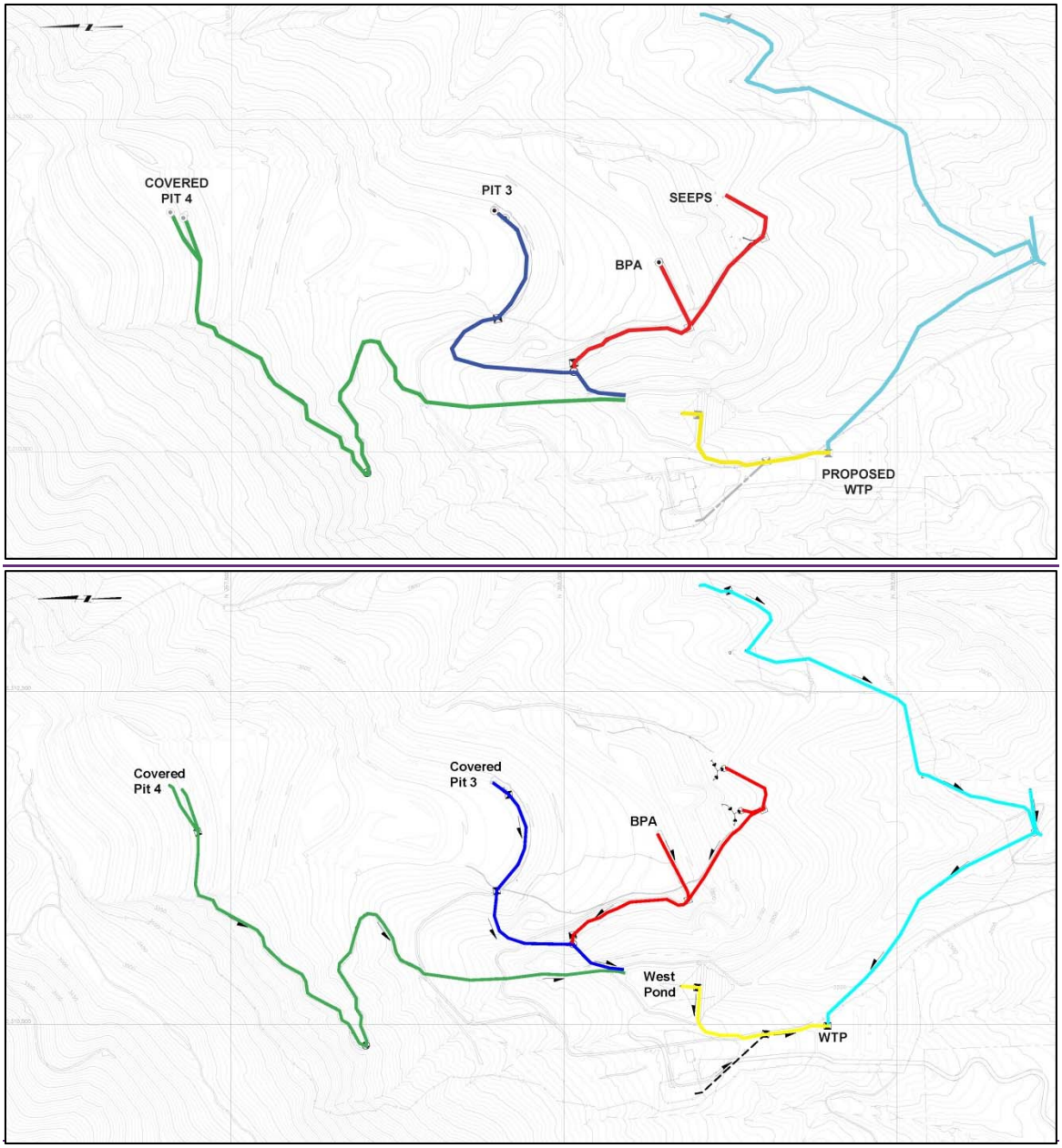


Figure J-5 – End of Phase 3 Influent Pipelines

Figure J-5 depicts the following influent water sources and pipelines:

- The BPA well will continue discharging via an influent pipeline (shown in red) into a wet well where it will be combined with flow from the seepage collection drains.
- This wet well discharge will connect to~~then tie into~~ the Pit 3 pipeline (shown in dark blue) that runs~~before running~~ to the West Pond.
- Pit 4 pipeline (shown in green) will be modified to follow the access road from Pit 4.

- The extraction trenches (shown in light blue) will continue to be pumped to the West Pond.
- Once all the extracted water has been conveyed to the West Pond, pumps will lift the water and carry it down a single pipeline (shown in yellow) to an equalization pond at the new WTP.

It is important to note that, prior to removing the West Pond at some time following the end of construction, pipelines will be installed to enable water to bypass the West Pond and run from Pit 4, Pit 3, the BPA well, and the Pit 3 seepage collection directly to the WTP equalization pond.~~.~~ This will be done by rerouting the Pit 4 pipeline to follow access roads and then connection to~~tying into~~ the Pit 3 pipeline prior to reaching the WTP.

J5.1.5 Permanent Influent Pipelines

Once the influent discharges to the Western Pond are stable, the Western Pond and groundwater trenches will be decommissioned as described in Appendix E. The water from all the various pits~~, trenches,~~ and wells ~~will~~ then will be routed directly to the equalization pond at the WTP site. The layouts of the proposed pipelines are shown in Figure J-6, below.

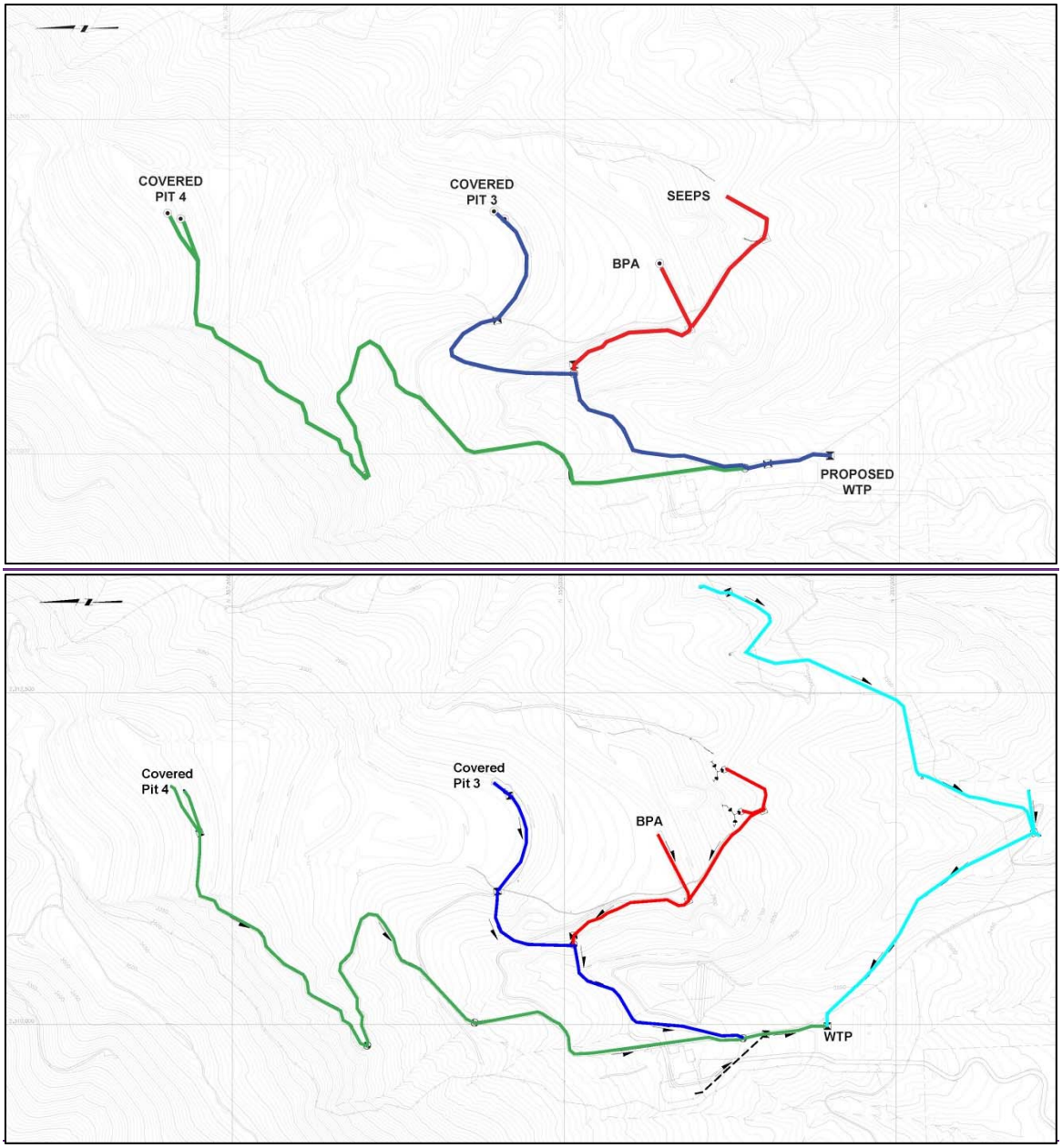


Figure J-6 – Permanent Influent Pipelines

Figure J-6 depicts the following permanent influent water sources and pipelines:

- The BPA well will discharge via an influent pipeline (shown in red) into a wet well where it will be combined with flow from the seepage collection drains.

- The dewatering trenches (shown in light blue) will discharge into a combined wet well. The water that accumulates in the wet well will then be ~~and then~~ pumped into the combined pipeline from the pits at the WTP bench.
- The Pit 4 alignment (shown in green) and Pit 3 alignment (shown in dark blue) will be extended and joined into a single pipeline just prior to reaching the new WTP. This collection pipeline will discharge groundwater into the equalization pond located adjacent to the new WTP before it is treated by the WTP and discharged to Lake Roosevelt.

These final alignments of influent pipelines are positioned to:

1) Provide the most direct route to the WTP holding pond to minimize materials used in construction
2) Minimize the amount of pressure in the lines pumped from the backfilled pits to the equalization~~holding~~ pond at the WTP
3) Allow ease of access to the pipeline over the long term so that maintenance is convenient

J5.2 EFFLUENT PIPELINE – (NOT UPDATED)

The selected effluent pipeline alignment is depicted on Figure J-7 from the new WTP location to Lake Roosevelt. The alignment (shown in blue) is approximately 5.5 miles long and begins at the location of the new WTP. A detailed evaluation of the pipeline alignment is included in Attachment J-1 – the Influent and Effluent Pipeline Hydraulic Calculations.

The pipeline progresses from the new WTP south along~~down~~ what will be the alignment of the proposed future Midnite Mine Access Road until it encounters the Ford-Wellpinit Road. After passing under the Ford-Wellpinit Road, the pipeline continues downhill in a southerly direction along an unnamed, unpaved 4x4 road until intersecting the Blue Creek Road (BIA Hwy 55). The Blue Creek Road then is followed to the confluence of Blue Creek with the Spokane Arm of Lake Roosevelt. Figure J-8 depicts a closer view of where the pipe enters the lake and the diffuser will be installed. The diffuser is located in the bottom of the Spokane River channel.

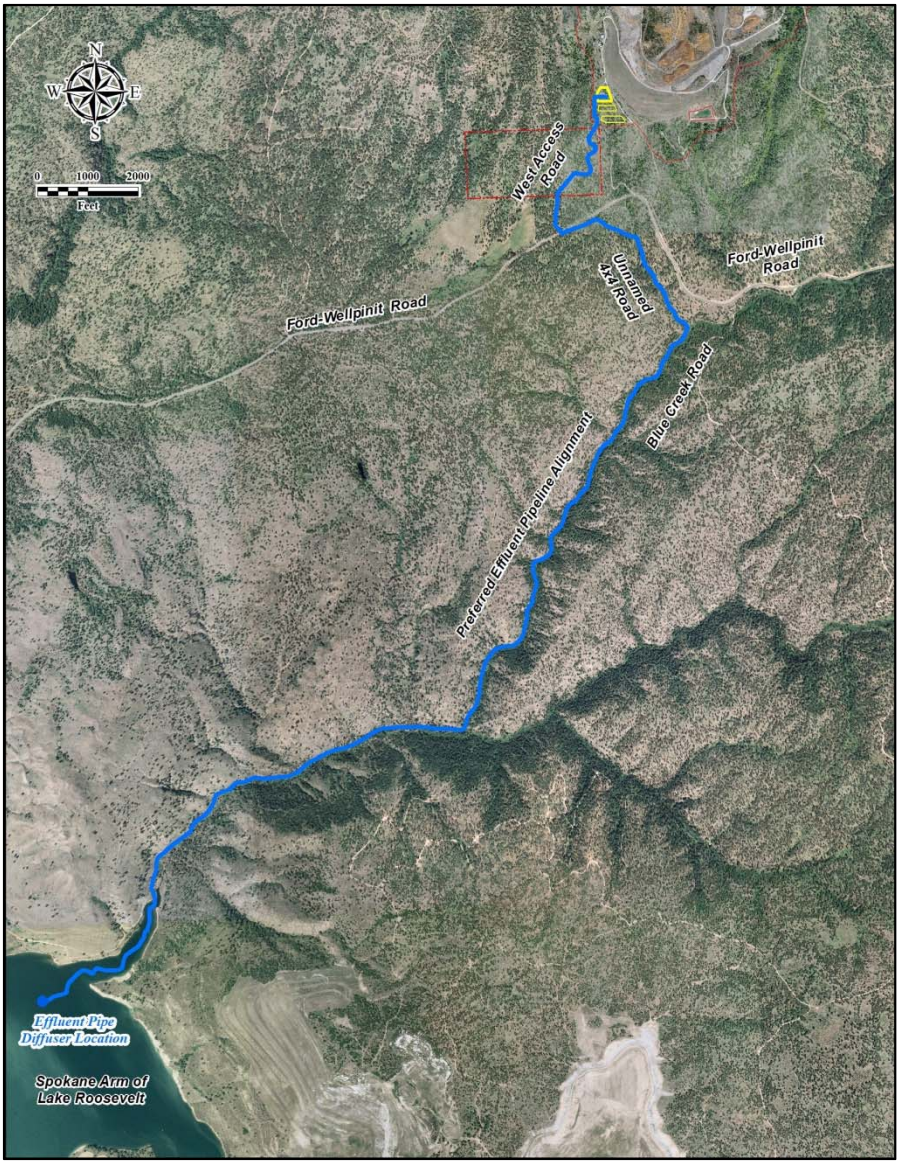


Figure J-7 – Selected Blue Creek Effluent Pipeline Alignment

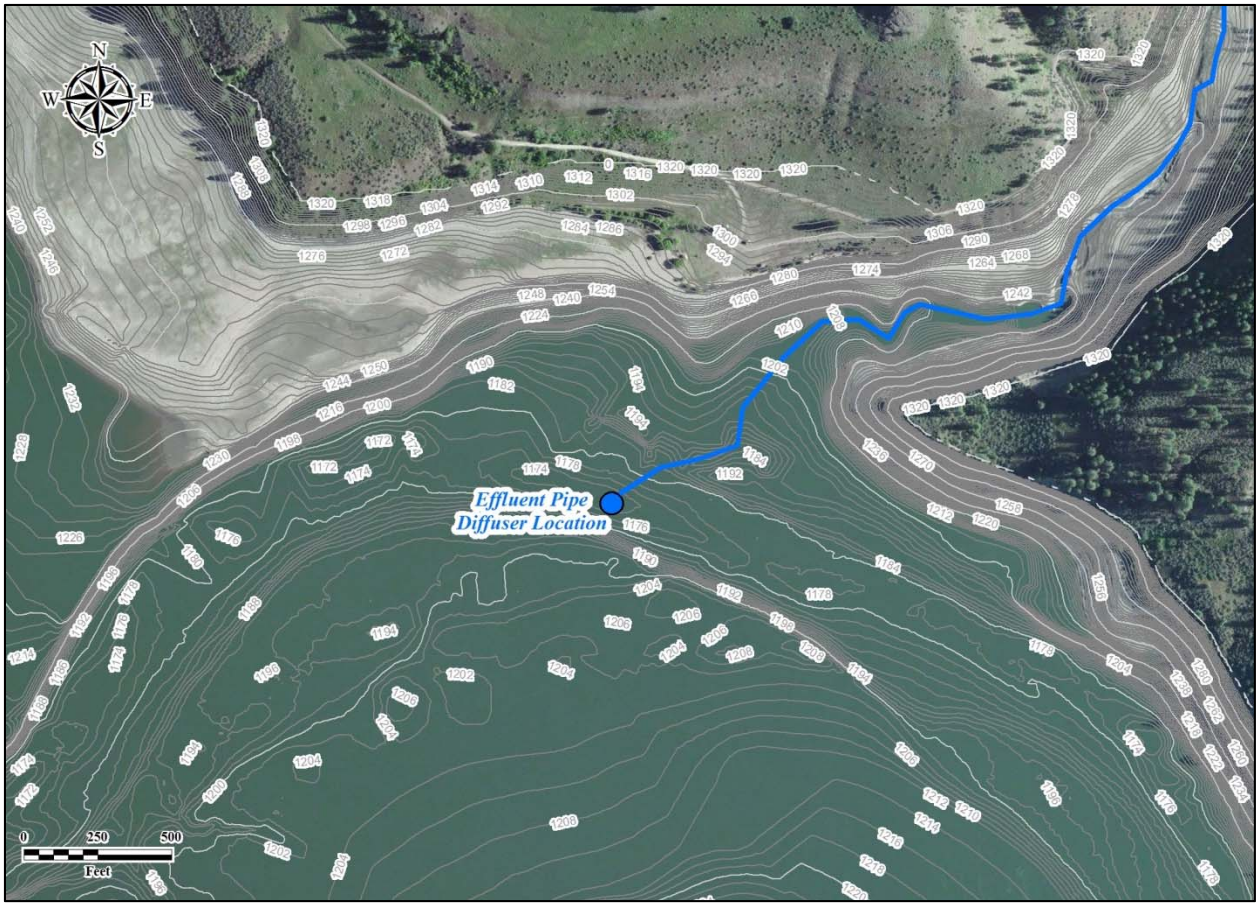


Figure J-8 – Blue Creek Effluent Pipeline Diffuser Location

While the primary goal of the pipeline is to transport water from the WTP to Lake Roosevelt, it also is very important to minimize any impact that could occur during pipeline construction to the surrounding area, including existing structures and native habitat. In order to accomplish this objective, the selected pipeline route will be located within existing roadways and already affected areas as much as possible. In addition to minimizing the environmental impact, by placing the pipeline along roadways, the pipeline will be more accessible for future monitoring and maintenance post construction.

It should be noted that negotiations currently underway with the Tribe regarding the pipeline construction and the necessary Tribal access agreement for the proposed alignment. Those negotiations could alter the final location of the pipeline; however, a site visit was conducted in the summer of 2013 and the lower pipeline location and position of the outfall was discussed and agreed upon. It is anticipated that the access agreement with the Tribe for the pipeline

alignment will be finalized prior to the 90%design so that any changes that might be necessary can incorporated in the 90% design.

J6.0 PIPELINE DESIGN INFORMATION

J6.1 PERMANENT INFLUENT PIPELINE

The temporary influent pipelines will be installed initially on the remediated surfaces prior to final reclamation. As the construction progresses, these lines will be moved regularly to allow the remediation to progress unimpeded. As a result, temporary topographic surfaces will be established and geotechnical conditions will be evaluated as construction progresses.

The influent pipeline drawings depict dual-walled pipelines for temporary piping during construction. However, the Field Engineer may permit single wall piping when crossing contaminated materials and in locations where potential leaks would not be detrimental to any remediated areas. All influent pipelines crossing remediated areas will require dual-wall containment pipe.

When construction is completed in areas of the Site where the influent pipeline will pass, topography and geotechnical data will be updated to provide “as-built” design information for evaluation of the final influent pipeline designs. If necessary, the designs provided herein may be revised based on the most current data. If substantially different from this design, the hydraulic requirements of the final pipeline alignments will be calculated using the ~~final~~ remediated surfaces to determine the slopes of the finished grades and possible vertical inflection points along the pipelines. Elevations of the final topography ~~also~~ will be used to determine pumping requirements to reach the new WTP. When construction is complete, the permanent influent pipelines will be dual~~double~~-walled pipe to prevent any discharge of contaminated water within the remediated Site.

It is anticipated that pumped flows will vary throughout the construction period as elevations are modified. Because these values will not be fixed until the final alignments, sizing for temporary influent pipelines has been selected based only on the final grading and pipeline design.

J6.1.1 Influent Hydraulic Design and Modeling

To complete the hydraulic design of the influent pipelines at the end of construction, modeling~~modelling~~ was conducted using the SWMM 5.0 software (EPA, 2011a). This model is used to calculate the depths, pressures, flows, velocities, and necessary pipe sizes throughout

the system. An in-depth discussion of the hydraulic model and alternative alignments is included in the Influent and Effluent Pipeline Hydraulic Calculations in Attachment J-1.

Influent Assumptions – The influent pipelines carry varying flows in each of the pipes depicted in each of the construction phases on Figure J-1 through J-6. Maximum flows from Pit 4 during construction were assumed to be approximately 68 gpm for the overliner waste dewatering system and 128 gpm for the underliner drain system. Maximum flows from Pit 3 during construction were assumed to be 228 gpm for the overliner waste dewatering system and 366 gpm for the underliner drain system, and combined flows from the BPA extraction wells were assumed to be 40 gpm. The reasoning behind these flows is described in greater detail in Appendix D. The three extraction trench flows are assumed to be 15 gpm each based on the calculations in Attachment G-1 which, under a worst case scenario from seasonal variation, could provide flows up to 45 gpm to the system. The Pit 3 toe seepage collection will be minimal and was assumed to be 5 gpm from each toe for a total of 10 gpm.

This provides a potential flow in the influent pipelines much higher than the assumed 500 gpm maximum WTP total throughput assumed in the WTP design (see Appendix I of the 60% Basis of Design Report [MWH, 2013b]),~~),~~ however, the higher flows are only expected to occur~~run~~ for only short periods of time. In all cases, there will be various ponds, at various times during the RA, upstream of the WTP that provide equalization of the mine affected water flows prior to treatment. Over the long term, flows into these water sources are expected to decrease and the Western Pond will not be decommissioned until the WTP is capable of handling observed flows.

Influent pipe diameters range from a nominal 2-inch to 6-inch High Density Polyethylene (HDPE) pipe. The pipe was sized to minimize the pressure in the pipelines and to limit the number of different pipe diameters used in the system. Pipe diameters were not increased to provide extra capacity for precipitate buildup that might occur over time. However, discussion with the current plant operators indicate no chemical precipitation or scaling has been observed in the piping for the existing WTP and it is expected that the composition of the water during the project will be similar to the current WTP.

A 5-foot minimum depth to the pipe invert was used to meet the required four feet of cover to avoid freezing conditions in all pipelines operating year-round (WSWRG, 2006). This criterion was determined using several available technical sources of potential soil frost depths, plus practical experience by the current WTP operators at the Midnite Mine that indicates a minimum cover of four feet will be necessary to avoid freezing conditions.

Influent Results - All influent lines are assumed to be pressurized and will require dual-walled HDPE pipe to prevent leaks from leaving the unremediated areas of the Site. All high points in the pipelines will require the installation of air/vacuum relief valves so that air does not collect in the top of the pipe and so that siphons cannot occur. The proposed alignments maintain positive or negative grades as much as possible to prevent the need for additional appurtenances and valves. Because the lines are pressurized, the actual slopes of the pipes are unimportant and maintain a depth of 5-ft everywhere. However, grades were maintained to allow water captured in the annular space of the dual-walled pipe to be drained to an inspection point. Diameters were chosen to reduce the required pressure to deliver water from the pits to the equalization ponds and ultimately the WTP.

Influent Conclusions – The selected diameters (i.e., 2-inch through 6-inch) and pipeline alignments at the end of construction (minimize the pressure head required at the pumps and will reduce the number of flanges and fittings where leaks could occur. Leaks ~~that do develop~~ will be captured in a dual-walled pipe and delivered to one of the various ponds for treatment. Pipe sizing, locations, and details are shown in Section 10 of the drawings.

J6.1.2 Influent Leak Detection and Flow Monitoring

The primary method of preventing releases from the influent piping will be through the use of dual-walled pipe. Any possible leakage from influent piping will be reduced by:

- Minimization of pressure in the influent lines.
- Through the use of fuse-welded HDPE piping. When using fuse-welded piping there will be fewer joints where leaks can develop.

In addition, influent pipelines will be inspected regularly. Manholes will be placed at a maximum of every 2,500 feet along the permanent influent pipeline alignments. Visual inspections of flows will be performed regularly through inspections at each influent pipeline manhole. These manholes will allow workers to visually inspect the flows out of the inner pipe, which conveys the water, and check the annular space between the inner and outer pipes for possible leaks (from either the inner or outer pipe surfaces). Any significant flow in the annular space will indicate a leak in the upstream section of pipe that will be investigated. These monitoring methods and procedures are discussed in the Remedial Action Operation, Maintenance and Monitoring Plan~~Manual~~ prepared for water management activities at the Site (~~in~~ Appendix P).

During the RA, the temporary influent pipelines are not designed with manholes as discussed above for the permanent influent pipeline. This is because these pipelines will be regularly moved and it is not practical to install manholes on temporary lines. However, the temporary pipelines will be dual-walled to prevent leaks. During construction, workers regularly will inspect the annular space and flows at major storage locations (e.g., where the water enters the South Pond) to evaluate whether or not~~if~~ a leak may be occurring. In addition, when temporarily pipelines are uncovered and moved during construction, the fuse-welded joints along the pipeline length will be visually inspected ~~by workers looking~~ for external signs of leaks or cracks in the outer wall of the pipe before it is anchored into its new location. If leaks or cracks are found, welds and/or pipeline sections will be replaced. Construction workers ~~also~~ will also be required to travel the temporary alignments and check for external signs of a leak, such as saturated soil or ground settlement. If a leak is suspected, sections of pipe will be replaced until the leak is eliminated.

It should be noted that visual inspections must be performed while the pumps are running. When the system is not running, it will be impossible to verify leaks in the annular space of the dual walled pipe.

J6.2 EFFLUENT PIPELINE – (NOT UPDATED)

The effluent pipeline was designed using inputs consisting of topographic data and geotechnical investigations which are used to perform hydraulic modeling of the pipeline in order to design the gravity flow lines. A geotechnical investigation of the pipeline alignment was performed and showed that the selected alignment would be adequate for installing a pipeline. Modeling was performed using topographic light detection and ranging (LiDAR) data that was collected in 2010 (Tetra Tech, 2010). Discussions of the effluent pipeline design considerations used for the effluent alignment are presented below.

J6.2.1 Topographic Investigations – (Not Updated)

During the summer of 2010, a LiDAR survey of the Site was performed along the entire length of Blue Creek from the Site down to the Lake Roosevelt. These elevation data were used to generate contours which were inputs to the hydraulic design of the pipeline.

J6.2.2 Geotechnical Investigations and Design – (Not Updated)

As part of the geotechnical studies at the site, a potholing investigation was performed to locate potential geologic obstacles along the pipeline alignment in 2013. The results of this

investigation are summarized in a report entitled *Summary of 2013 Blue Creek Geotechnical Investigation – November 2013, Rev 0* (MWH, 2013a~~2013~~) and included as part of Attachment J-2.

The following summarizes the results of the geotechnical investigation:

- For engineering and construction purposes, the deposits of alluvium and colluvium can be considered to have similar properties. The colluvium has slightly higher fines content than the alluvium. The colluvium was difficult to excavate, but is suitable for pipeline support. The alluvium was easy to excavate and would be suitable for reuse as construction material after processing.
- Weathered bedrock was encountered at shallow depths ranging from 4 to 4.5 feet bgs at locations near the north end of the pipeline alignment. The bedrock is typically weathered and friable and was rippable to a depth of 6-inches with conventional excavation equipment.
- Boulders were encountered along the pipeline alignment. These may affect excavation, depending on pipeline depths and boulder locations and depths.

The following are recommendations for excavation and construction of the pipeline based on the results of this investigation:

- The undisturbed native soils are suitable for support of the proposed pipeline with little settlement if construction disturbance is minimized. It will be important to provide adequate compaction of native or backfill materials in the pipe zone particularly along the sides and below the pipe haunches to reduce deflections of the pipe with loading from the soil placed above the pipe.
- Some processing of excavated soil (depending on location) will be required to remove large aggregate (>3-inch) that could damage piping material due to the development of large point loads during backfilling.
- Boulders within the alluvium or shallow bedrock that cannot be excavated will need to be removed with a hydraulic hammer attached to the excavator arm if the boulder is large enough to span the planned width of the trench.
- Field observation and evaluation of subsurface conditions by a field engineer or geologist may be required during pipeline excavation to evaluate when weathered

bedrock has been reached and if the anticipated excavation depths match the conditions encountered in the field.

J6.2.3 Geologic Hazard Investigation – (Not Updated)

A geologic hazard investigation of the pipeline route along Blue Creek was conducted during the summer of 2012 to better understand the hazards along the pipeline route that could impede its construction and/or operation. Attachment J-3 includes *Geohazard Evaluation Proposed Water Treatment Discharge Pipeline Alignment* (Plumlee, 2012).

Based on information presented in this report and additional visual inspections of the pipeline route, the effluent pipeline alignment has been modified in the 60 percent design to avoid these areas entirely and it is not anticipated that any additional investigation will be necessary.

J6.2.4 Hydraulic Design and Modeling – (Not Updated)

To complete the hydraulic design, modelling was conducted using the SWMM 5.0 software (EPA, 2011a). This model is used to calculate the depths, pressures, flows, velocities, and necessary pipe sizes throughout the effluent pipeline system. An in-depth discussion of the hydraulic model and alternative alignments is included in the Influent and Effluent Pipeline Hydraulic Calculations in Attachment J-1.

Assumptions – The effluent pipeline was designed to carry a maximum flow rate of 500 gpm flow, based on the WTP design (see Appendix I of the 60% Basis of Design Report [MWH, 2013b]).~~).~~ This flow is anticipated to decrease over time and could eventually be as low as 50 gpm. Both flows were modeled.

Pipe diameters use a nominal 6-inch HDPE pipe through the upper reaches of the pipeline and then transition to an 8-inch diameter HDPE pipe down to Lake Roosevelt. The pipe was sized to maintain gravity flow as much as possible and to limit the number of different pipe diameters used in the system. Gravity flows are maintained where possible to prevent leaks as might occur if the pipeline were pressurized. In general, the pipeline only will be partially filled at 500 gpm and at 50 gpm the flows will be at the very bottom of the pipe.

Pipe diameters were not increased to provide extra capacity for precipitate buildup that might occur over time. Discussion with the current plant operators indicate no chemical precipitation or scaling has been observed in the effluent piping from the existing WTP and it is expected that the composition of the effluent water from the new WTP will be similar to the current WTP.

A 5-foot minimum depth to the pipe invert was used to meet the required four feet of cover to avoid freezing conditions in the pipelines (WSWRG, 2006). This criterion was determined using several available technical sources of potential soil frost depths, plus practical experience by the current WTP operators at the Midnite Mine that indicate a minimum cover of four feet will be necessary to avoid freezing conditions.

Manholes will be spaced at a maximum of 2,500 feet apart and buried cleanouts will be spaced at a maximum of 400 feet. The manhole and cleanout positioning will be implemented at appropriate intervals to provide necessary access to the pipeline for monitoring and maintenance. Manhole locations are shown in Section 10 of the drawings and cleanout locations will be field located. The manhole spacing also allows sediments, generated during pipeline construction and maintenance, to be trapped in the manholes and removed during pipe cleaning.

Results - The selected pipeline alignment travels downhill for the most part. In a few sections where adverse slopes occur in the existing terrain, pipeline depths are increased up to a maximum of 14 feet in order to maintain downward pipe slopes. By adjusting the depth of the pipe and the pipe diameters, pressurized sections are avoided in the pipeline. Pressurized segments were avoided to prevent the need for additional leak detection in the effluent pipeline as discussed below in Section J6.2.5. Pipe sizing and depths are included in Section 10 of the drawings.

Conclusions - The selected pipe diameters, based on the calculations, allow the pipeline to maintain gravity flows in the calculations and are sufficient to handle flows throughout the life of the pipeline. The pipe sizing and depth of emplacement also helps to prevent pressurization in the pipeline. The upper 3.3 miles of pipe will be 6-in nominal diameter pipe and the remaining pipe will be 8-in nominal diameter pipe. These diameters also help maintain pipe depths at 5 feet for over 80 percent of the alignment and reached a maximum depth of 14 feet for only approximately 500 feet. As discussed above, manholes will be spaced at a maximum of 2,500 feet apart, for a total of 12 manholes and buried, unidirectional cleanouts will be spaced as needed at a maximum of 400 feet.

By avoiding adverse slopes in the pipeline, which can pressurize these sections, by maintaining a downward grade and increasing pipe diameters, the effluent pipeline can maintain gravity flow throughout the alignment (i.e., the pipeline is only partially filled and acts like an open channel).

This greatly reduces the risk of a leak occurring and combined with the fact that the effluent water will be treated, prevents the need for leak detection.

In addition, the manholes and cleanouts will allow regular surveys to be performed on the pipeline to check for possible leaks or the issues that might lead to leaks. The methods for checking for leaks are discussed below in J6.2.5.

J6.2.5 Leak Detection and Flow Monitoring – (Not Updated)

Following water treatment in the new WTP, the effluent leaves meeting most of the Tribal standards and even if a leak does occur, it does not pose a significant threat to the environment. However the effluent pipeline is designed and will be operated to minimize the potential for leaks as described below.

As pressure rises within a pipe, the volume of water that can escape through a leak also increases. Pipeline leaks can be minimized by designing a gravity flow system where the pipe is not pressurized. To reduce the possible leakage and eliminate the need for secondary containment (such as dual–walled piping), the effluent pipeline is designed and will be constructed of sufficiently sized single-walled HDPE pipe which allows water in the pipeline to flow freely by gravity (i.e., the pipe is not full or pressurized). Leak risks are further reduced through the use of fuse-welded HDPE piping and since there will be fewer joints using this material, there are fewer locations where leaks might develop.

During the operation of the effluent pipeline, there will be regular inspections the pipeline manholes and the entire alignment. Manholes will be placed at a maximum of every 2,500 feet along the pipeline where visual inspections of flows can and will be performed. While travelling along the alignment, workers also will check for indications of leaks such as saturation or settling of the ground surface in the roadway where the pipeline is buried.

The combination of visual inspections of flow in the manholes and for settlement in the ground surface along the effluent pipeline corridor (as necessary), along with gravity flow in this pipeline system, should eliminate the need for additional monitoring methods. These monitoring methods and procedures are discussed in the Remedial Action Operation, Maintenance and Monitoring Plan~~Manual~~ prepared for water management activities at the Site (~~in~~ Appendix P).

J7.0 DIFFUSER DESIGN INFORMATION – (NOT UPDATED)

The effluent pipeline will discharge to the lowest part of the Spokane River Arm of Lake Roosevelt. This will be done via a single-port diffuser at the end of the effluent pipeline and a detailed description of its design is included in Attachment J-1 of this appendix. The 6-inch port will discharge approximately 4 feet above the lake bottom and will discharge at an angle of 45 degrees above horizontal to prevent any scouring that might occur to the lake bed. A "duckbill" valve will be installed on the end of the diffuser to prevent sediments from entering the pipe. Flow rates are also expected to decrease from a maximum of 500 gpm down to less than 50 gpm over time as the various pits are backfilled and covered. The location and details of the diffuser are shown in Figure J-3 and in Section 10 of the drawings.

J8.0 ADDITIONAL CONSTRUCTION CONSIDERATIONS

During construction of the various pipelines, soil may be encountered which requires remediation. Such soils will be removed and placed within the pits. Particularly near ~~the~~ Lake Roosevelt, between the low and high water levels, it will be assumed that all excavated material is contaminated and will be placed within the backfilled pits. All backfill for these sections of pipe will require clean, imported fill.

J9.0 GREEN AND SUSTAINABLE REMEDIATION CONSIDERATIONS

Below are ~~green and sustainable remediation (~~GSR~~)~~ considerations for Appendix J – Influent and Effluent Pipelines. GSR considerations were evaluated for: 1) Construction Materials (characteristics and manufacturing considerations), 2) Construction Methods, and 3) Low Impact Development/Sustainability measures undertaken during construction.

J9~~J8~~.1 CONSTRUCTION MATERIAL CONSIDERATIONS

Flexible~~A combination of rigid and flexible~~ HDPE piping will be utilized as the construction material for the influent and effluent pipelines. The use of HDPE as the pipeline material was in part selected for its GSR attributes. HDPE is less costly to transport and will require fewer truckloads over other pipe materials (e.g., metallic) because it weighs significantly less and smaller diameter pipes can be nested within larger pipes. HDPE fused joints are less likely to leak than any other connection. HDPE also is flexible so that during the RA temporary HDPE pipelines will be easy to re-route~~reroute~~. HDPE yields a longer life expectancy because it does not rust or scour and is highly resistant to mineral tuberculation. HDPE also has a high chemical

resistance yielding a superior piping material for this application with respect to environmental reliability as well as longevity of the material of construction.

J9~~J8~~.2 CONSTRUCTION METHODS/MINIMIZE DISTURBANCE

The length of each temporary influent pipeline alignment will be optimized and repeated movement of the lines will be minimized to the extent possible.

The final alignments of influent and effluent pipelines are positioned to:

1) Provide the optimum routes to minimize material procurement, handling, hauling, and installation (i.e. in most cases the shortest distance),
2) Ensure, to the extent possible, gravity flow of water, which significantly improves its sustainability and reliability, and
3) Allow ease of access to the pipeline segments over the long term so that maintenance activities cause minimal disturbance and are easy to accomplish.

The construction equipment used for all pipeline installations, as well as the trench width, as applicable, will be minimized (appropriately sized) to reduce fuel consumption and greenhouse gases emissions while minimizing site disturbance during installation activities.

The effluent pipeline is designed to move water by gravity flow. Neither the installation of additional electrical lines nor the continual use of electricity is required for this flow of water to reach Lake Roosevelt. The gravity flow design also enhances reliability of the system because it is not dependent on a continuous electrical supply for operation or the proper operation of pumping equipment. If the gravity flow pipe for the treatment plant effluent develops a leak, the amount of discharged water will be minimized which enhances its long-term environmental reliability.

J9~~J8~~.3 LOW IMPACT DEVELOPMENT/SUSTAINABILITY

The influent pipeline corridor is wholly within the site boundary which will be disturbed during the RA; therefore ~~the~~ additional land disturbance is minimal for the construction of the permanent influent pipeline routes.

The effluent pipeline is aligned within or along planned or existing traffic corridors. This greatly reduces the environmental impact of the installation and maintenance of the pipeline. Use of these traffic corridors minimizes habitat destruction and disruption and allows for easy access

during routine or emergency maintenance. Again, the effluent pipeline is designed to move water by gravity flow, which provides a highly sustainable and reliable pipeline.

Grading will be conducted to divert clean stormwater from the mining impacted areas and collect potentially impacted stormwater for treatment. The Storm Water Management Plan (SWMP; included in Appendix O) identifies Best Management Practices (BMPs) and specific sediment control measures that will be employed before, during, and after construction for both sediment and storm water control. The Surface Water and Sediment Controls will be used to shed clean water away from contaminated areas thereby reducing the volume of mine-impacted water requiring treatment and will contain contaminated water within the contaminated areas preventing recontamination of remediated areas.

Disturbed areas will be graded to conform to original drainage patterns and to restore the natural pre-existing landscape to the extent practicable. Permanent pipelines will be installed in segments and, when a segment is completed including backfill and final grading, it will immediately be revegetated, as described in the Revegetation Plan in Attachment D-12 of Appendix D. Revegetation efforts with an approved native seed mix will be conducted to restore habitat, improve infiltration, and reduce soil erosion.

J9.0 REFERENCES

Miller Geotechnical Consultants (MGC), 2011 Midnite Mine Design Investigation Report: Groundwater Investigations, Revision 2. Prepared for U.S. EPA on behalf of Dawn Mining Company and Newmont USA Limited. June 9.

MWH Americas, Inc. (MWH), 2013a~~2013~~. Summary of 2013 Blue Creek Geotechnical Investigation Report. November 13.

MWH Americas, Inc. (MWH), 2013b. Midnite Mine Superfund Site, 60 Percent Design Basis of Design Report. December 16.

Plumlee, P., 2012. “Geohazard Evaluation Proposed Water Treatment Discharge Pipeline Alignment”. November.

Tetra Tech, Inc. (Tetra Tech), 2010. Survey Design Investigation Report. Prepared for U.S. EPA on behalf of Dawn Mining Company and Newmont USA Limited. August 6.

U.S. Environmental Protection Agency (EPA), 2011a. Program SWMM 5.0, March.

U.S. Environmental Protection Agency (EPA), 2011b. Midnite Mine Consent Decree, Civil Action No. CV-05-020-JLQ, August.

Washington State Water Reuse Group (WSWRG), 2006. Pipeline Separation Design & Installation Reference Guide. July.

Attachment J-1

Blue Creek Effluent Pipeline Hydraulic Calculations

ATTACHMENT J-1

INFLUENT AND EFFLUENT PIPELINE HYDRAULIC CALCULATIONS

Revisioning					
Rev.	**Date**	**Description**	**By**	**Checked**	**Date**
0	*12/19/12*	*30% Design Submittal Effluent Pipeline Hydraulic Calculations*	*J. Dixon*	*D. Miklas*	*12/19/12*
1	*12/16/13*	*60% Design Submittal Pipeline Hydraulic Calculations*	*J. Dixon*	*W. An*	*12/11/13*
2	*07/31/14*	*90% Design Submittal Effluent Pipeline Hydraulic Calculations*	*J. Dixon*	*S. Romney*	*07/31/14*
3	*06/15/15*	*100% Design Submittal Influent and Effluent Pipeline Hydraulic Calculations*	*J. Dixon*	*D. Miklas*	*06/15/15*

Location and Format

Electronic copies of these calculations are located in the project files system at:

\\Usslc1s01\IFO\Industrial Projects\MIDNITE MINE\EFFLUENT PIPELINE

The calculations herein were generated using the following software:

AutoCAD Civil 3D 2011
Microsoft Office Excel 2010
SWMM 5.0

Supplements

Supplement J-1.1 – SWMM Model Status Report (Influent and Effluent)
Supplement J-1.2 – SWMM Link and Node IDs
Supplement J-1.3 – SWMM Hydraulic Profiles

1.0 INTRODUCTION

This attachment includes design details for the pipelines necessary to convey impacted waters to the Water Treatment Plant (Influent Pipelines) and the pipeline necessary to convey treated water from the Water Treatment Plant (WTP) to the discharge point proposed in Lake Roosevelt (Effluent Pipeline).

Currently additional water quality data is being collected in support of the NPDES permit application process. On May 20, 2014, a letter was sent to the EPA requesting a delay in the design of the WTP since the design of the WTP cannot be finalized until the discharge limits for the reissued NPDES permit are established~~known~~. EPA approved that request. Delay~~As part~~ of the design of~~this request,~~ the effluent pipeline from the new WTP to Lake Roosevelt ~~also~~ was included in the request to EPA~~proposed for delayed~~. The Effluent Pipeline design has not been advanced beyond~~past~~ the 60% design level.

It must be noted that, although effluent design has not been advanced, the sections of this attachment regarding the effluent design have not been removed. Headings have been added to the effluent portions of the design documents with the text "Not Updated" so the reviewer understands the situation and status of each section. Also, in Volume II: Part 2 of 2 - Design Drawings~~Drawing~~, Section 10 – Influent and Effluent Pipeline Designs, the effluent pipe drawings in the 100~~90~~% submittal have watermarks~~notations~~ indicating that the 60% effluent design has not been updated and a note has been added to the general notes section of Sheet 10-1 that "The effluent pipeline drawings and design have not been updated in this design submittal.~~".~~ The effluent pipeline drawings will be revised concurrently with the new WTP design once the NPDES permit is reissued and the discharge limits are established~~known~~."

2.0 BACKGROUND

The Midnite Mine Superfund Site (the Site) has mine waste rock containing uranium on the surface that will be backfilled into several existing open pits at the Site (Pits 3 and 4). These mine wastes will be moved back into the existing pits, then capped~~,~~ to prevent precipitation from contacting ~~with~~ the waste rock. Once capped, groundwater entering the pits must be treated to remove metals before it is discharged off Site. The water will be collected and pumped for treatment via a series of influent pipes. Leak detection in the influent pipeline is described in Appendix J, Section J6.1.2.

Remediation~~The remediation~~ of the Midnite Mine requires that contaminated water be treated before it is discharged into the Spokane River Arm of Lake Roosevelt. This water will be treated at a new WTP~~water treatment plant~~ located at the former mine site and then must travel in a pipeline approximately 5.5 miles to Lake Roosevelt. The~~This~~ pipeline is designed to allow gravity flow to ~~carry the water to~~ the Spokane River Channel at the bottom of the lake.

3.0 SYSTEM DESCRIPTION

In order to convey water around the project site for treatment at the ~~water treatment plant (~~WTP.~~),~~ several pipelines will be required. The piping will primarily consist of three major sections: the influent piping (before treatment), the effluent piping (after treatment), and the outfall diffuser. The diffuser utilizes a single port and requires very little in the way of hydraulic

modeling. This attachment discusses each of these sections individually as they are somewhat independent of each other. As noted above, the effluent pipeline and the diffuser design has been put on hold at the 60% design level until the NPDES permitting process is finalized.

3.1 INFLUENT PIPELINES

During remediation, influent piping will be temporary and frequently~~constantly~~ relocated to avoid areas where earthwork is being performed. As such, locations of influent piping during different phases are shown in this attachment, but only the final influent piping routes are~~is~~ modeled. Three primary locations will require dewatering: Pit 4, Pit 3, and the Backfilled Pit Areas. Each of these areas produce different flows during different periods and design flows for each are discussed below. All influent pipelines are shown in Section 10 of the ~~90% submittal~~ drawings.

The influent pipeline drawings depict dual-walled pipelines for temporary piping during construction. However, the Field Engineer may permit single wall piping when crossing contaminated materials and in locations where potential leaks would not be detrimental to any remediated areas. All influent pipelines crossing remediated areas will use dual-~~-~~wall pipe.

3.1.1 Initial Layout/Start of Phase 1

Initially, the existing pipelines will be used to convey water from Pit 4 and Pit 3 to the existing WTP. When construction begins, the mine–effected water in Pit 4 will be pumped directly to Pit 3 as shown in Figure 1 to dewater the pit. Also water will be pumped directly from the Backfilled Pit Areas (BPA) to Pit 3 as it is currently and from the existing seep collection system to the Pollution Control Pond (PCP) and into Pit 3. The water then will be pumped from Pit 3 to the existing WTP. The existing WTP will be operated until the new WTP is permitted and constructed near the end of Phase I of the RA. The layouts of the proposed pipeline configurations at the beginning of Phase 1 are shown in Figure 1, below.

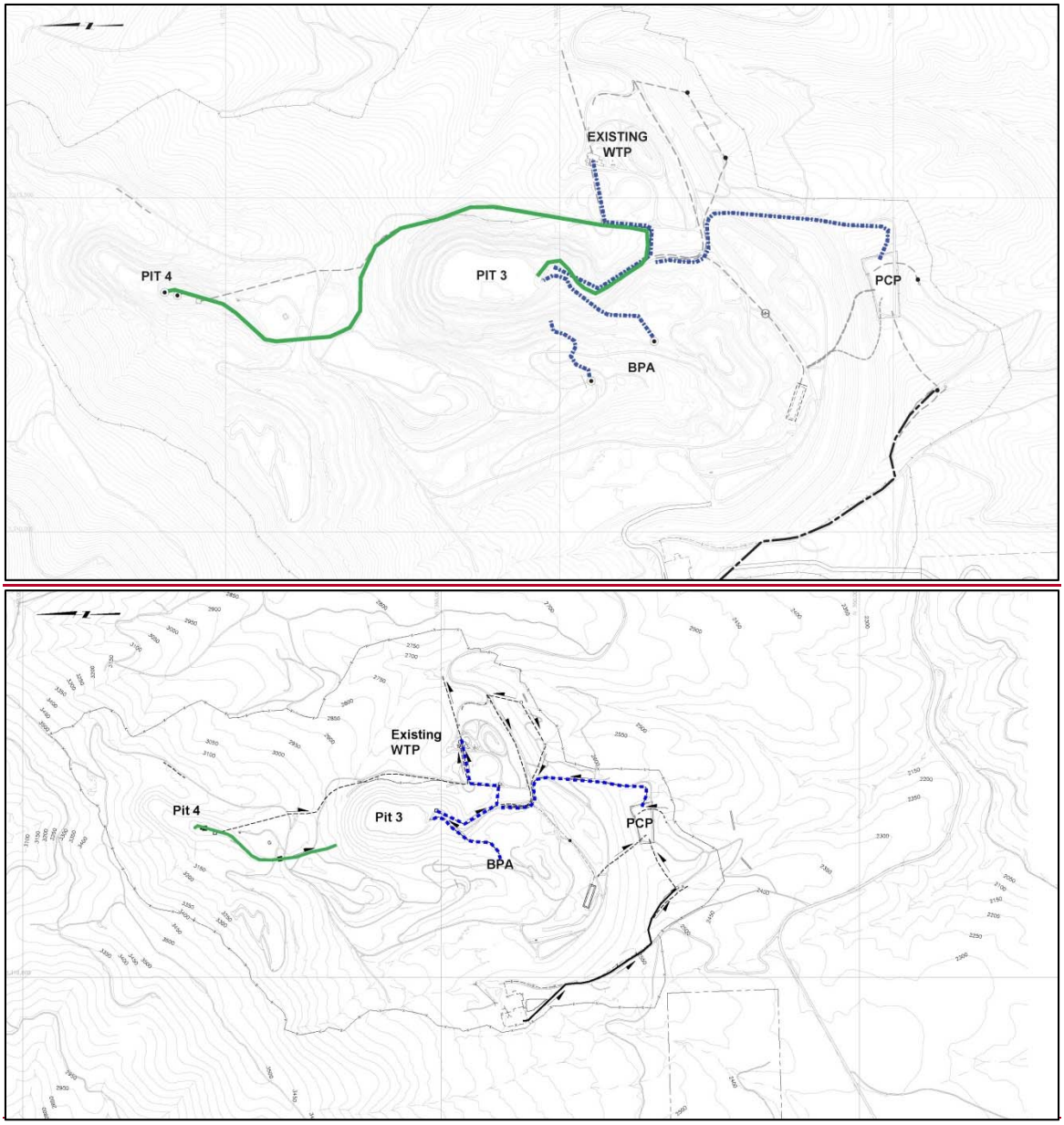


Figure 1. Start of Phase 1 Influent Pipelines

Pit 4 to Pit 3 (shown in green)

Currently water is pumped from Pit 4 directly to the existing WTP. However, as backfilling begins in the pit, water will be redirected to Pit 3 in order to avoid those areas affected by construction. Water will be pumped from the bottom of Pit 4, along the Pit 4 access road and then discharge into Pit 3 on the north side. Pit 4 initially is expected to produce up to 196-gpm, based on information in Appendix D.

As Pit 4 is backfilled, the head requirements for~~on~~ the pump will vary. The pump initially will be oversized to allow for this change in head. As the backfill rises and the dewatering well is extended, head on the pump should approach the design head.

Because the existing WTP is only run seasonally (during warmer months), the influent piping will not require protection against freezing and will not be buried during Phase 1.

Pit 3 to Existing Plant (shown in blue)
Influent piping between Pit 3 and the existing plant is already in place. for the current treatment process. The existing pump and pipeline are currently capable of moving 500 gpm, exceedingexceeds the capacity of the existing WTP and is capable of pumping 500 gpm.

Backfilled Pit Areas to Pit 3 (shown in blue)
Influent piping from the Backfilled Pit Area (BPA) is already in place and is currently being used to pump water from the BPA to Pit 3. These pipelines produce about 40 gpm and will not require modification for the first phase of construction.

3.1.2 Start of Phase 2

At the beginning of Phase 2, Pit 4 will be filled and capped and it is assumed that the new WTPCP plant will be completed. The new WTP will replace the existing plant and allow for water to be treated year-round. This will require that all influent piping be protected against freezing, provided by and will recommend a minimum of 48-inches of cover. The South Pond also will be in place for storage of water prior to the treatment at the new WTP. The influent pipe alignments at the beginning of Phase 2 are shown in Figure 2 below.

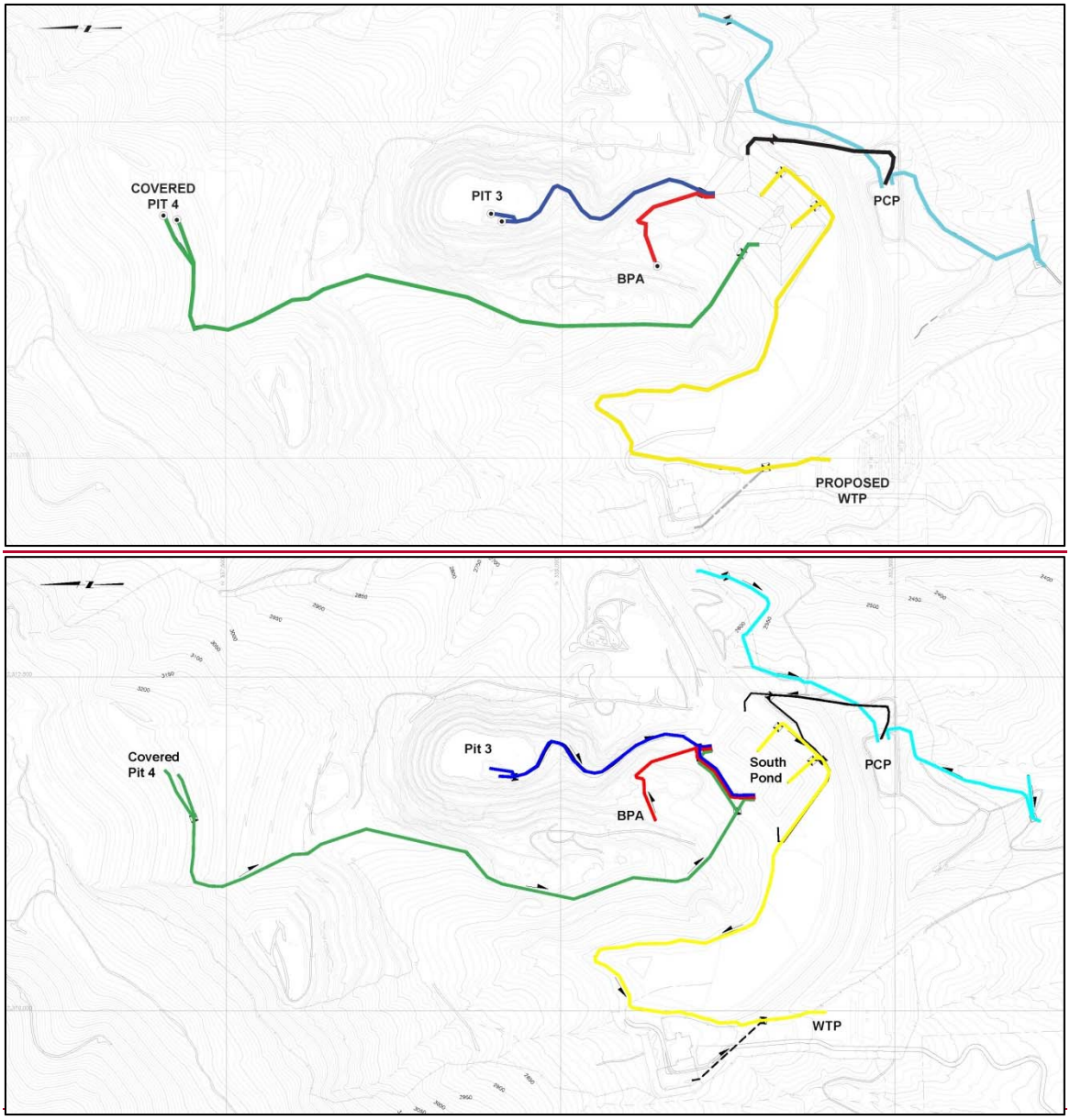


Figure 2. Start of Phase 2 Influent Pipelines

Pit 4 to South Pond (shown in green)
When Phase 2 begins, the piping from Pit 4 to Pit 3 will be abandoned and a new pipe will be operating that runs from Pit 4, along the west side of Pit 3, and dischargesdischarge into the northwest corner of the new, temporary South Pond. If WTP makeup water needs require it, and the water quality from Pit 4 is acceptableamenable, it is also possible that a portion of the water from Pit 4 will be piped directly to the WTP. Water will be stored in the South Pond until it is pumped for treatment at the new WTP.

Pit 3 to South Pond (shown in blue)
Once the new WTP is completed at the end of Phase 1, the existing WTP will be abandoned and water will be sent from Pit 3 down to the South Pond. Similar to the methods used in Pit 4,

as Pit 3 is backfilled, the dewatering well(s) will have to be raised over time and the temporary pipeline route changed.

Backfilled Pit Areas to South Pond (shown in red)
After the first phase of construction, the pipelines from the BPA will have to be rerouted to transfer water to the South Pond instead of Pit 3. In conjunction with these changes, a wet well will be installed to collect and monitor flow from each of the wells. A single pipeline then will be installed~~routed~~ from the wet well, to allow~~via~~ gravity flow~~,~~ down to the South Pond.

Extraction Trench Pipelines (shown in cyan)
At the end of Phase 1, new extraction trenches will be installed in the Western, Central, and Eastern Drainages. Water will flow from the Eastern Drainage via gravity down to the PCP. Water will be pumped from the Western and Central drainages into a wet well and then pumped again from the wet well up to the PCP.

South Pond to New WTP (shown in yellow)
The South Pond is located at a higher elevation than the new WTP location and will be capable of delivering water to the new WTP via gravity flow. A single pipeline will run west along the South Waste Rock Bench before changing direction to the south for delivery of the water to the new WTP.

3.1.3 Start of Phase 3

At the end of Phase 2, Pit 3 backfilling will continue but the West Pond will replace the South Pond. The South Pond which is constructed entirely within a waste rock dump will be decommissioned and removed during Phase 3 Treatment also will continue to operate year-round necessitating a~~48-inches of~~ minimum of 48-inches of cover over the influent piping. The influent pipeline alignments at the beginning of Phase 3 are shown in Figure 3 below.

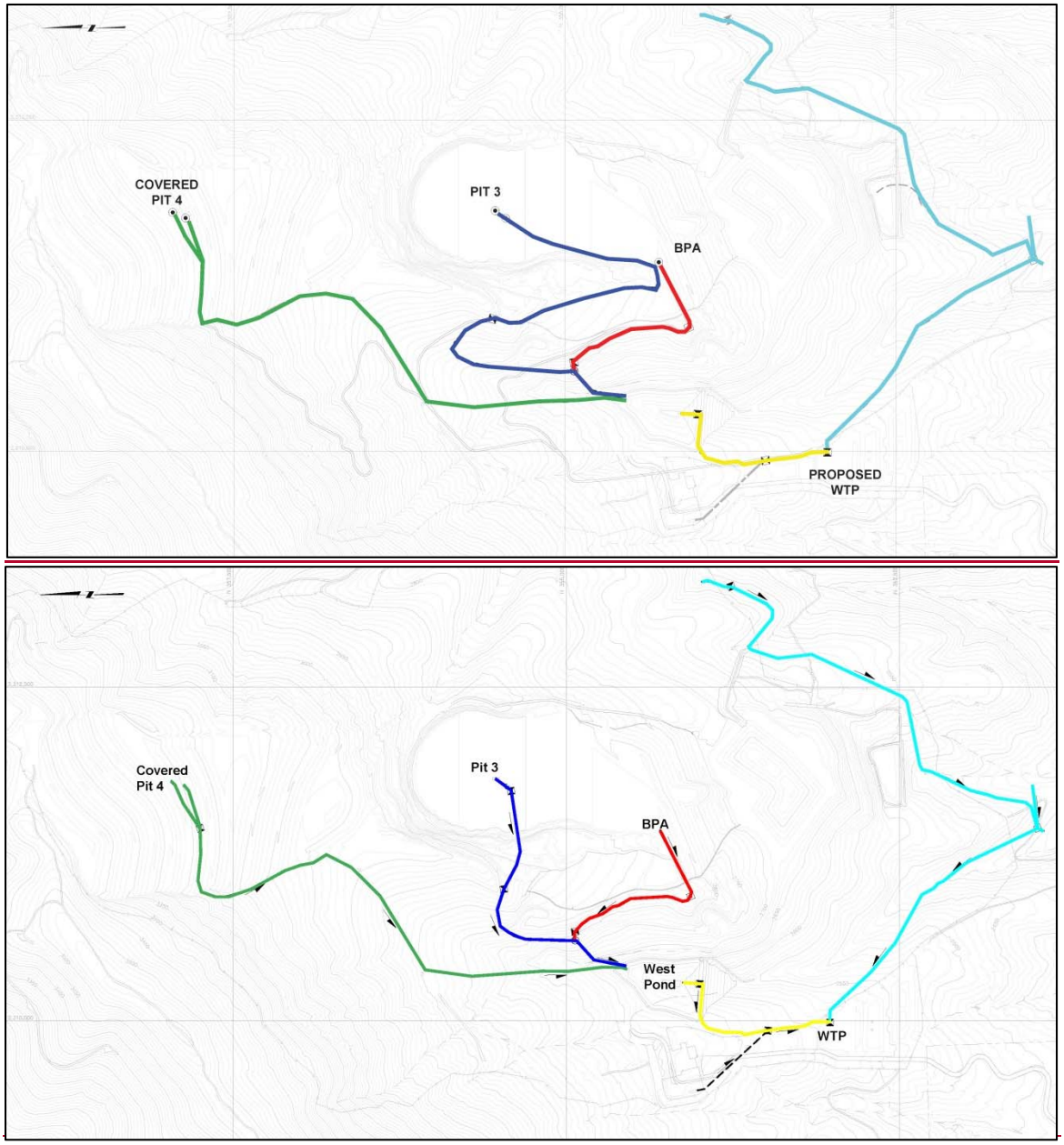


Figure 3. Start of Phase 3 Influent Pipelines

Pit 4 to West Pond (shown in green)
Prior to Phase 3 ~~of~~ construction, the Pit 4 pipeline running around the western edge of Pit 3 will be relocated further to the west to flow into the West Pond. If WTP makeup water needs require it, and the water quality from Pit 4 is acceptable~~amenable~~, it is also possible that a portion of the water from Pit 4 will be piped directly to the WTP.

Pit 3 to West Pond (shown in blue)
Near the end of Phase 2, the Pit 3 water will be redirected to the West Pond. The pipeline running to the South Pond then will be removed.

Backfilled Pit Areas to West Pond (shown in red)

As Phase 2 is completed, the BPA pipeline will be relocated so that water flows to the West Pond instead of the South Pond. This line will run from the wet well, as in Phase 2 ~~of~~ construction. The water will~~, and then~~ flow down to the pond via gravity.

West Pond to New Plant (shown in yellow)
Similar to the South Pond, the West Pond will be located at a higher elevation than the new WTP. At the end of Phase 2, a pipeline will be installed from the West Pond to the WTP Equalization Pond for~~prior to~~ treatment.

Extraction Trench Pipelines (shown in cyan)
At the end of Phase 2, the extraction trench pipelines will no longer discharge into~~use~~ the PCP and will be relocated to connect to~~tie into~~ the main WTP influent pipelines.~~.~~ The Eastern Drainage will flow by~~via~~ gravity and the Central and Western Drainages will be pumped into a single wet well. Rather than pump the~~to~~ water to the West Pond, water from this wet well will be pumped~~pump~~ to the main influent pipeline from the West Pond at the WTP bench.

3.1.4 End of Phase 3 (End of Construction Period)

At the end of Phase 3, Pit 3 backfilling will be completed but the West Pond will continue to operate. The Western Pond likely will remain in place as long as necessary post remediation to contain possible seasonal fluctuations in surface water and groundwater flows and until the hydrogeology and character of all water sources can be verified. It is estimated that the Western Pond could remain in place for 10 to 15 years following the completion of the construction period. Treatment also will continue to operate year-round requiring ~~necessitating 48-inches of minimum cover over the influent~~ piping system freeze protection.~~.~~ The influent pipeline alignments at the end of Phase 3 are shown in Figure 4 below.

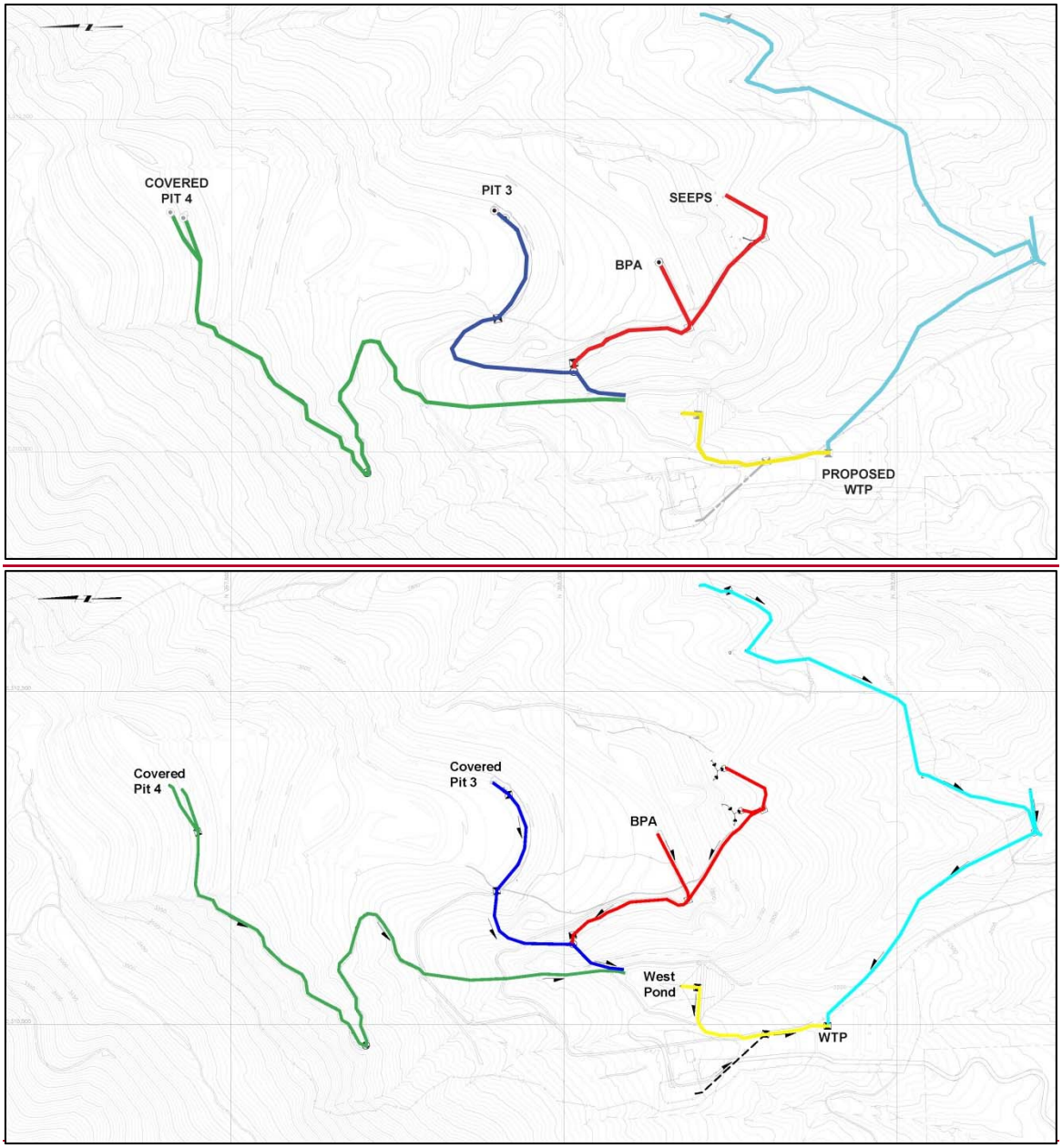


Figure 4. End of Phase 3 Influent Pipelines

Pit 4 to West Pond (shown in green)
After Phase 3, operation of the Pit 4 to West Pond pipeline will have been modified to follow the access road to the Pit 4 cover. If WTP makeup water needs require it, and the water quality from Pit 4 is acceptable~~amenable~~, it is also possible that a portion of the water from Pit 4 will be piped directly to the WTP.

Pit 3 to West Pond (shown in blue)
Near the end of Phase 3, Pit 3 will be capped and the Pit 3 influent pipelines will have to be installed within the access roads on that cover. Once outside the cap, the pipeline will maintain the same alignment as described for the start of the phase.

Backfilled Pit Areas to West Pond (shown in red)
Near the end of Phase 3, Pit 3 will be capped and the BPA influent pipeline will have to be installed within the access roads on that cover. Once outside the cap, the pipeline will maintain the same alignment as described for the start of the phase.

A seepage collection system will also be installed within the cover of Pit 3. This pipeline will be connected to the BPA influent pipeline at a wet well.

West Pond to New Plant (shown in yellow)
After Phase 3, operation of the West Pond pipeline will continue as described at the start of the phase.

Extraction Trench Pipelines (shown in cyan)
After Phase 3, operation of the extraction trench pipelines will continue as described at the start of the phase.

3.1.5 Permanent Influent Pipelines

Once the influent discharges to the Western Pond are stable, the Western Pond will be decommissioned as described in Appendix E. The alluvial groundwater collection trenches will also be removed prior to the end of Remedial Action. The water from all the various pits and wells then will then be routed directly to the equalization pond at the WTP site. After remediation has ended at the Site, all influent pipelines will be dual-walled. The ~~and will run directly to the new WTP location. The West Pond also will be decommissioned. The~~ WTP will continue to operate year-round. The final alignments are shown in Figure 5 below.

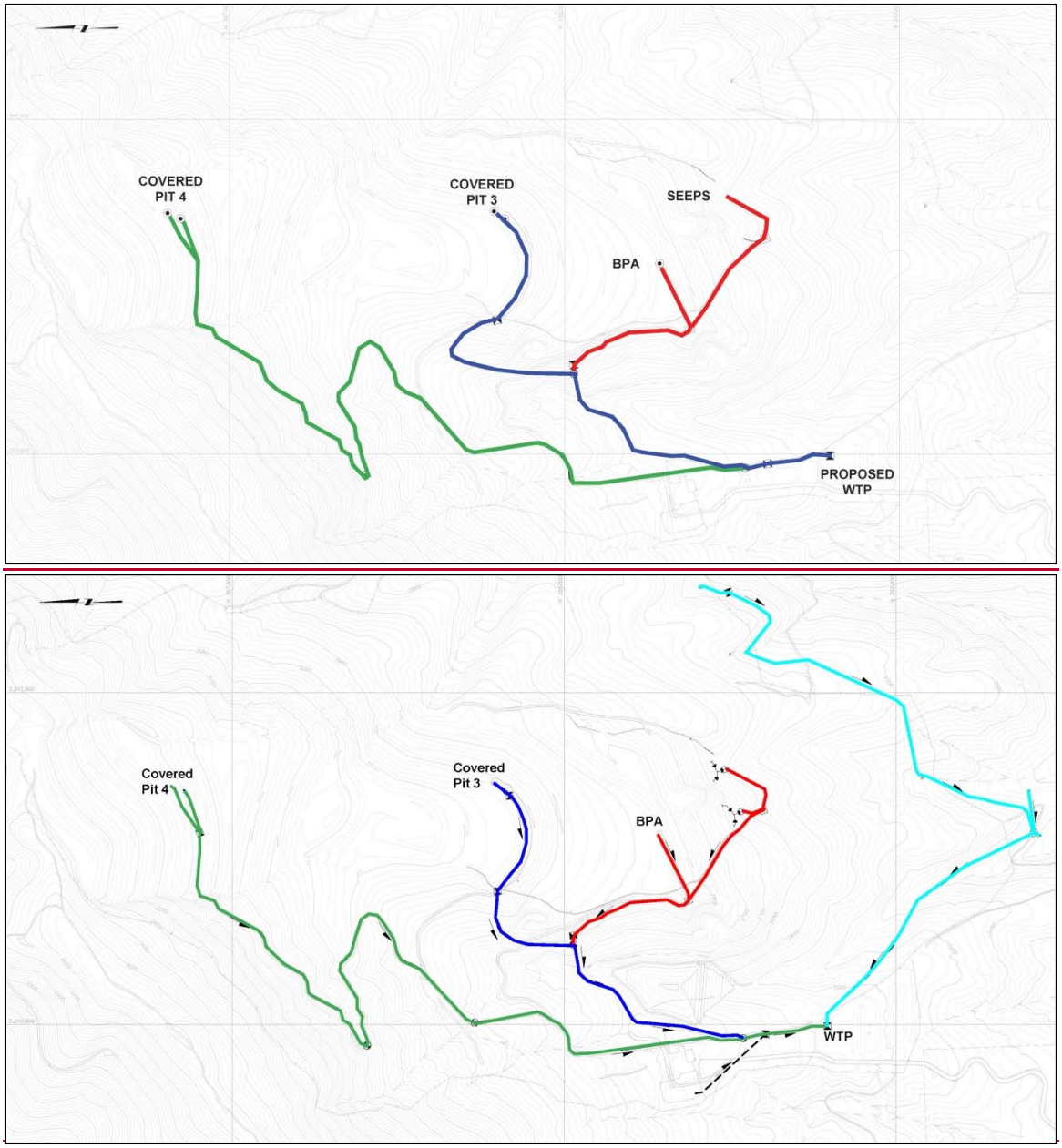


Figure 5. Permanent Influent Pipelines

Pit 4 to New Plant (shown in green)
The pipeline from Pit 4 to the West Pond will be modified at the end of construction to run along permanent access roads directly to the WTP. Water flow will be via gravity.

Pit 3 to Pit 4 Pipeline (shown in blue)
The pipeline from Pit 3 to the West Pond will be modified at the end of construction to connect to~~tie into~~ the Pit 4 pipeline which runs to the WTP. Water flow will be by~~via~~ gravity.

Backfilled Pit Areas to Pit 3 Pipeline (shown in red)

The pipeline from BPA will remain connected to~~tied into~~ the Pit 3 pipeline. The wet well from the BPA will also be relocated further west to fall outside the Pit 3 cover. The seepage collection system will continue to connect to~~tie into~~ the BPA pipeline at the wet well. Water will flow by~~via~~ gravity from the wet well down to the WTP.

~~**Extraction Trench Pipelines (shown in cyan)**~~
~~Permanent operation of the extraction trench pipelines will continue as described at the start of Phase 3.~~

3.2 EFFLUENT PIPELINE – (NON-DESIGN UPDATES ONLY)

Two alternative pipeline alignments between the Site and Lake Roosevelt were reviewed as part of the 30 percent design submittal and one was selected for design (see Figure 6). While both alignments maintain a downward slope through most of the pipe, the selected alternative maintains more consistent grades. This helps to reduce sediment buildup, which could occur in the more shallow slopes. (Sediment might enter the pipe during construction and maintenance.) Although the selected alignment allows for the pipe to be placed within roadways along nearly the entire alignment so accessibility is improved. While both alignments are capable of conveying the water to Lake Roosevelt, the selected alternative does so with a smaller amount of disturbance and fewer hydraulic issues. It will also provide better access for installation and maintenance because it follows existing and future road alignments more so than the alternative.

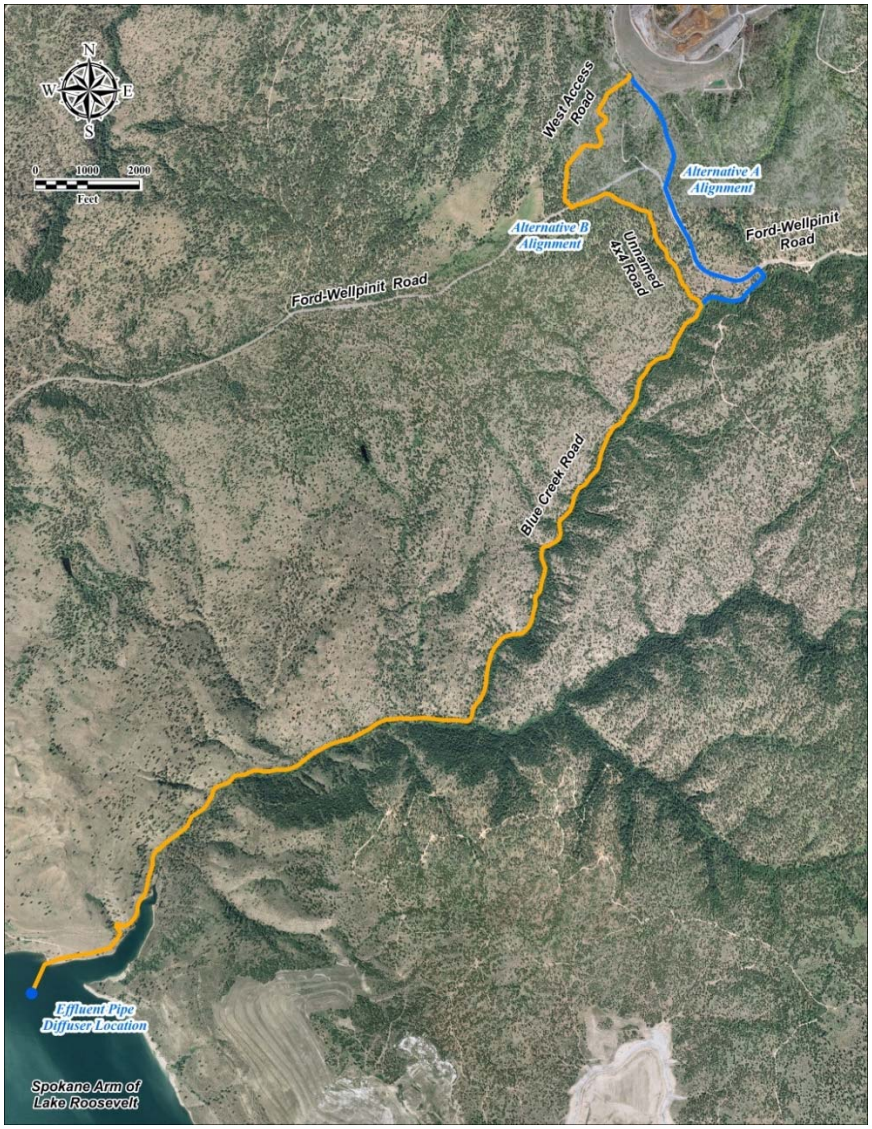


Figure 6. Effluent Pipeline Alternative Alignments (yellow was preferred)

The selected alignment utilizes the existing and future roadways and other easily accessible features and allows for a continuous downward slope in the pipeline. This will:

- Make pipeline construction easier
- Improve accessibility to the pipeline for maintenance
- Reduce the ecological impact of the pipeline to the surrounding area.

In addition, construction will be easier along the Blue Creek Road as rocky geologic features will be mostly avoided.

Figure 7 below shows the selected pipeline alignment. The blue line represents the pipeline from the future CP plant location down to the Spokane River Arm of Lake Roosevelt. At the discharge location, an outfall diffuser will release the treated water into the lake. The maximum flow from the WTP will be 500 gpm and will decrease over time down to 50 gpm or less. The system was modeled using 500 gpm and 50 gpm as the discharge variables.

The selected effluent pipeline route follows the western mine road until passing through the southwest gate. The pipeline then follows the proposed mine access road until reaching the Ford-Wellpinit Road. The pipe immediately passes underneath the road and travels roughly 100 feet eastward while remaining in the south shoulder. Once the pipeline reaches the Western Drainage, it travels down an unnamed 4x4 road until reaching the Blue Creek Road and then follows the road to Lake Roosevelt.

The upper 60 percent or so of the pipeline uses nominal 6-inch diameter pipe while the lower portion uses 8-inch pipe due to shallower slopes which are not capable of discharging water in the smaller diameter pipe as quickly. A total of 13 manholes will be spaced at a maximum of 2,500 feet apart with buried cleanouts spaced as needed (typically at 400 foot intervals). Manholes will act as traps to collect sediments being flushed down the pipe as well as points where effluent discharge can be observed visually. Manhole locations and details are showing in Section 10 of the drawings.

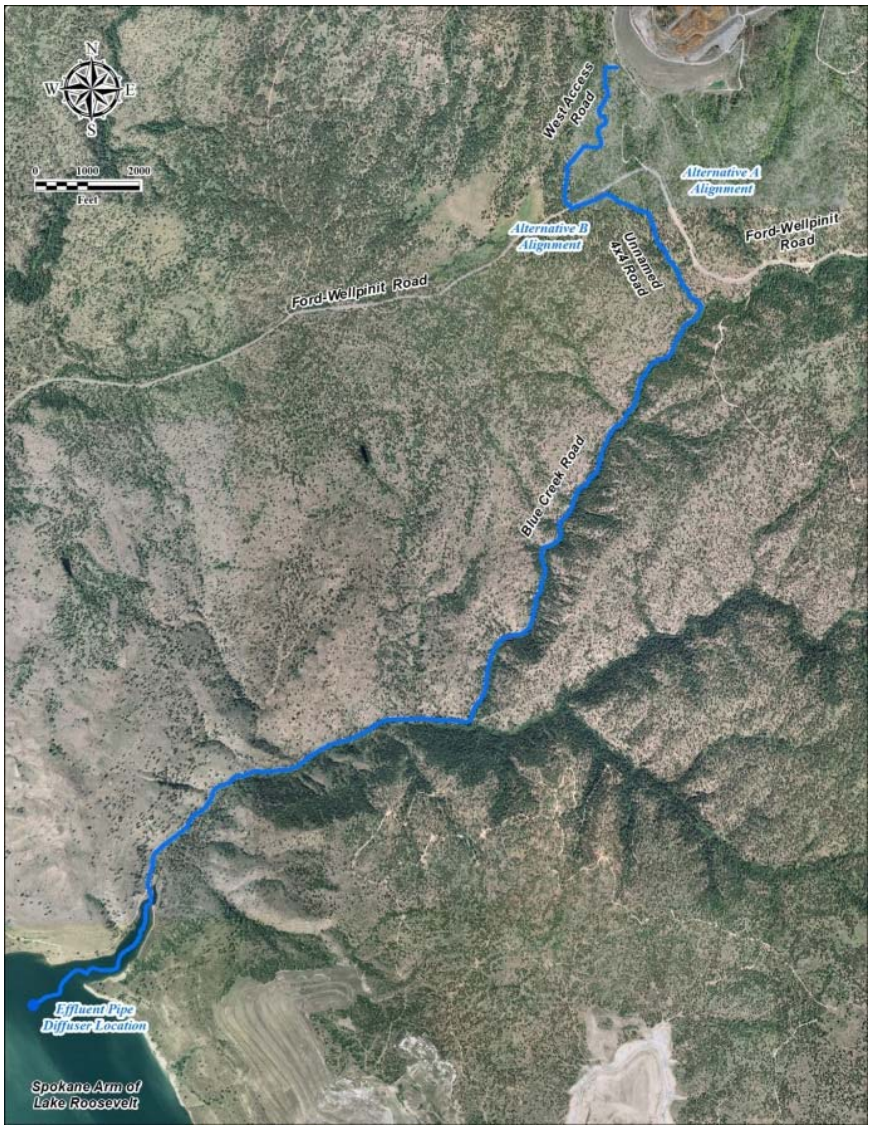


Figure 7. Final Effluent Pipeline Alignment

3.3 DIFFUSER – (NOT UPDATED)

The diffuser design was presented as part of the NPDES permit application, *Effluent Discharge Mixing Evaluation for the Midnite Mine Water Treatment Plant* (MWH, 2013), and consists of a single port, 6-inches in diameter, coming off at a 45 degree angle from an 8-inch diameter trunk line. The port will utilize a "duckbill" valve to prevent clogging from sediments entering the pipe. The effluent diffuser drawing detail is shown in Figure 8 below.

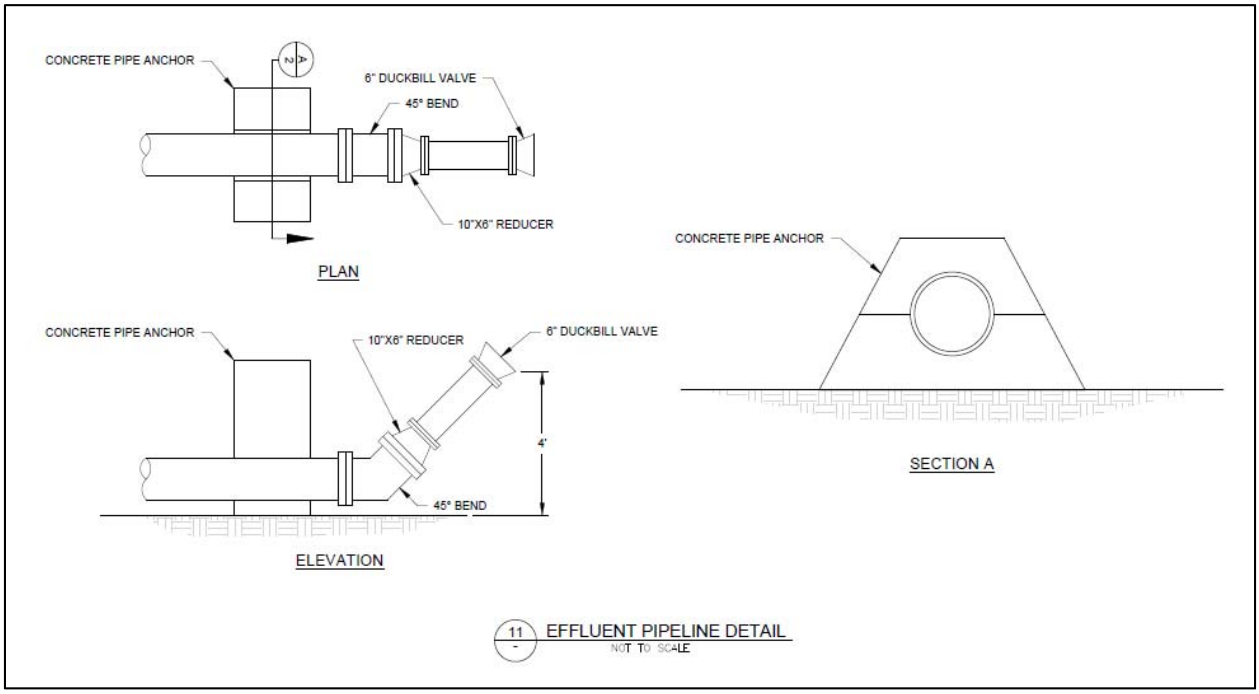


Figure 8. Effluent Diffuser Details

4.0 METHODOLOGY

4.1 PIPELINES

In order to accurately determine water levels in the pipelines and to calculate the pipe sizing, a model was run using the SWMM 5.0 software program (EPA, 2011). This program uses a series of user-input nodes and links to simulate the pipeline and to route flows through the system. These nodes and links require inputs such as lengths, diameters, depths, and coefficients in order to accurately model the system. While the nodes do not necessarily represent manholes or points of inflection, they can be adjusted to simulate these structures. The model provides calculations for heads and depths in the nodes, and flows, velocities, and slopes for the links.

The program utilizes a dynamic wave model to route flows through the pipeline and to the various end outfall points. The dynamic wave method was necessary due to the adverse slopes that occur regularly throughout the various pipelines. In the pressurized sections of pipe, the Darcy-Weisbach equation is used to calculate head losses due to friction through the pipe; whereas the Manning equation is used in non-pressurized sections.

The Manning equation is:

$$\cancel{Q = \frac{1.486}{n} * \frac{A_{pipe}^{5/3}}{P^{2/3}} * S_o^{1/2}} \quad \underline{Q = \frac{1.486}{n} * \frac{A_{pipe}^{5/3}}{P^{2/3}} * S_o^{1/2}}$$

Where:

Q is the flow travelling through the pipe (cubic feet per second [cfs])
n is the Manning's coefficient
A_{pipe} is the cross-sectional area of the pipe (square feet [sf])
P is the wetted perimeter of the pipe (ft)
S_o is the slope of the pipe (ft/ft)

The Darcy-Weisbach pressurized friction head loss equation is:

$$\cancel{h_f = \frac{fLV^2}{2gd}} \quad \underline{h_f = \frac{fLV^2}{2gd}}$$

Where:

h_f is the head loss in the pipe due to friction (ft)
f is the coefficient of friction
V is the velocity in the pipe (fps)
g is the acceleration of gravity (ft/s^2)
d is the inner diameter of the pipe (ft)

Other pressurized head losses were calculated as:

$$\cancel{h_L = K\frac{Q^2}{2gA^2}} \quad \underline{h_L = K\frac{Q^2}{2gA^2}}$$

Where:

h_L is the head loss (ft)
K is the loss coefficient
Q is the flow in the pipe (cfs)
g is the acceleration of gravity (ft/s^2)
A is the cross-sectional area of the pipe (sf)

4.2 OUTFALL DIFFUSER – (NOT UPDATED)

Because the diffuser uses a single port discharge, it follows the same methodology as the other pipelines outlined above and calculated in the Effluent Pipeline SWMM model.

5.0 ASSUMPTIONS

Pipe diameters on the influent pipelines were calculated in the SWMM model and vary for each pipeline.

Pipe diameters for the effluent pipeline are primarily nominal 6-inch from the inlet to approximately station 172+50 where the pipe then transitions to 8-inch diameter and continues at that diameter down to the discharge point in Spokane River Channel at the bottom of Lake Roosevelt. This sizing was selected to maintain gravity flows in the pipe and help prevent the need for additional containment or leak detection.

The Manning friction coefficient used was 0.012 for all sections of pipe. This number is based on the coefficient for slightly rougher than new plastic pipe. (Sanks, 1998).) An average head loss was assumed to be approximately one velocity head per thousand feet of pipe to calculate any small losses not accounted for otherwise, such as uneven pipe and wide bends. Entrance losses assumed 0.5 velocity heads and exit losses assumed 1.0 velocity head (Sanks, 1998).

A 5-foot minimum depth to the pipe invert in the model is assumedwill be required to avoid freezing. Where adverse slopes occurred in the gravity flow sections of pipe, depths were increased to maintain a steady slope as much as possible, but were not allowed to be more than 14- -feet in depth. In the effluent pipeline, pipe depths were also increased in sections where existing ground slopes decreased in order to maintain steeper grades in the pipe and pipe diameters were increased to allow more water to flow through the pipe. By maintaining the steeper slopes and increasing flow capacity, gravity flows are maintained in the effluent pipeline.

Flow rates for each source were assumed as follows:

- During construction, flows from Pit 4 were assumed to be approximately 68 gpm for the overliner waste dewatering system and 128 gpm for the underliner drain system.

- Flows from Pit 3 were assumed to be 228 gpm for the overliner waste dewatering system and 366 gpm for the underliner drain system.

- Combined flows from the BPA extraction wells were assumed to be 40 gpm. The reasoning behind these flows is described in greater detail in Appendix D.

- The Western, Central, and Eastern Drainages are expected to provide 15 gpm each as described in Appendix G for a total of 45 gpm.

- The Pit 3 Seepage Collection System will be minimal and was assumed to provide 5 gpm from each toe for a total of 10 gpm.

However in all cases, there will be various ponds, at various times during the RA, upstream of the WTP that provide equalization of the mine affected water flows prior to treatment. The effluent pipeline will only be required to carry 500 gpm and it was assumed that it would enter the lake under the most conservative period when the reservoir is full (elevation 1290-ft).

SWMM also assumes that hydraulic jumps do not occur and that transitions are linear between nodes and exact locations of jumps are not calculated within the pipe sections. This does not allow the model to determine exact distances of pressurized sections in the pipe, but can at least determine which segments of pipe will be pressurized over some length.

Under normal operating conditions, surge is not considered a concern for the Midnite pipelines. On the permanent alignments, most pipeline segments will not be pressurized which eliminates the potential for surge. Valving has been avoided and allows for open flow which removes the possibility of dead-head on the pump. Vacuum breaks are also included to prevent siphoning. In addition, PE pipe is very tolerant of the effect of pressure surges (PPI, 2012).

6.0 NODE AND LINK IDS – (NOT UPDATED FOR EFFLUENT)

Because hundreds of nodes and links were used in the creation of the SWMM models, individual nodes and links cannot be visually discerned on a single map and it becomes impossible to determine where specific output and station values occur. Node and link IDs for each of the pipeline models were used to relate the plan views to the profiles and outputs and are included in Supplement J-1.2. Figure 9 and Figure 10 below show the links and nodes used to model the permanent (final)~~end of construction~~ influent and effluent pipelines, respectively. For the influent piping, nodes are shown in dark blue and links are shown in light blue color. For the effluent pipeline, dark blue nodes indicate non-pressurized sections and red nodes indicate pressurized sections. It should be noted that the alluvial groundwater trenches are included in the influent model to determine final sizing even though they will be eliminated at the end of remedial action.

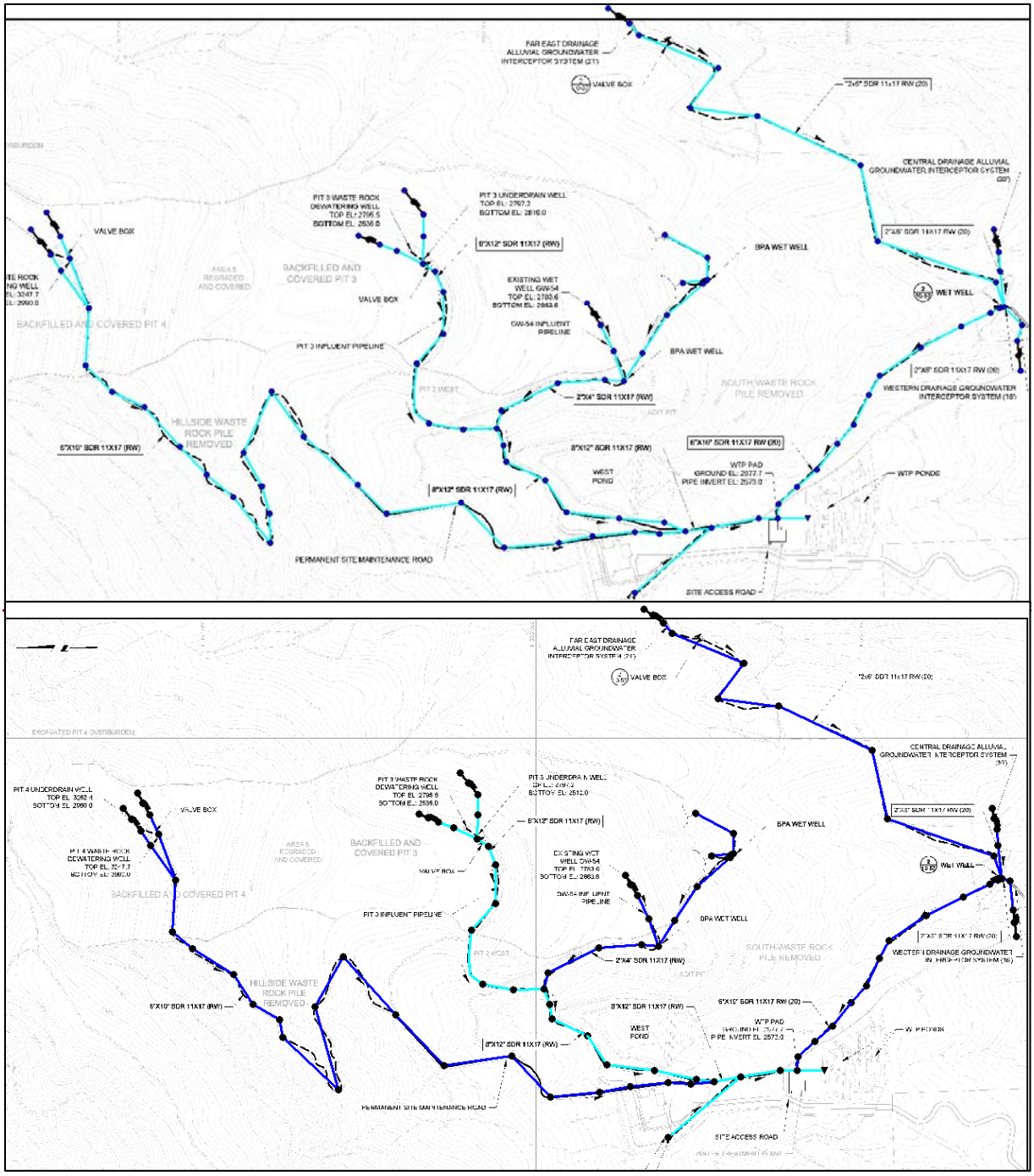


Figure 9. SWMM Model Nodes and Links for the End of Remedial Action (Permanent)~~Construction~~ Influent Pipelines

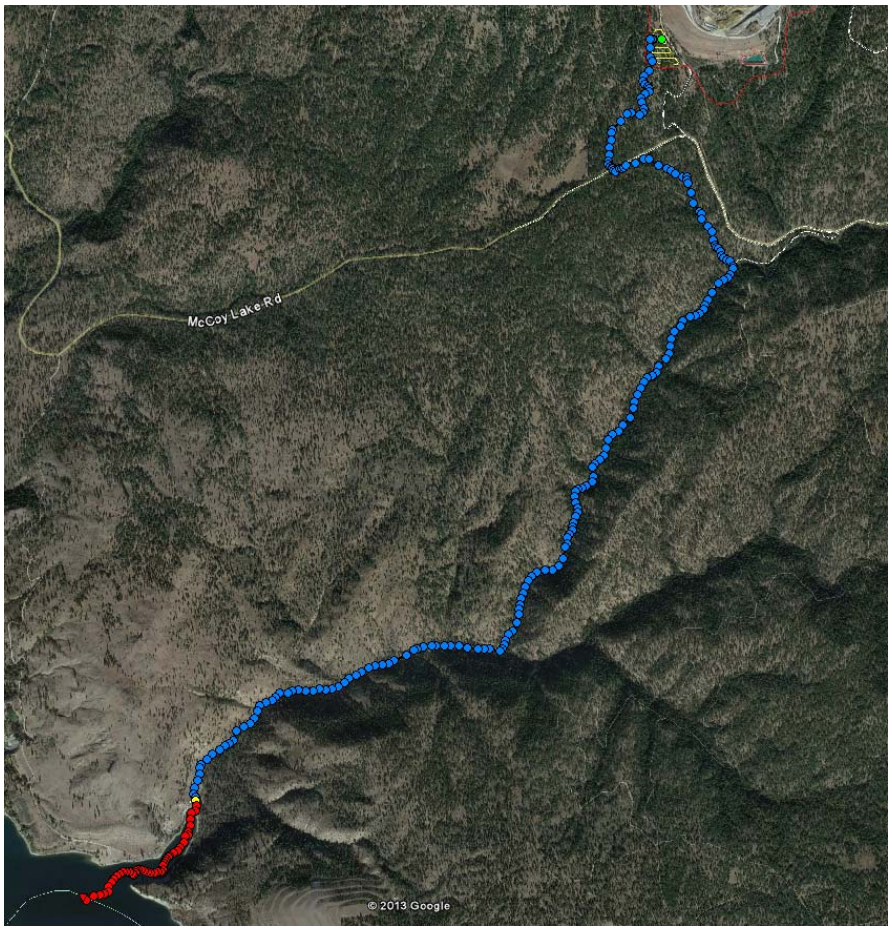


Figure 10. SWMM Model Nodes and Links for the End of Remedial Action (Permanent) Effluent Pipeline

7.0 HYDRAULIC MODEL RESULTS

Profiles for each of the various alignments and their resulting depths are discussed below.

7.1 INFLUENT PIPELINES

Pit 4 to the WTP

The influent pipeline from Pit 4 to the WTP is a pressurized pipeline and will be dual-walled. Maximum pressures occur at the lower dewatering well pump and reach a maximum pressure of roughly 300 ft (130 psi) at the pump but transitions to a gravity flow pipeline at ground surface.

While pressures at the dewatering pump are very high due to the large amount of elevation that must be overcome, the flow is 196-gpm and requires a nominal pipe diameter of 4-inches before combining with the other pipelines to transport the water to the Raw Mine Water Storage Pond at the WTP. At that point, the total flows increase to 840-gpm and the diameter will increase to 6-inches. Velocities are maintained below 10~~12~~ fps prior to the junction and below 16~~17~~ fps after, which is acceptable per the *Handbook of Polyethylene Pipe* (PPI, 2012).

Velocities through each section of pipe, pipe slopes, and other information are contained in the attached Status Report document (see Supplement J-1.1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results are shown in Figure 11 below. Views of smaller profile sections are included in Supplement J-1.3.

These profiles begin at the upper inlet and continue down to the outfall structure. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level.

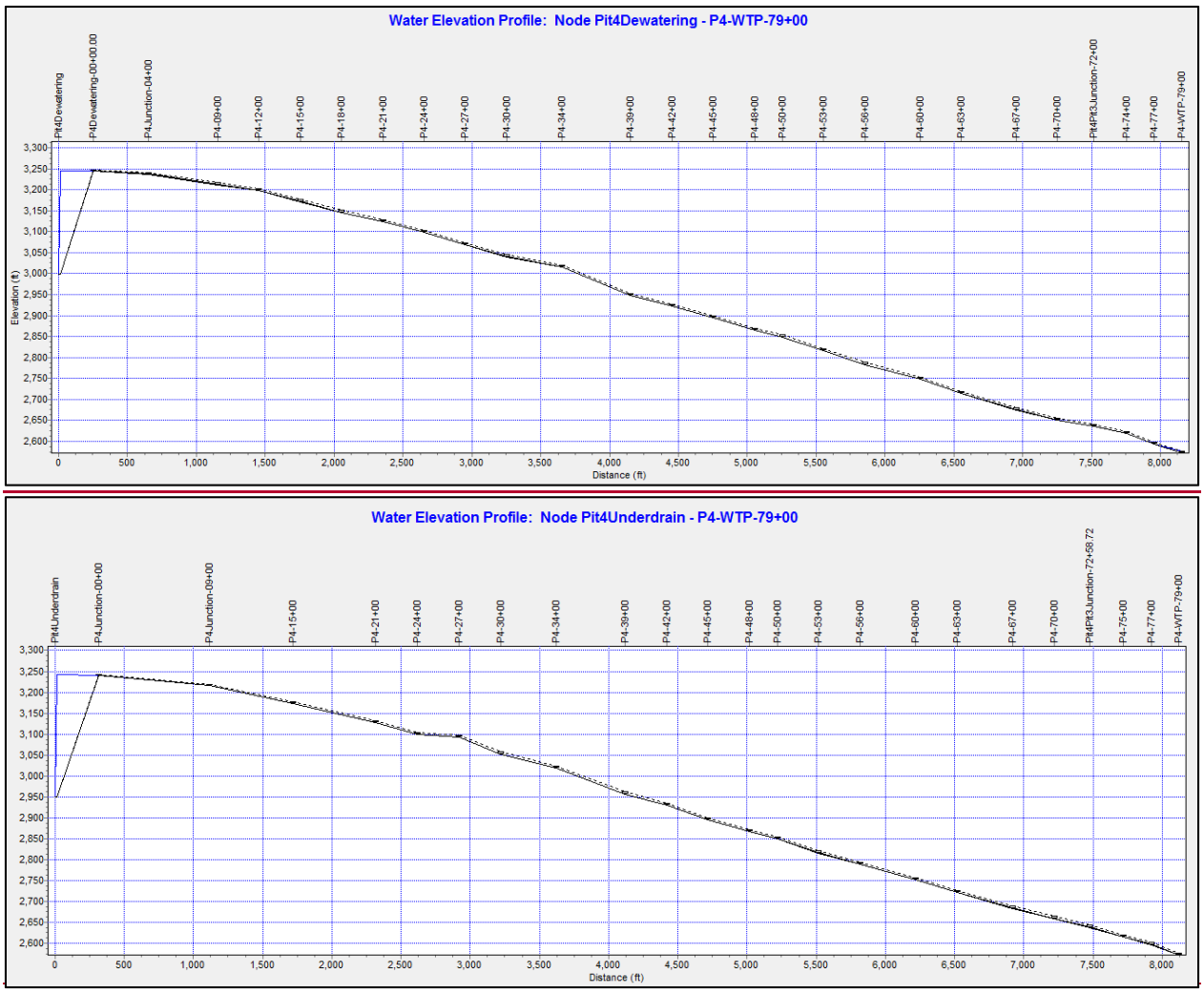


Figure 11. Influent Pipeline Profile from Pit 4 to WTP

Pit 3 to Pit 4 Pipeline

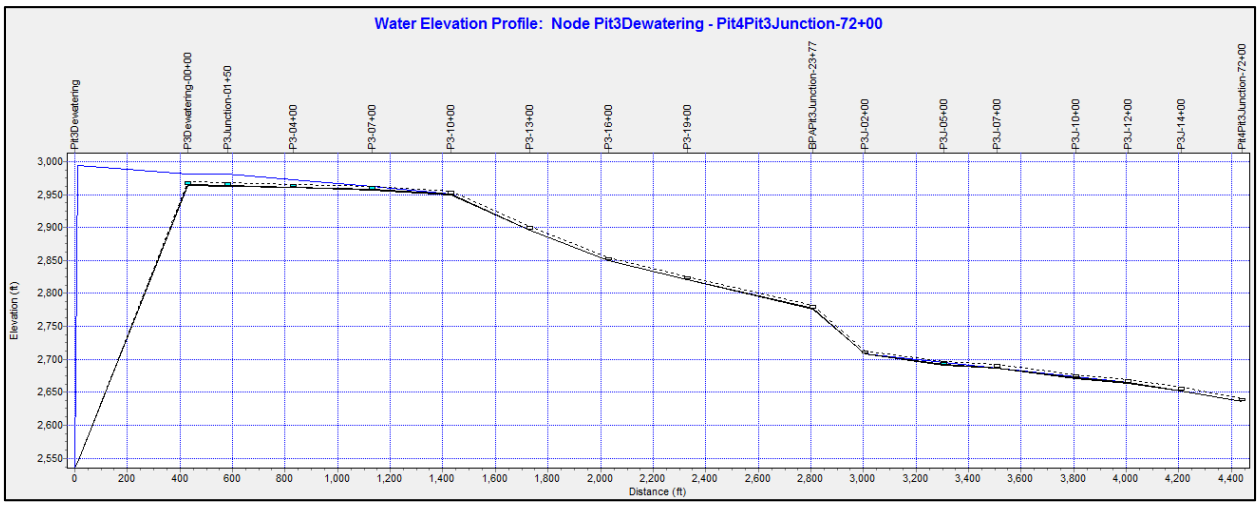
The influent pipeline from Pit 3 to the Pit 4 pipeline is a pressurized pipeline and will use dual-walled pipe. Maximum pressures occurred at the pump from the underliner well and reached a

total pressure of over 500~~465~~ ft (217~~202~~ psi) at the pump. Once reaching the ground surface, the pipeline transitions to gravity flow.

While pressures were very high due to the large amount of elevation that must be overcome, the flows reach 594-gpm and require a nominal pipe diameter of 6-inches before combining with the other pipelines. At that point, the total flows increase to 840-gpm. Velocities are maintained below 10~~23~~ fps which is acceptable per the *Handbook of Polyethylene Pipe* (PPI, 2012), as long as surging is prevented. This will be done through the use of air and vacuum break valves prior to large changes in grade.

Velocities through each section of pipe, pipe slopes, and other information are contained in the attached Status Report document (see Supplement J-1.1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results are shown in Figure 12 below. Views of smaller profile sections are included in Supplement J-1.3.

These profiles begin at the upper inlet and continue down to the junction with the Pit 4 pipeline. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level.



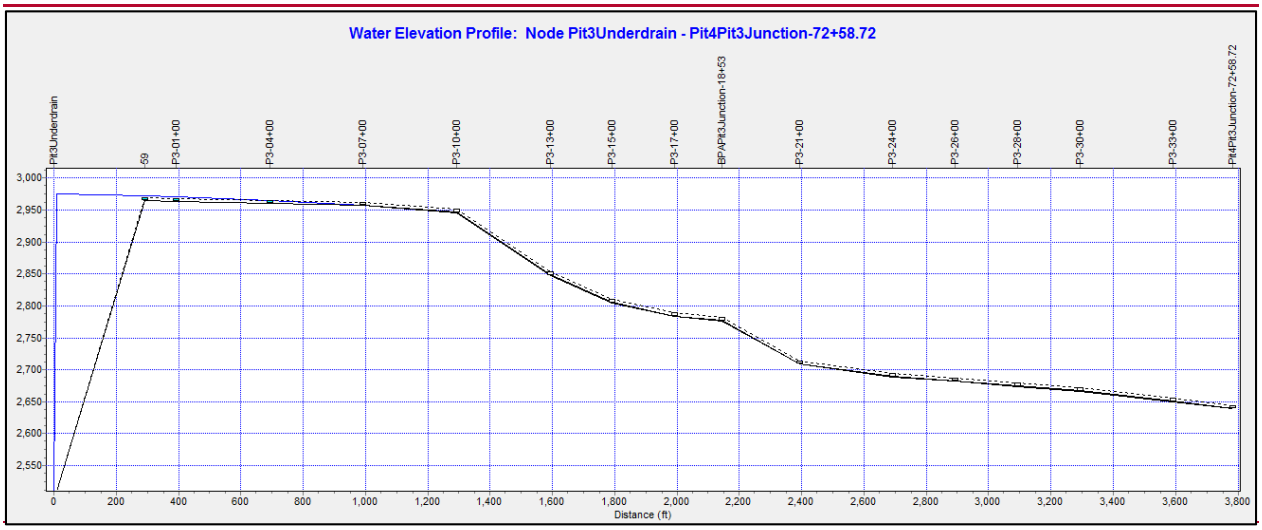


Figure 12. Influent Pipeline Profile from Pit 3 to Pit 4 Pipeline

Backfilled Pit Areas to the Pit 3 Pipeline

The influent pipeline from GW-54 to the Pit 3 pipeline is a pressurized pipeline and will use dual-walled pipe. Because the well is already in place, discharge lines will be maintained with new design after the well header. Assuming that the existing pumps are not oversized, it is assumed that maximum pressures after the well header will reach 15 ft (6 psi).

The combined flows reach 40-gpm and require a nominal pipe diameter of 2-inches prior to combining with the seepage collection pipe and then increase to 4-inches until the junction with the Pit 3 pipeline. Velocities are maintained below 5 fps which is acceptable per the *Handbook of Polyethylene Pipe* (PPI, 2012).

Velocities through each section of pipe, pipe slopes, and other information are contained in the attached Status Report document (see Supplement J-1.1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results are shown in Figure 13 below.

These profiles begin at the upper inlet and continue down to the junction with the Pit 3 pipeline. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level.

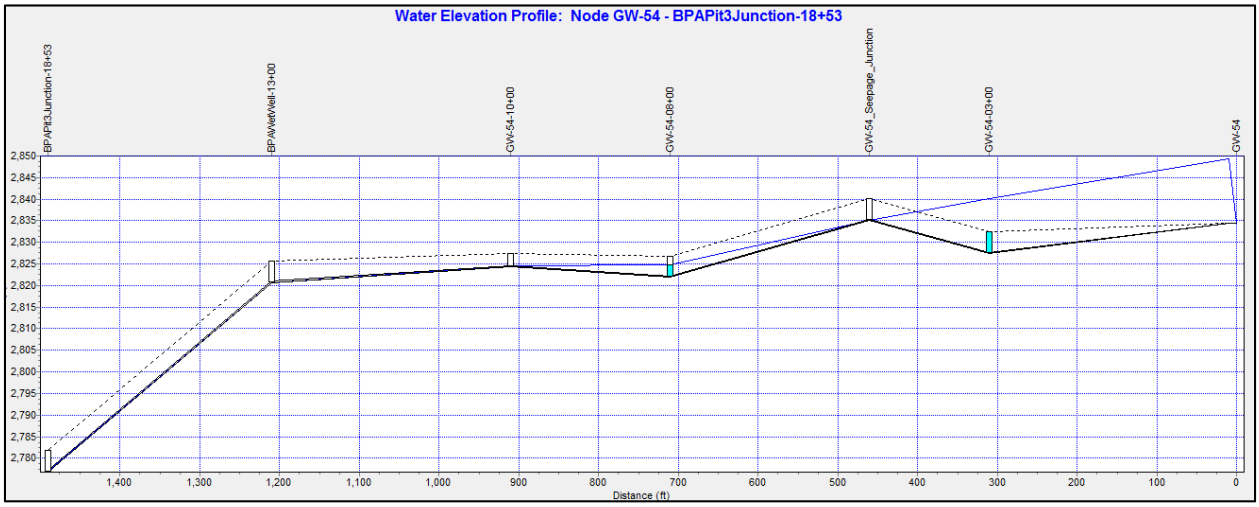


Figure 13. Influent Pipeline Profile from BPA to Pit 3 Pipeline

Extraction Trench Pipelines

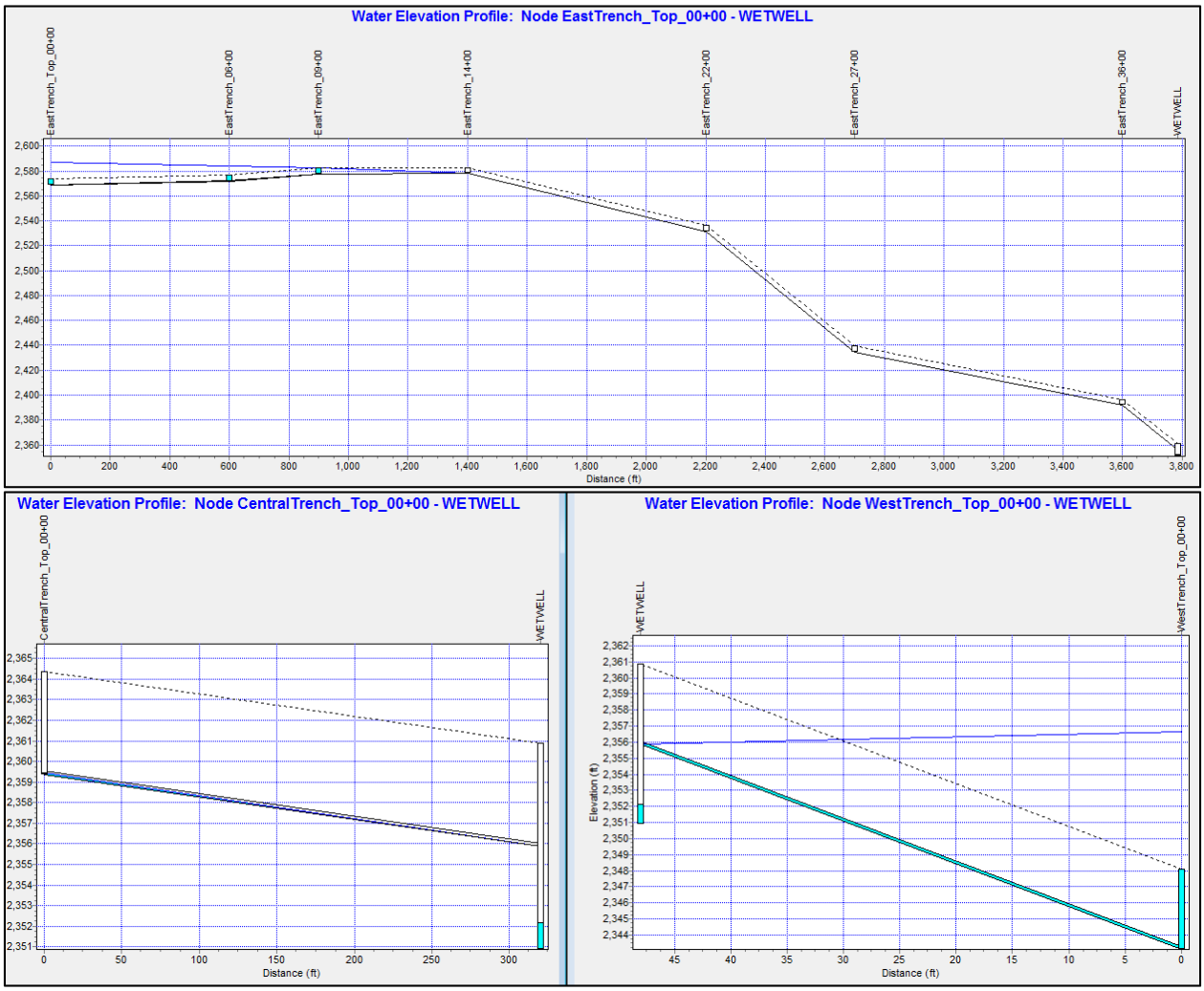
The influent pipeline from the extraction trenches to the WTP is a pressurized pipeline and will use dual-walled pipe. Maximum pressures at the trench pumps reached total pressures of less than 50 ft (22 psi) at the pumps. Once reaching the ground surface, the pipelines transition to gravity flow to the wet well and are then pumped in a pressurized pipe up to the WTP. From the wet well, pressures are much higher and reach about 230~~250~~ ft (100~~108~~ psi).

The flows from each trench are assumed to be 15 gpm and will see atmospheric pressures. Once the trench flows are combined in the wet well, they will be pumped at 45 gpm up to the

WTP. Velocities are maintained below 8 fps which is acceptable per the *Handbook of Polyethylene Pipe* (PPI, 2012).

Velocities through each section of pipe, pipe slopes, and other information are contained in the attached Status Report document (see Supplement J-1.1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results are shown in Figure 14 below.

These profiles begin at the upper inlets and continue down to the wet well and then up to the WTP pipeline. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level.



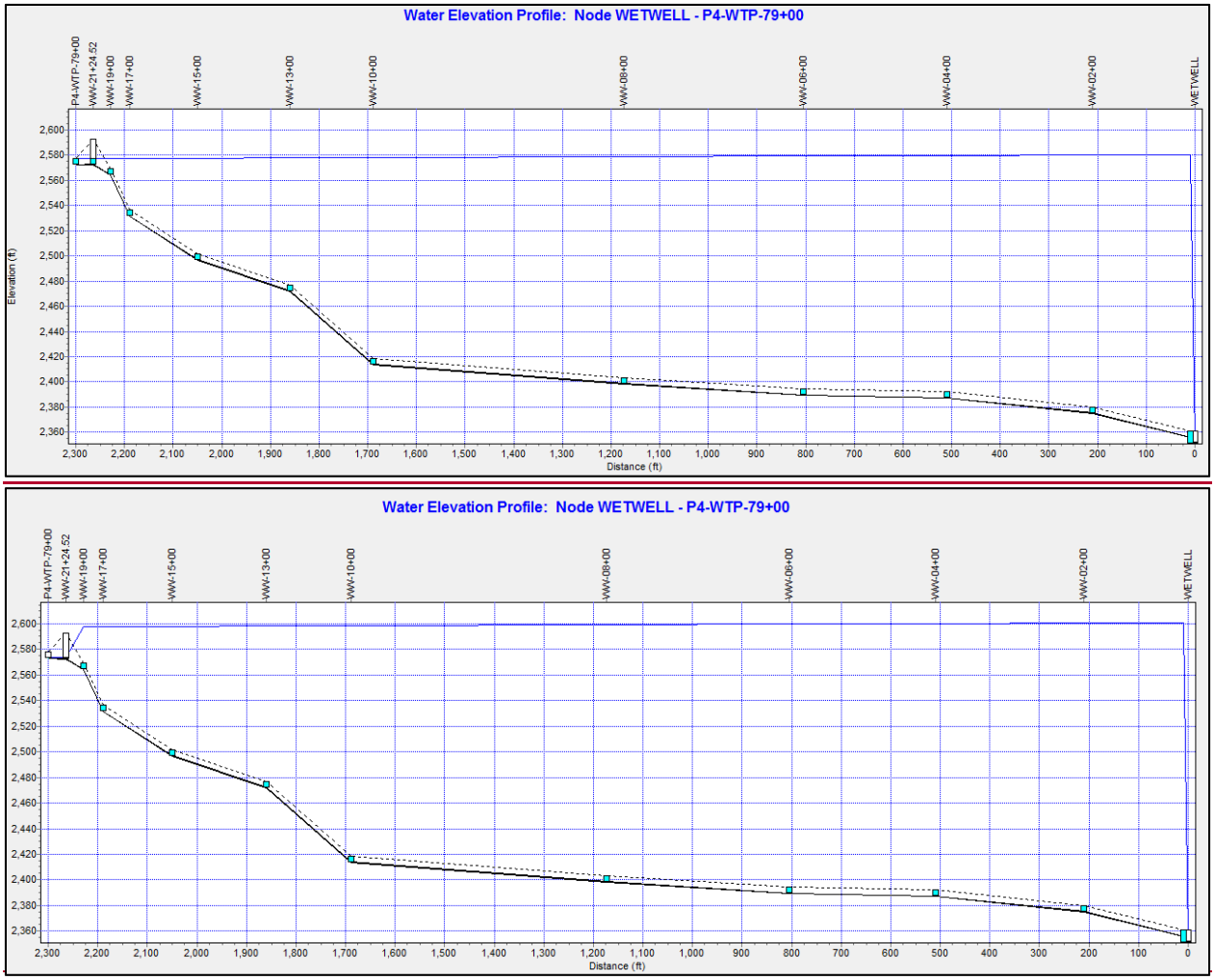


Figure 14. Extraction Trench Pipelines

Seepage Collection Pipeline

The influent pipeline from Pit 3 seepage collection system to the BPA wet well is a pressurized pipeline and will use dual-walled pipe. Water will flow via gravity from two toe drains into a single wet well where they will be pumped to the BPA wet well. Maximum pressures occur at the discharge line of the wet well around 210 ft (91 psi).

The combined flows reach 10-gpm and utilize a nominal pipe diameter of 2-inches. Velocities are maintained below 2~~7~~ fps which is acceptable per the *Handbook of Polyethylene Pipe* (PPI, 2012).

Velocities through each section of pipe, pipe slopes, and other information are contained in the attached Status Report document (see Supplement J-1.1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results are shown in Figure 15 below.

These profiles begin at the upper inlet and continue down to the junction with the Pit 3 pipeline. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level.

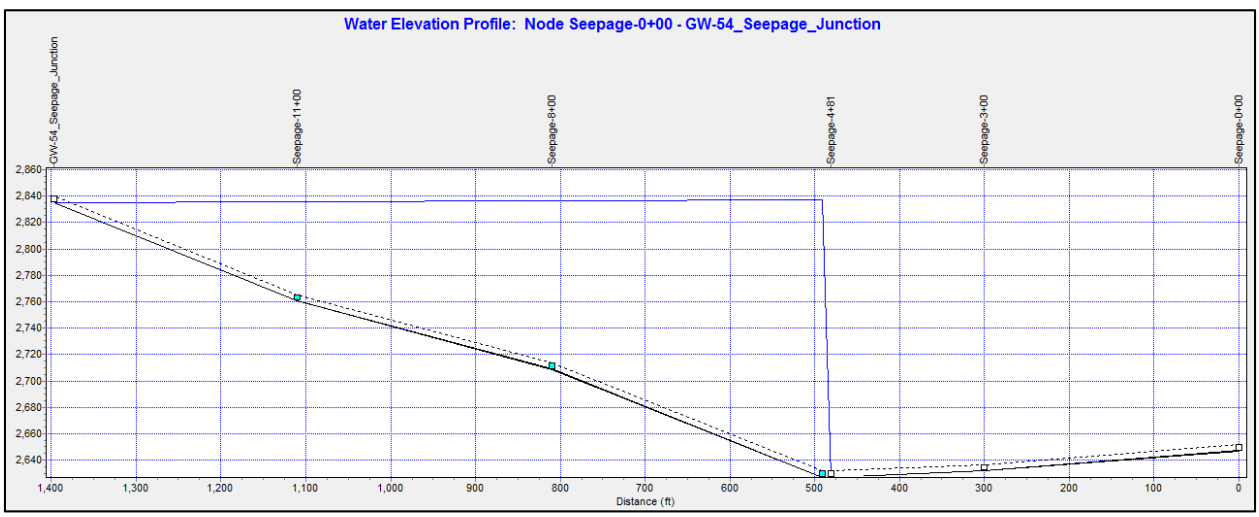


Figure 15. Seepage Collection Pipelines

7.2 EFFLUENT PIPELINE – (NOT UPDATED)

For the majority of the upper reaches, flows remained supercritical due to the steep slopes. In the lower approximately 40 percent of the alignment before entering the lake, the flows become subcritical. For the upper 60 percent, a nominal 6-inch diameter is primarily used in the modeling, while the lower subcritical sections primarily use a nominal 8-inch pipe. The pipe sizing is shown in greater detail in Section 10 of the design drawings.

Velocities through each section of pipe, pipe slopes, and other information are contained in the attached Status Report document (see Supplement J-1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and

pressure results are shown in Figure 16 below. Views of smaller profile sections are included in Supplement J-1.3.

These profiles begin at the upper inlet and continue down to the outfall structure. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level. Of the 5.5 miles of pipe, roughly 5,400 feet requires installation deeper than 5 feet.

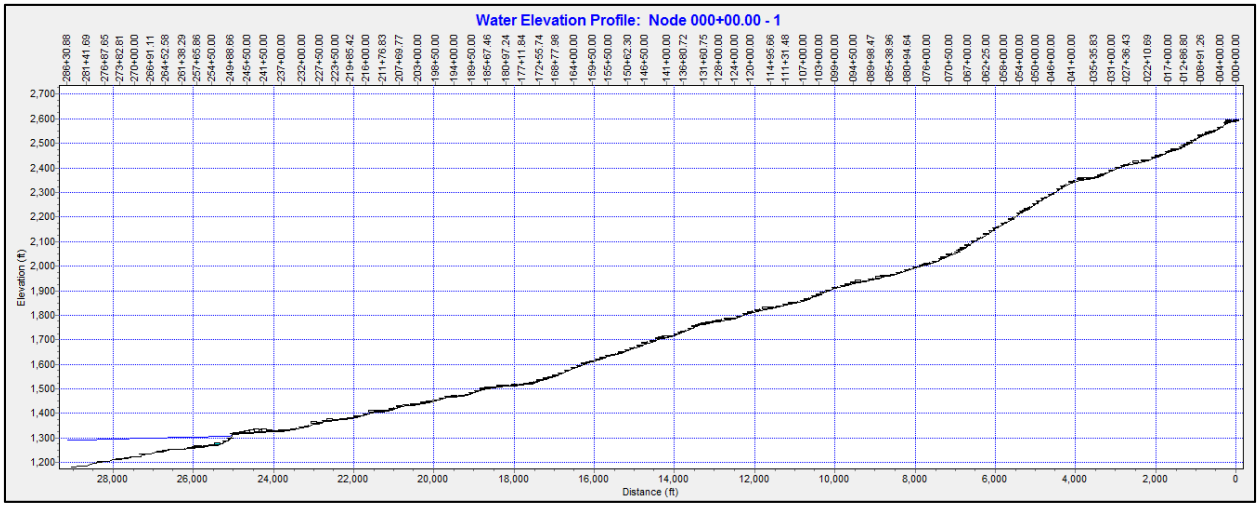


Figure 16. Effluent Pipeline Profile from Inlet to Diffuser

8.0 CONCLUSIONS

8.1 INFLUENT PIPELINES

Although the influent pipelines can be pressurized and don't require gravity flow, the selected pipe diameters allow for minimal pipeline pressures and are sufficient to handle flows throughout the life of the pipeline. Any potential leaks will be collected in the annular space between the inner and outer walls of the dual-walled pipes and, by minimizing the pressures, the potential for leaks to become serious, or to pressurize the annular space, will be reduced greatly. To prevent pressurization of the annular space any leaks will be allowed to drain back into the various pits and storage ponds.

The added benefit of pressurization is that it allows the pipes to maintain invert depths at 5 feet along nearly the entire alignment which will greatly reduce the higher costs of deep trenches that might otherwise be needed to maintain gravity flow in the influent pipelines.

The alignments were selected to maintain consistent grades, whether uphill or downhill. This will assist in reducing the number of vacuum break/air release valves that will be required to prevent siphoning and air entrapment in the pipelines. The locations of these valves are shown in Section 10 of the drawings. Constant/consistent grades also will allow for leaked flow trapped in the annular space of the dual-walled pipes to drain back in the pits and storage ponds for later treatment.

The influent pipe sizing and outputs is summarized in Table 1, below. Pipe sizing is shown in Section 10 of the 100~~90~~% submittal design drawings.

Table 1. Final Influent Pipe Sizing and Outputs

Pipeline	Diameter (inches)	Design Flow Rate (gpm)	Max Velocity (fps)	Max Pressure at Grade (psi)
Pit 4 Underdrain to Junction	4	128	6.4	Atmospheric
Pit 4 Dewatering to Junction	4	68	4.64	Atmospheric
Pit 4 to Junction	4	196	11.62	Atmospheric
Pit 3 Underdrain to Junction	6	366	4.15	Atmospheric
Pit 3 Dewatering to Junction	6	228	2.59	Atmospheric
Pit 3 to Junction	6	594	22.23	Atmospheric
GW-54 to BPA Wetwell	2	40	4.98	6.5
Pit 3 Seepage to Seepage Wetwell	2	5	6.22	Atmospheric
Seepage Wetwell to BPA Wetwell	2	10	1.25	90.9
BPA Wetwell to Junction	4	50	4.64	1.3
Pit 3 Junction to Pit 4 Junction	6	644	16.66	Atmospheric
Pit 4 Junction to WTP	6	840	16.27	Atmospheric
East Trench to Wetwell	2	15	8.00	7.8
Central Trench to Wetwell	2	15	2.57	Atmospheric
West Trench to Wetwell	2	15	2.40	5.8
Trench Wetwell to WTP	4	45	1.15	108.2
Collection Sump to WTP	3	Not Determined	Not Determined	Not Determined

8.2 EFFLUENT PIPELINE – (NOT UPDATED)

The selected pipe diameters allow the pipeline to maintain gravity flows and will be sufficient to handle flows throughout the life of the pipeline. These diameters also helped to maintain pipe depths at 5 feet for over 80 percent of the alignments and reach a maximum depth of 14 feet for only about 100 feet in the entire effluent pipeline route.

There appear to be no pressurized sections and pressures were kept at atmospheric pressure. This greatly reduces the risk of a serious leak occurring in the pipeline and helps to prevent the need for leak detection. It should be noted that the pipeline appears to be pressurized where it enters the lake, however, this is actually just the lake level with a very minimal amount of pressure required to push the water out of the pipe. As the lake level drops, the head in the pipe will drop to that same level. In addition, the minimal pressure required to push water out of the pipe.

The alignment also maintains a consistent downward grade which helps to reduce sediment buildup, which could occur in the more shallow slopes (e.g., sediment might enter the pipe during construction). Any sediments that do collect will be contained at the manholes where they can be cleaned out.

8.3 DIFFUSER – (NOT UPDATED)

The diffuser design was taken from the NPDES permit application and modeled to verify functionality. Hydraulically, the outfall is capable of discharging the required 500 gpm into the

lake and the “duckbill” valve installed on the end will prevent clogging due to sediment that might enter the pipe during any shut-down period that might be experienced at the new WTP.

9.0 REFERENCES

Plastic Pipe Institute (PPI), 2012. Handbook of Polyethylene (PE) Pipe.

MWH Americas, Inc. (MWH), 2013. Effluent Discharge Mixing Evaluation for the Midnite Mine Water Treatment Plant. November ~~2013~~.

Sanks, R.L., 1998. “Pumping Station Design”.

U.S. Environmental Protection Agency (EPA), 2011. Program Storm Water Management Model (SWMM) version 5.0. ~~2011.~~

Supplement J-1.1

SWMM Model Status Report

Supplement J-1.2

SWMM Node and Link IDs

Node IDs

Node IDs for the effluent pipe are found in the 60% design submittal and have not been repeated in these figures.

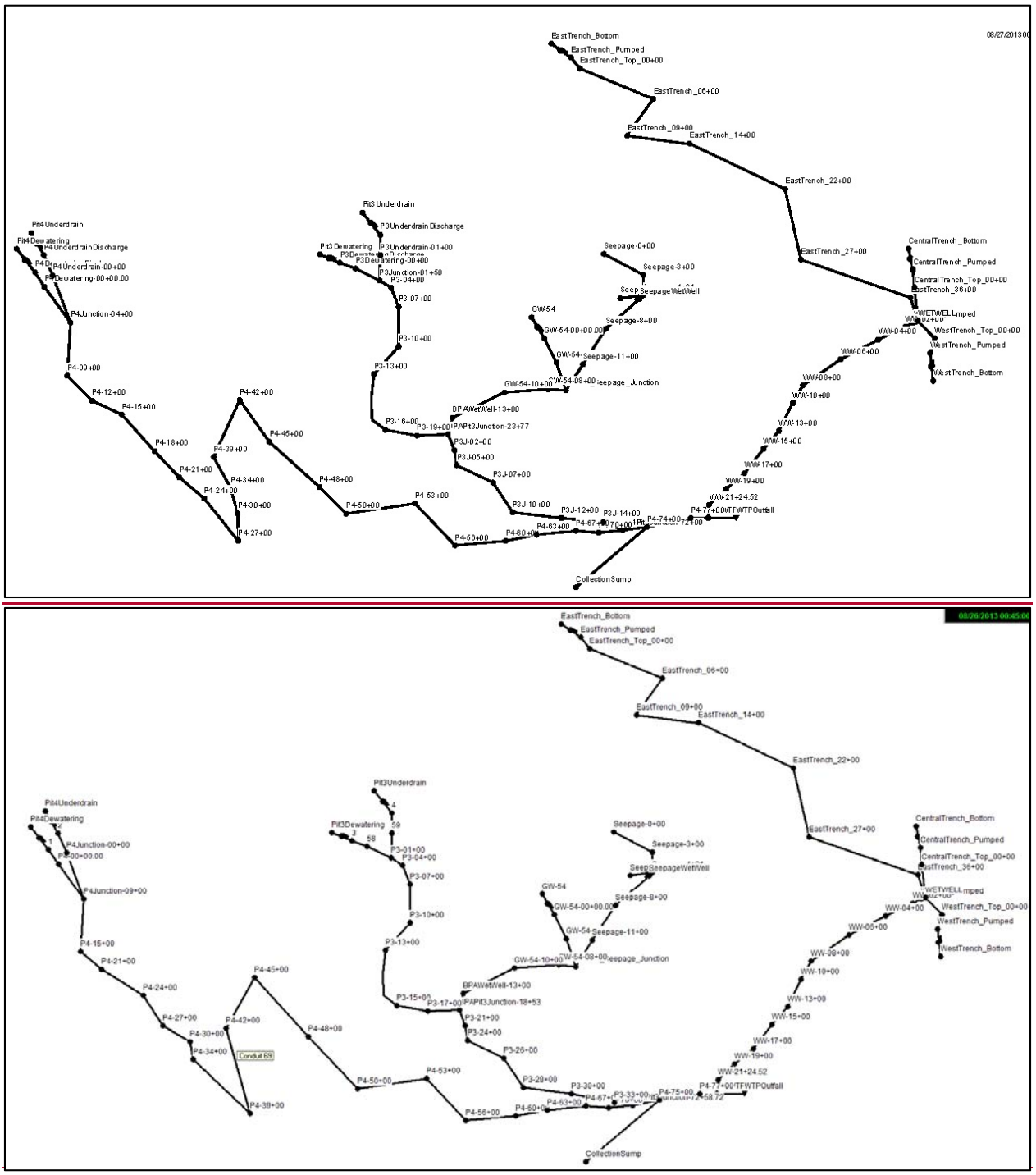


Figure 1~~17~~. Influent Pipeline Node IDs

Link IDs

Link IDs for the effluent pipe are found in the 60% design submittal and have not been repeated in these figures.

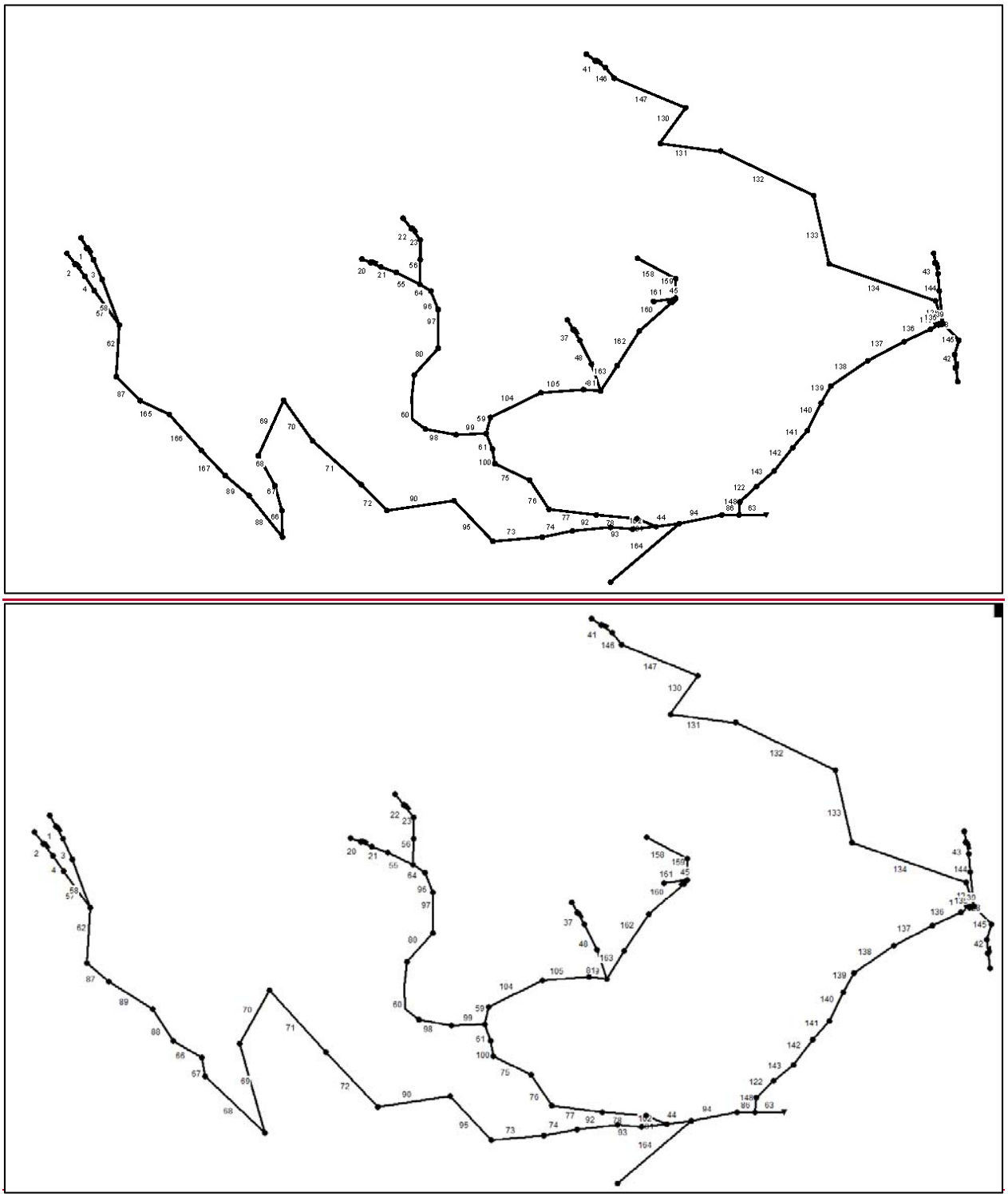
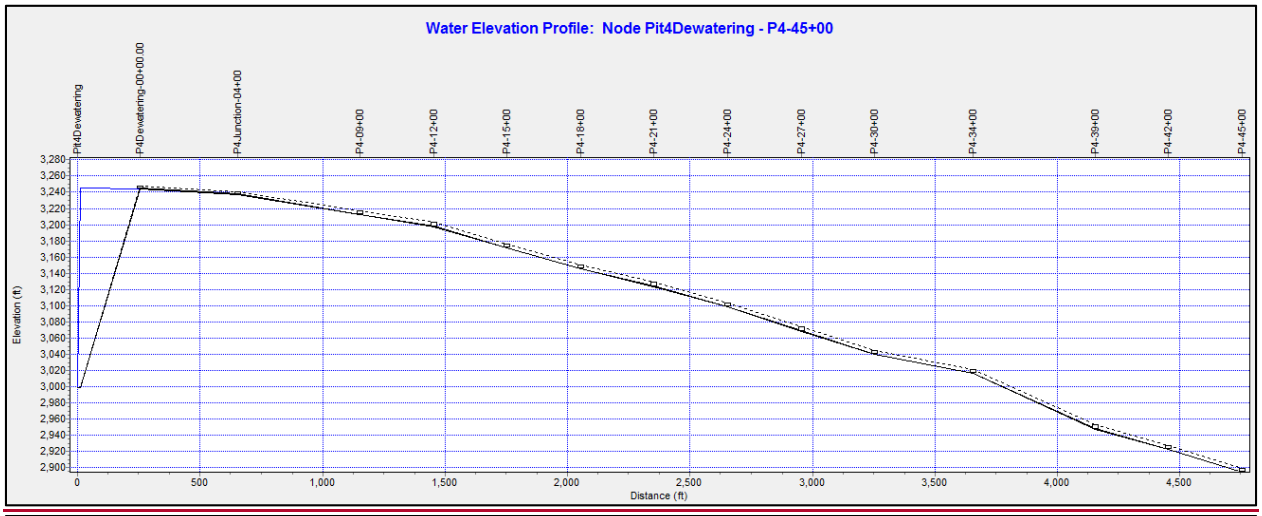


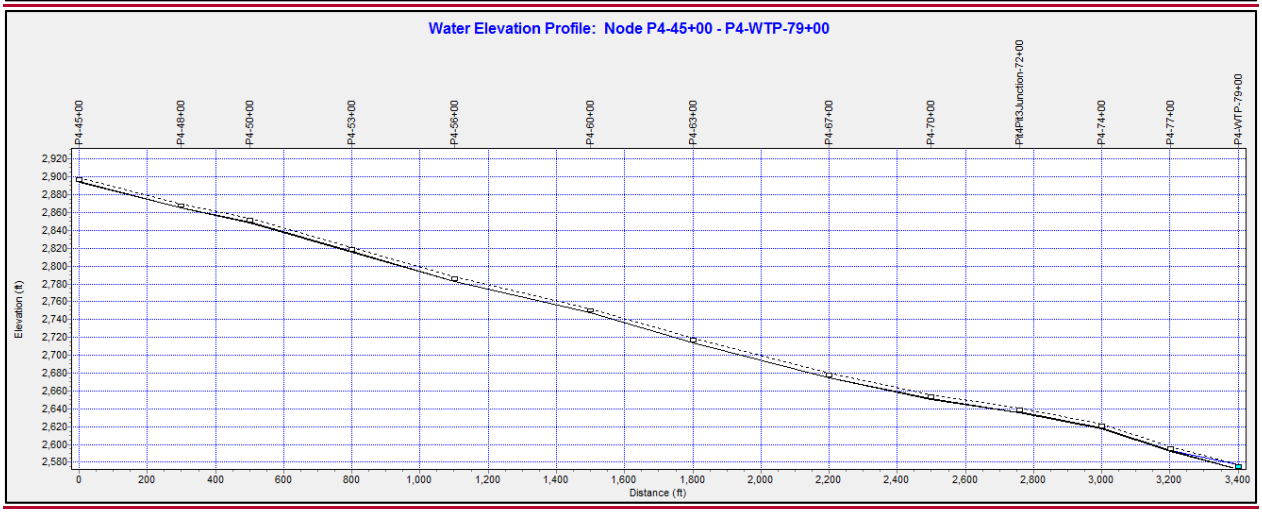
Figure 2~~18~~. Influent Pipeline Link IDs

Supplement J-1.3

SWMM Hydraulic Profiles

Influent Pipeline Alignment Hydraulic Profiles





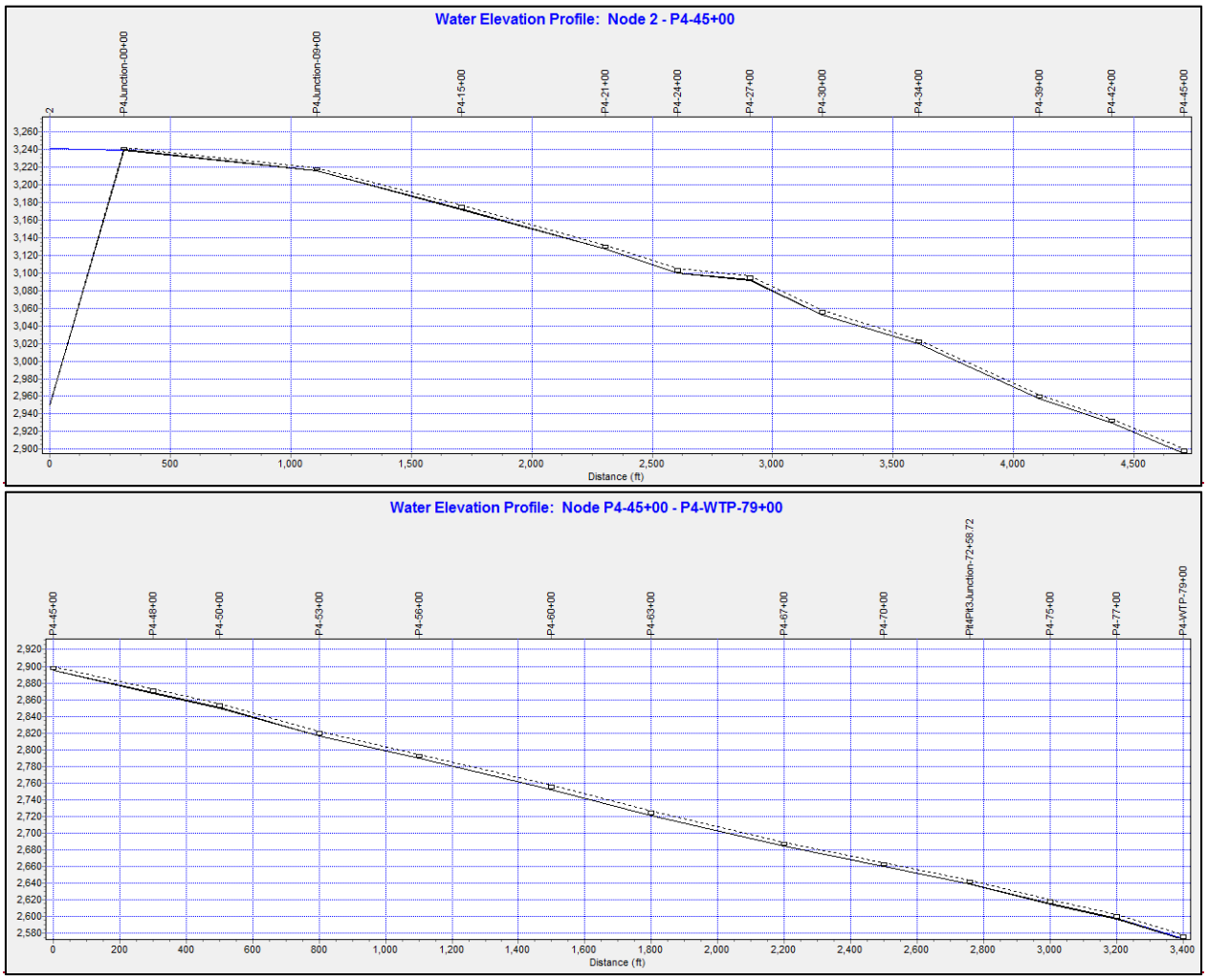
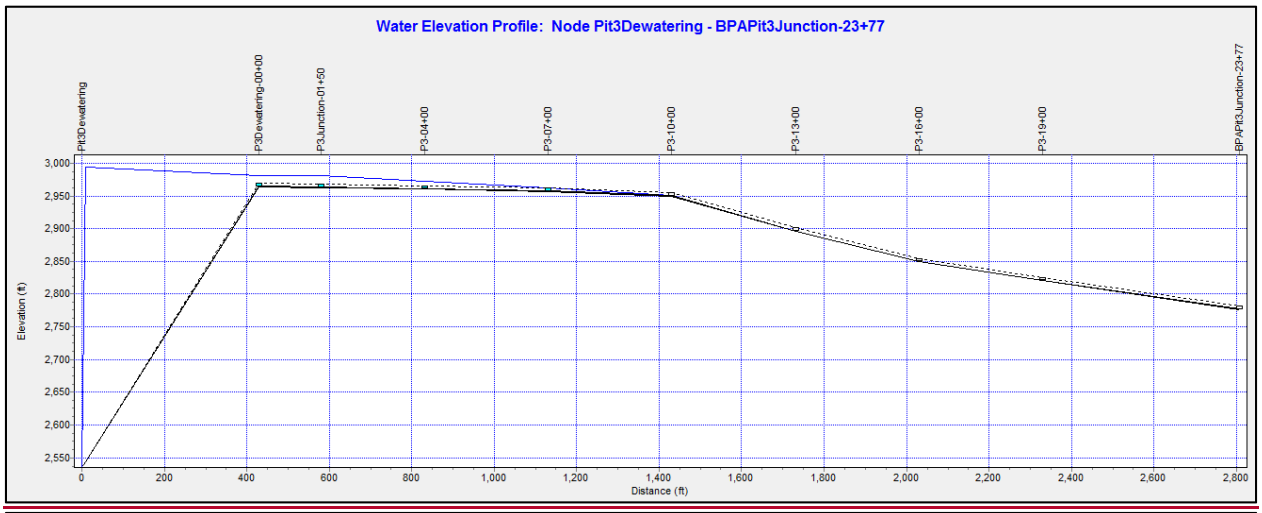
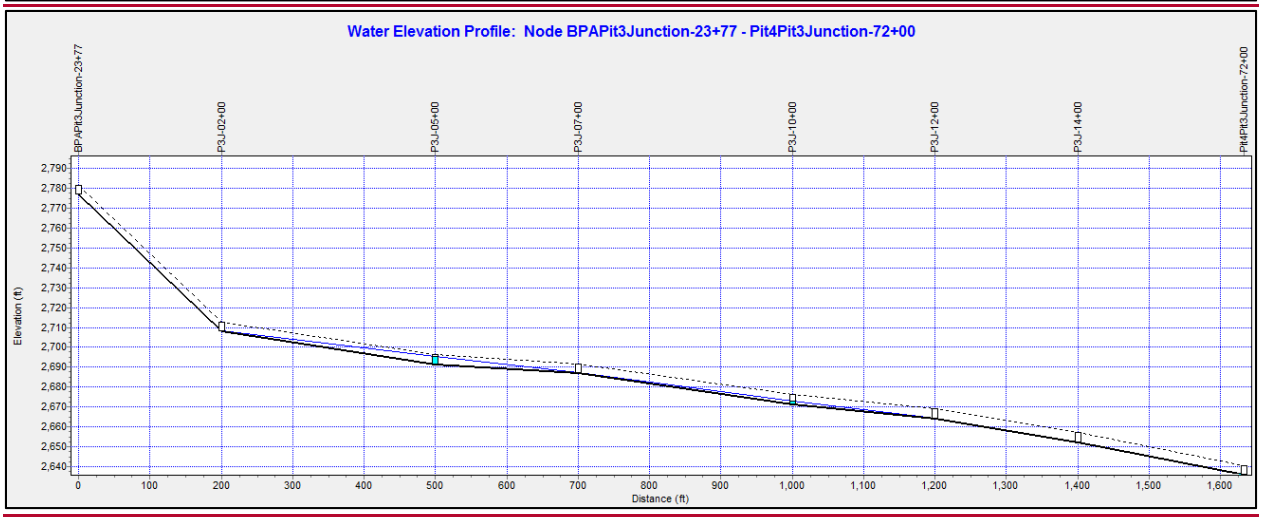


Figure 1~~19~~. Pit 4 profiles


Water Elevation Profile: Node Pit3Dewatering - BPAPit3Junction-23+77
Pit3Dewatering
P3Dewatering-00+00
P3Junction-01+50
P3-04+00
P3-07+00
P3-10+00
P3-13+00
P3-16+00
P3-19+00
BPAPit3Junction-23+77
Elevation (ft)
Distance (ft)


Water Elevation Profile: Node BPAPit3Junction-23+77 - Pit4Pit3Junction-72+00
BPAPit3Junction-23+77
P3J-02+00
P3J-05+00
P3J-07+00
P3J-10+00
P3J-12+00
P3J-14+00
Pit4Pit3Junction-72+00
Elevation (ft)
Distance (ft)

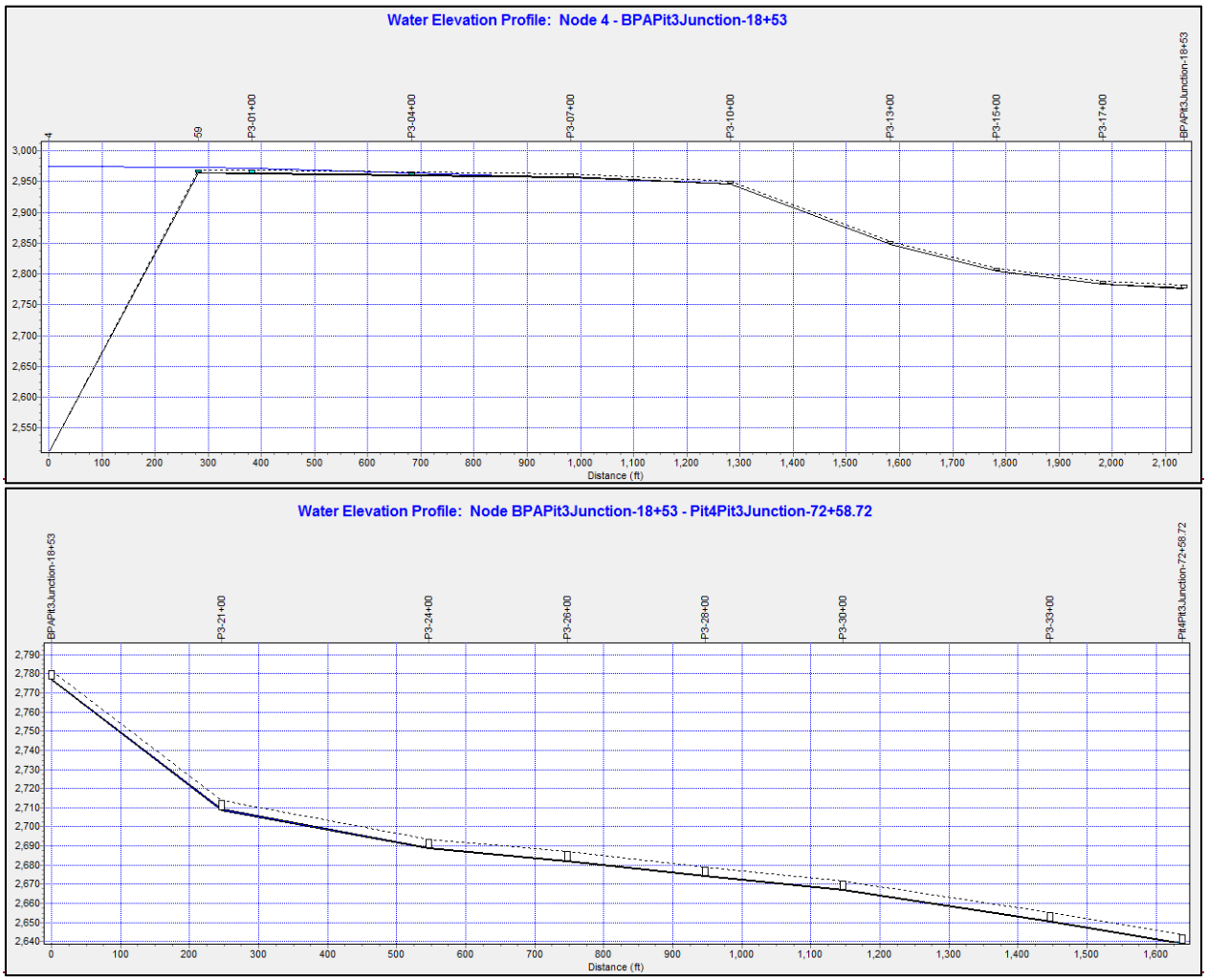


Figure 2~~20~~. Pit 3 profiles

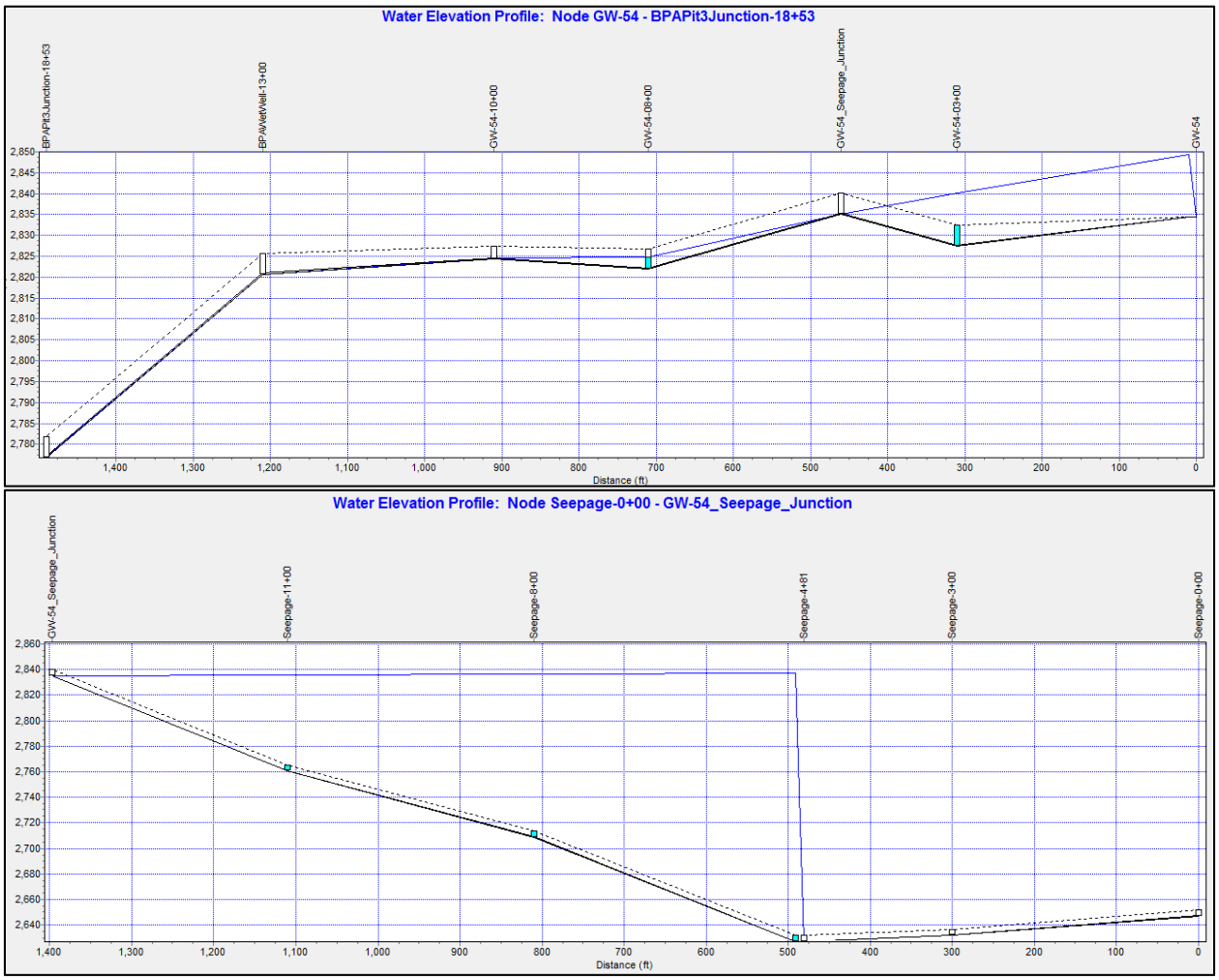
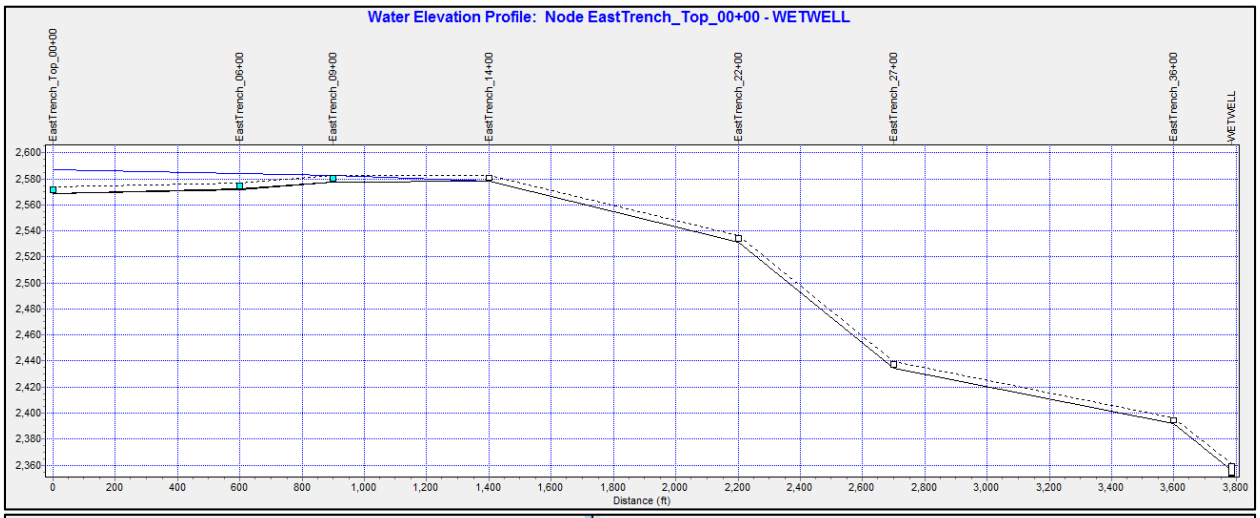


Figure 3~~21~~. Seepage Collection and BPA profiles


Water Elevation Profile: Node EastTrench_Top_00+00 - WETWELL
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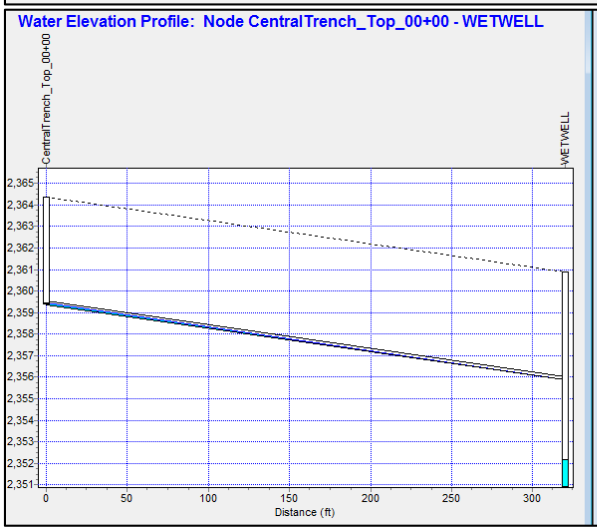
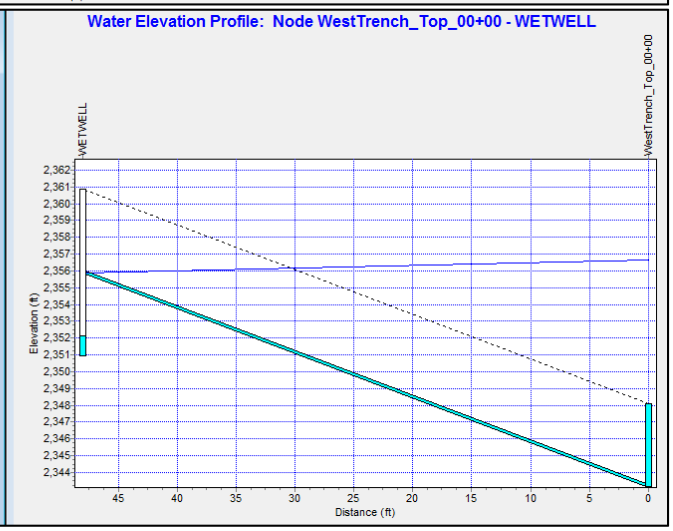
EastTrench_06+00
EastTrench_09+00
EastTrench_14+00
EastTrench_22+00
EastTrench_27+00
EastTrench_36+00
WETWELL
Distance (ft)


Water Elevation Profile: Node CentralTrench_Top_00+00 - WETWELL
CentralTrench_Top_00+00
WETWELL
Distance (ft)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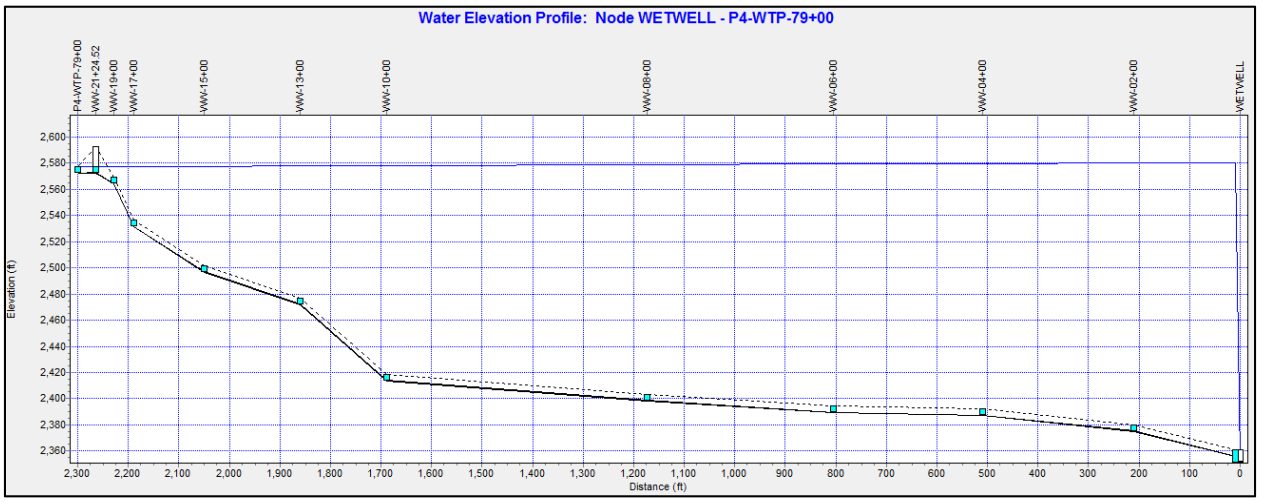
WETWELL
WestTrench_Top_00+00
Elevation (ft)
Distance (ft)



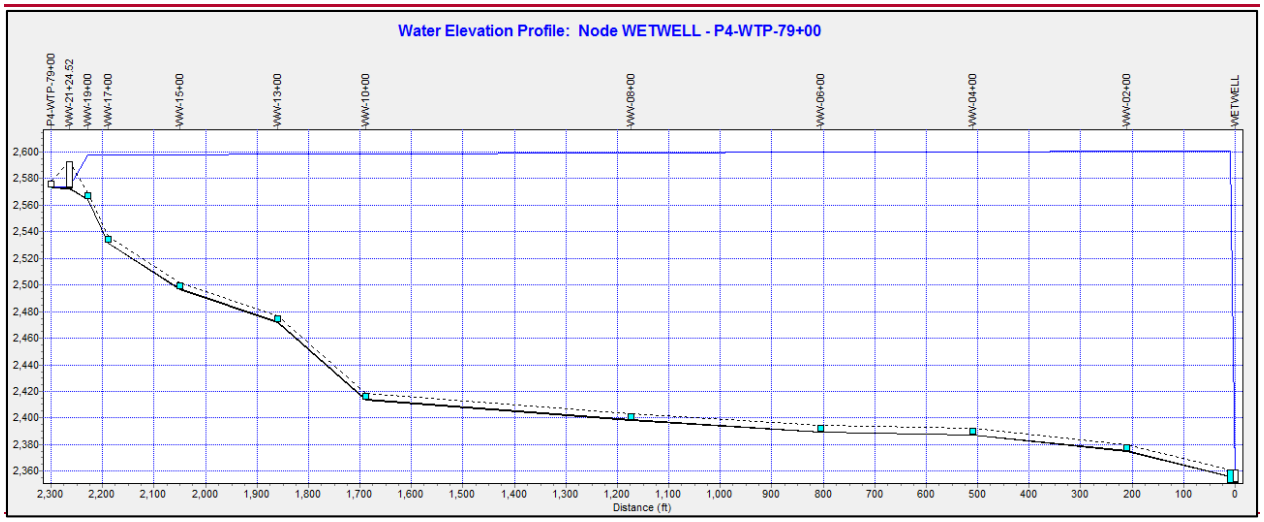
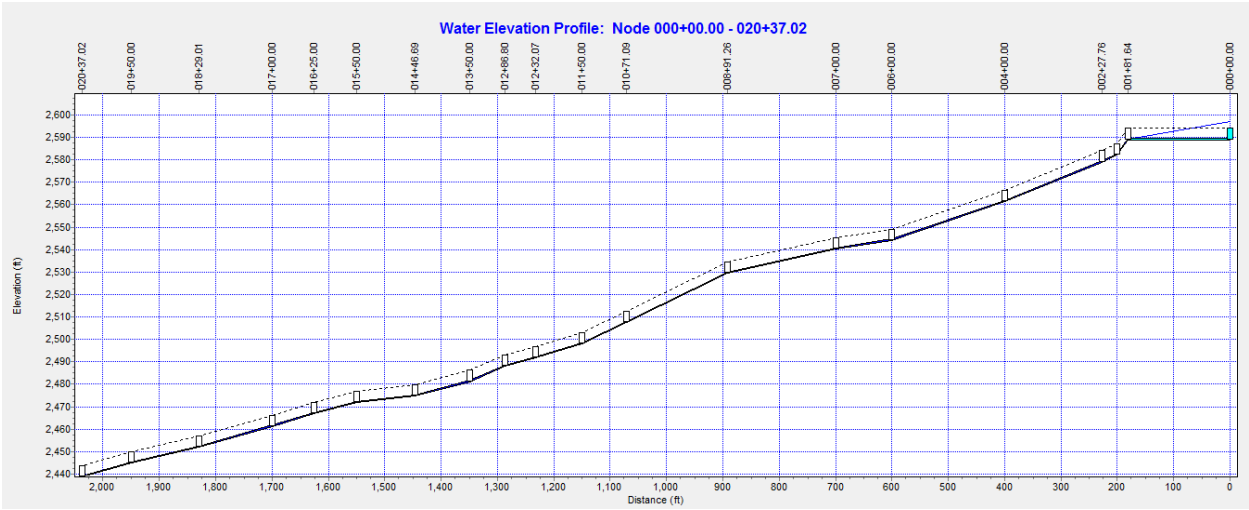
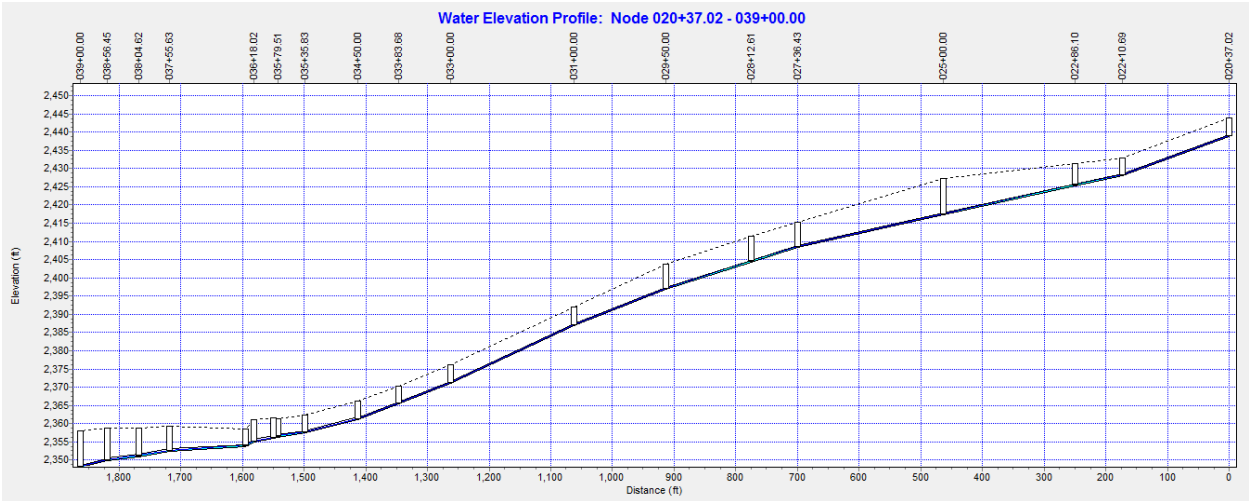
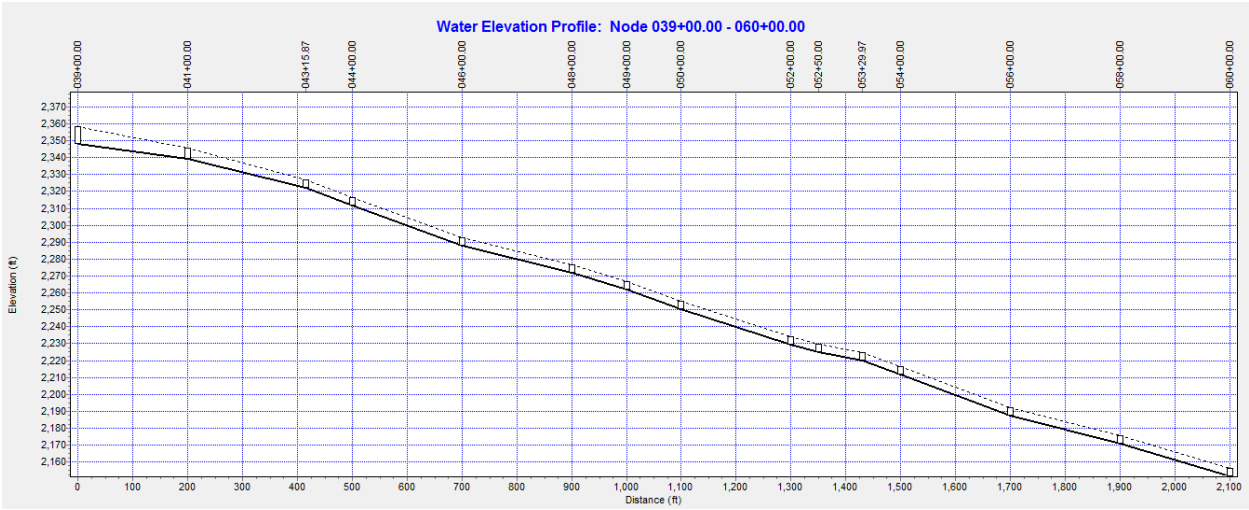


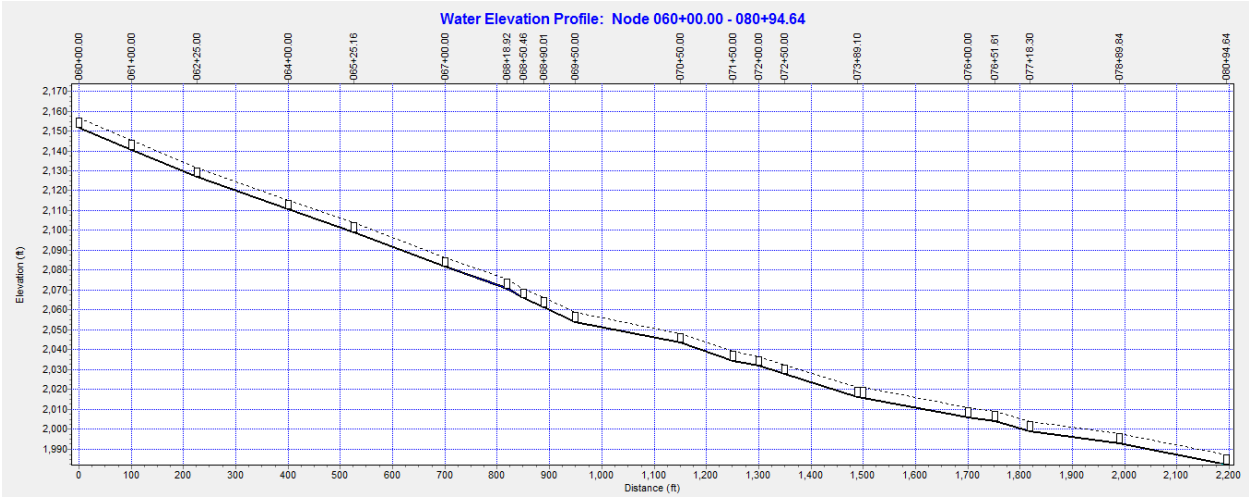
Figure 4~~22~~. Extraction Trench Profiles

Effluent Pipeline Alignment Hydraulic Profiles – (NOT UPDATED)





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062+25.00
064+00.00
065+25.16
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068+18.92
068+50.46
068+90.01
069+50.00
070+50.00
071+50.00
072+00.00
072+50.00
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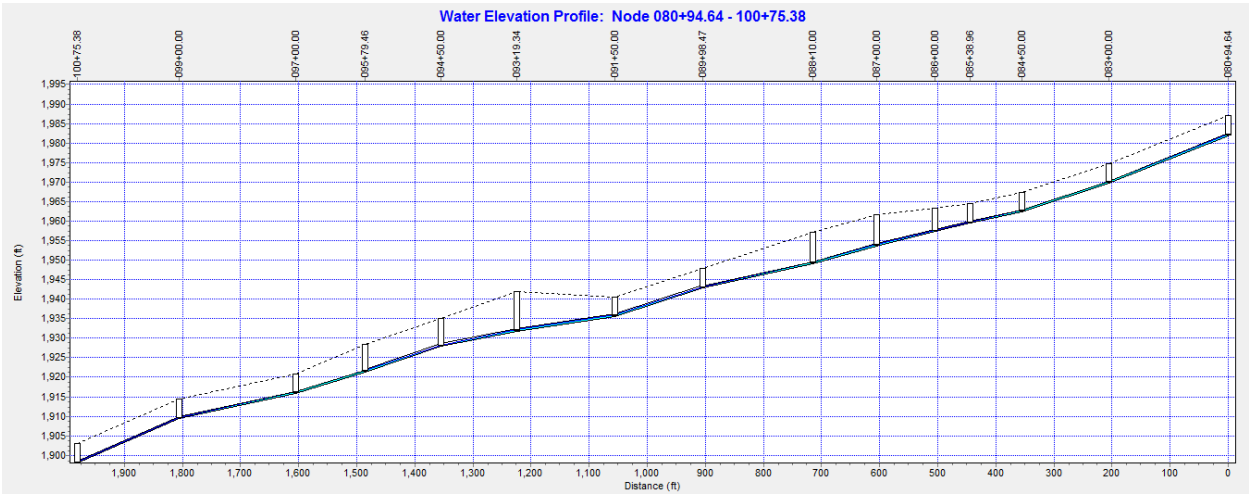
080+94.64
Elevation (ft)
Distance (ft)


Water Elevation Profile: Node 080+94.64 - 100+75.38
100+75.38
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095+79.46
094+50.00
093+19.34
091+50.00
089+98.47
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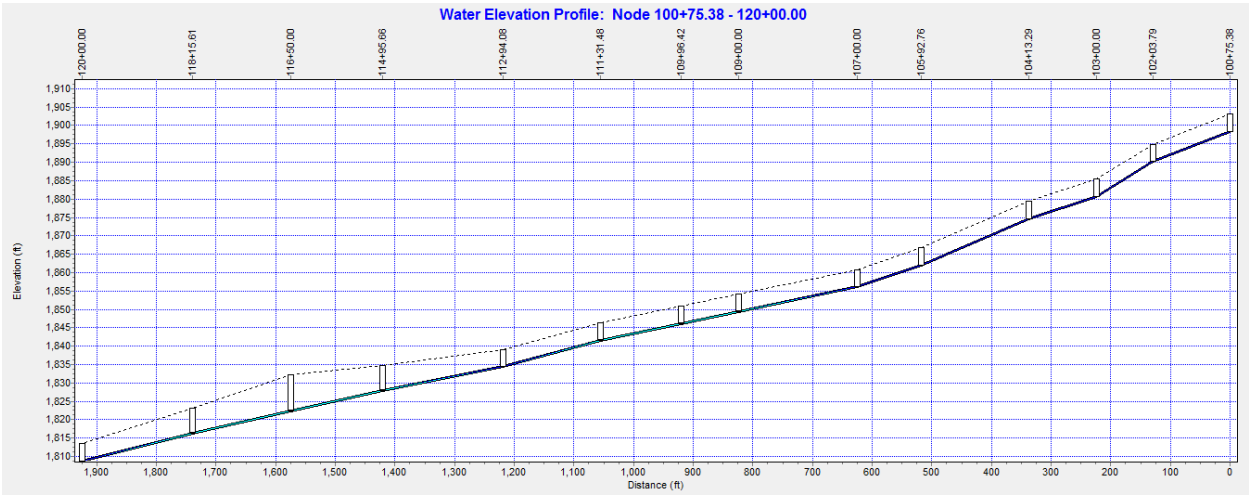
Elevation (ft)
Distance (ft)


Water Elevation Profile: Node 100+75.38 - 120+00.00
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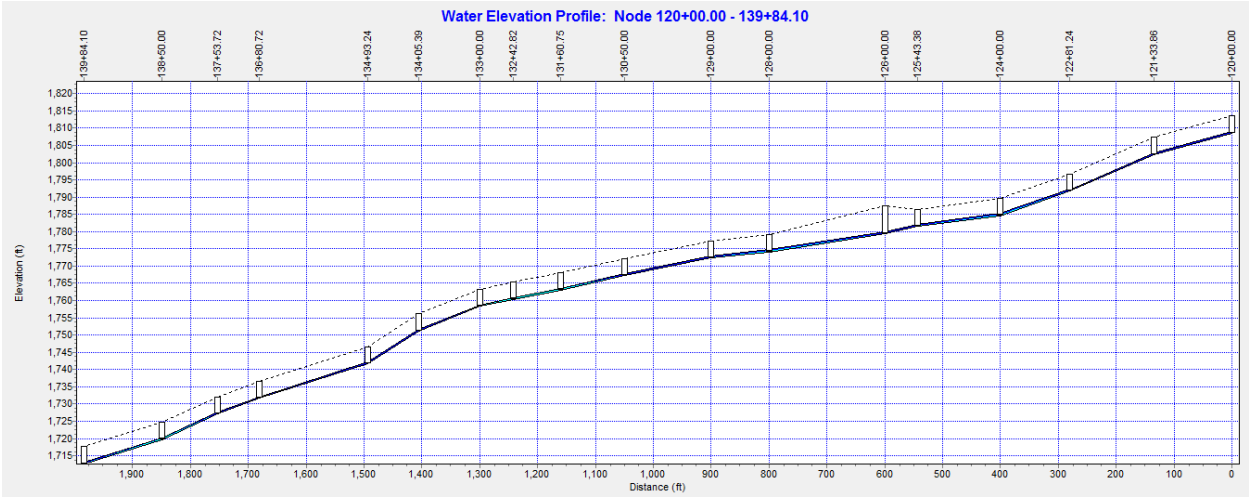
112+94.08
111+31.48
109+96.42
109+00.00
107+00.00
105+92.76
104+13.29
103+00.00
102+03.79
100+75.38
Elevation (ft)
Distance (ft)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134+93.24
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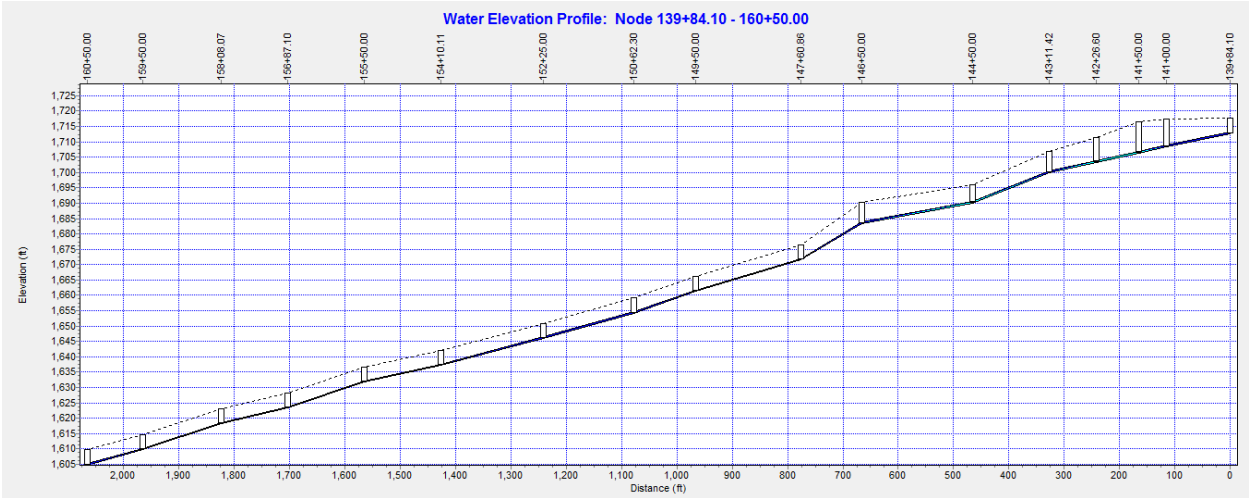
132+42.82
131+60.75
130+50.00
129+00.00
128+00.00
126+00.00
125+43.36
124+00.00
122+81.24
121+33.86
120+00.00
Elevation (ft)
Distance (ft)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149+50.00
147+60.86
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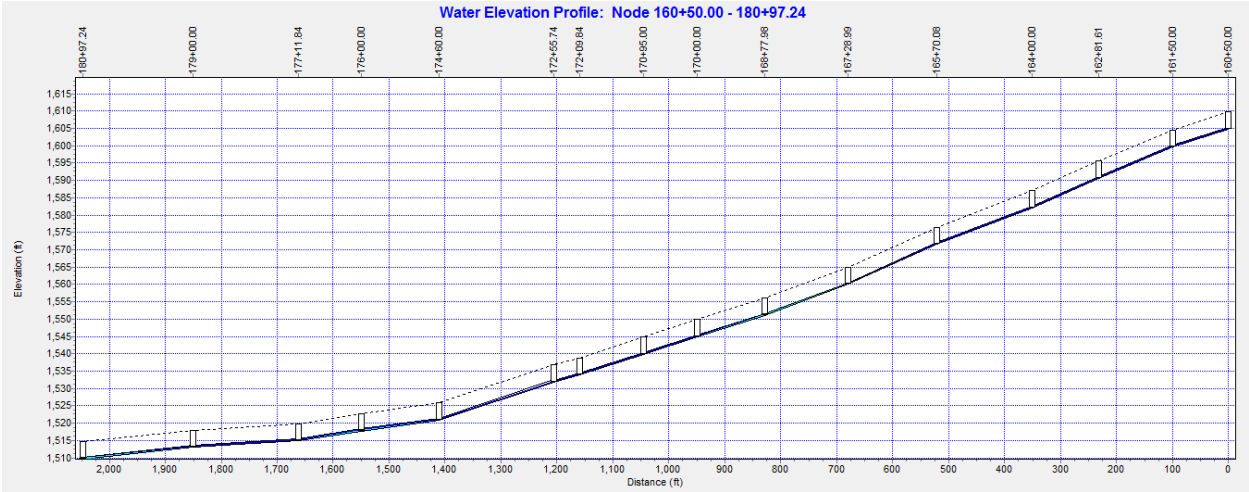
139+84.10
Elevation (ft)
Distance (ft)


Water Elevation Profile: Node 160+50.00 - 180+97.24
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172+09.84
170+95.00
170+00.00
168+77.99
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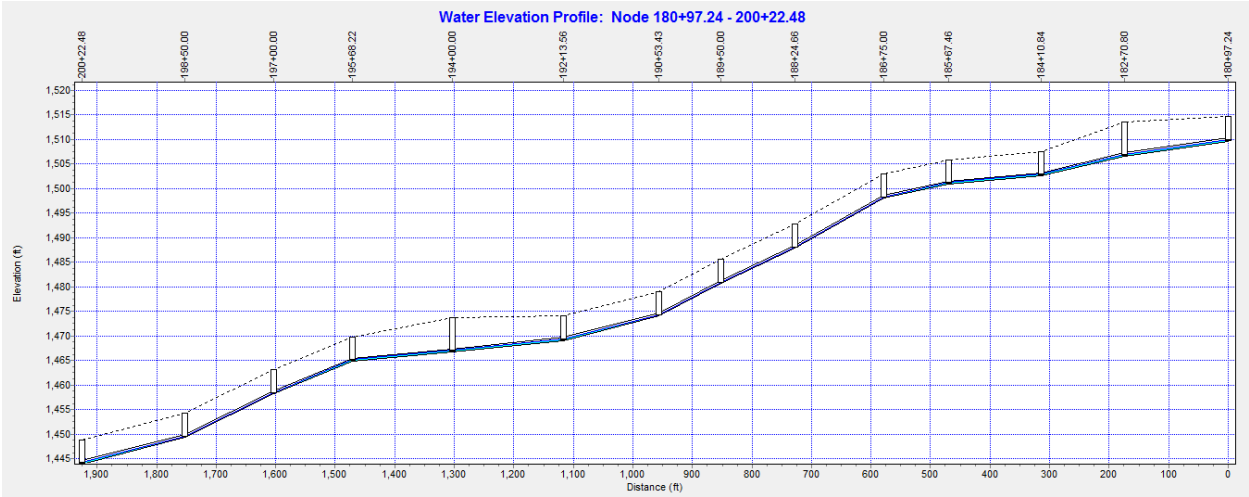
164+00.00
162+81.61
161+50.00
160+50.00
Elevation (ft)
Distance (ft)


Water Elevation Profile: Node 180+97.24 - 200+22.48
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190+53.43
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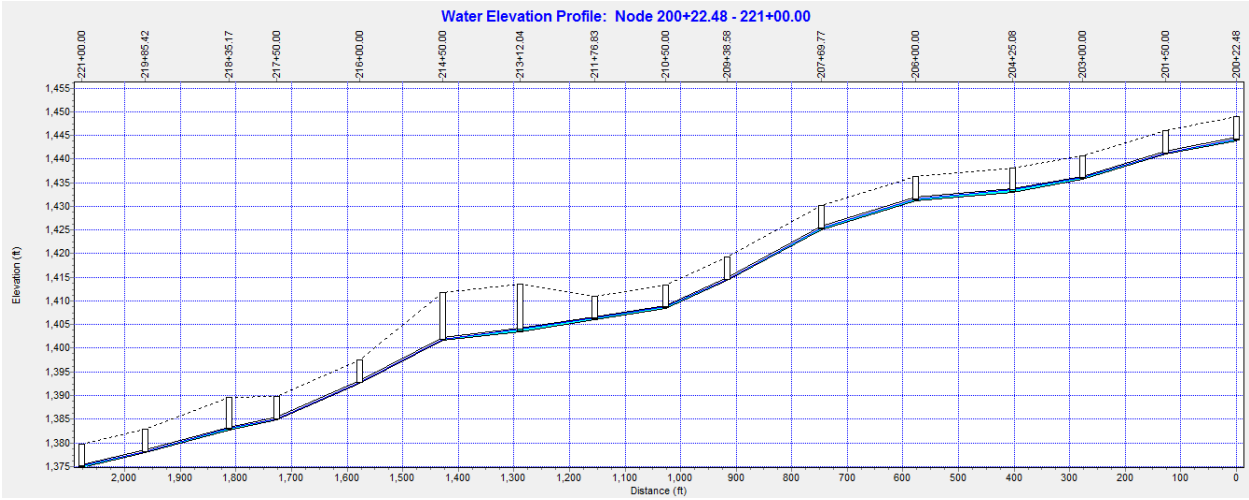
180+97.24
Elevation (ft)
Distance (ft)


Water Elevation Profile: Node 200+22.48 - 221+00.00
221+00.00
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211+76.83
210+50.00
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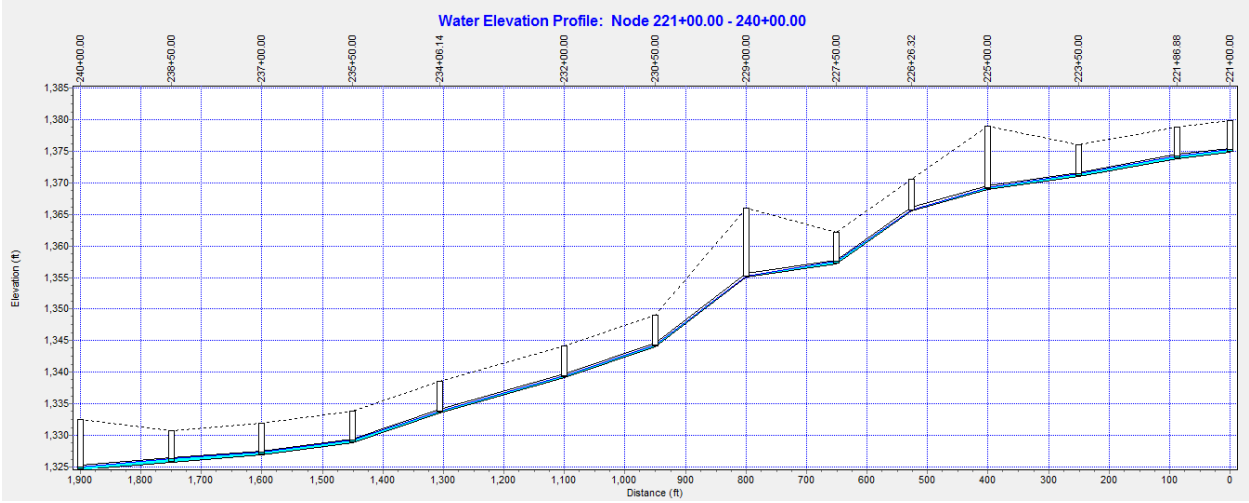
200+22.48
Elevation (ft)
Distance (ft)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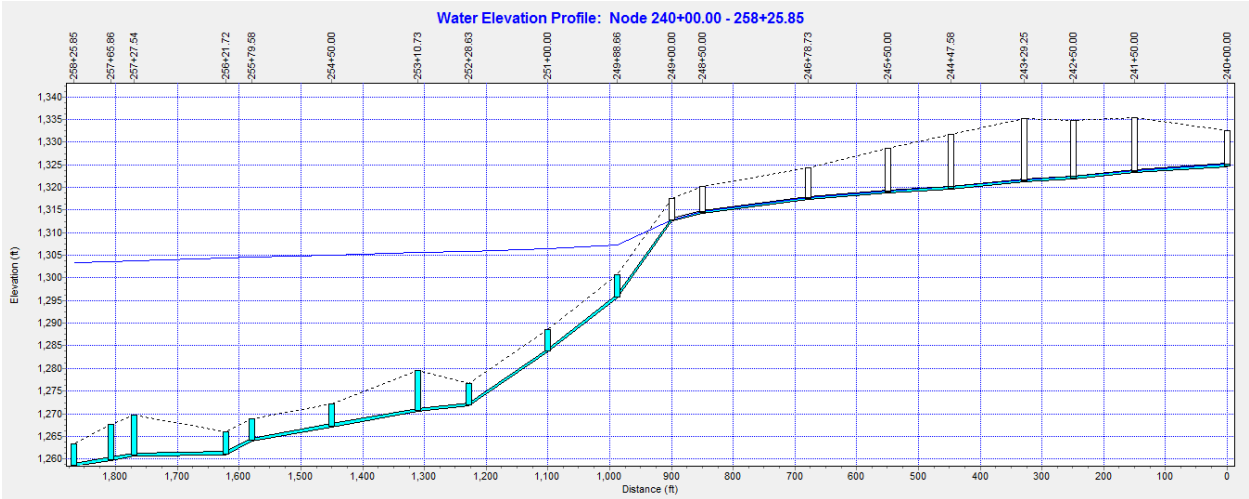
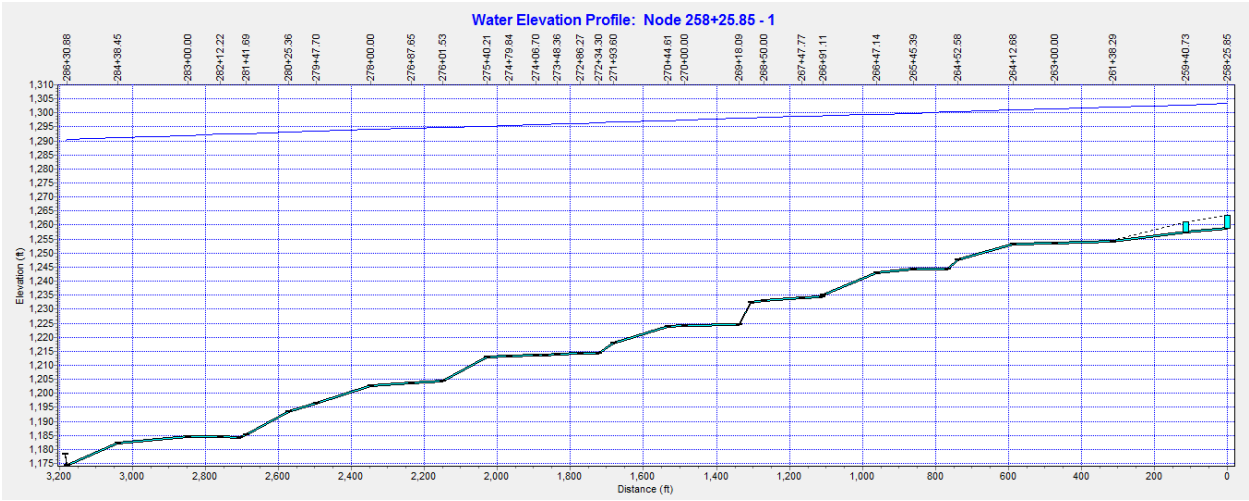
221+00.00
Elevation (ft)
Distance (ft)





Profiles showing water levels in the pipeline. Profiles begin at the inlet and end at the outfall.

Attachment J-2

Summary of 2013 Blue Creek Geotechnical Investigation Report

Attachment J-3

Geohazard Evaluation Proposed Water Treatment Discharge Pipeline Alignment

Attachment J-4

Letter Requesting Delay in Schedule