PUBLIC WORKS COMMITTEE

AGENDA

TOWN OF CHINCOTEAGUE

September 4, 2013 – 5:00 pm – Council Chambers – Town Hall

CALL TO ORDER

ROLL CALL

PUBLIC PARTICIPATION

AGENDA ADOPTION

1. 2013 Fall Paving

2. Self-Contained Cleaning Units

3. Inundation Study Results from Clark Nexsen

4. Questions/Comments

Adjourn

2. 2013 Fall Paving

Committee input on the selection of 2013 fall paving projects.

3. Self-Contained Cleaning Units

Consideration of purchasing a self contained cleaning unit for the municipal restrooms.

Article reproduced from Parks and Recreation Magazine

However, there are tools available to help make this job more of the "hands-off" rather than the less desirable "hands-on" method.

Different companies offer a self-contained cleaning unit, complete with an indoor pressure washer, a vacuum system, and a drying unit that enables thorough cleaning without a human's ever having to touch anything. The all-in-one systems, which came into wider use in the mid-1990s, promote this no-touch approach using "green" chemicals or none at all.

The original model was designed specifically for the public restroom, which is not only the number-one source of maintenance complaints, but also the most health-hazardous area within a building, according to leading manufacturers and environmental scientists.

People who have used the hands-off systems report they are easy, make cleanup faster, and keep the crew from having to deal with hands-on, nasty situations better left un-described here; the result is a happier crew, cleaner restrooms, and more satisfied patrons.

"It is the most effective and efficient tool we have for cleaning our restrooms," notes Lance Perry, manager of facilities and operations for the Lakota school district, the seventh largest in Ohio, with 22 schools. He says the district has 27 of the units and has used them for about 7 years in school and sports-complex restrooms.

"The maintenance crews love it," he notes. "There was some early resistance to using it, but once we trained them and they learned how to use it, they discovered they can get restrooms very clean, much quicker, and without having to touch the surfaces of the facilities."

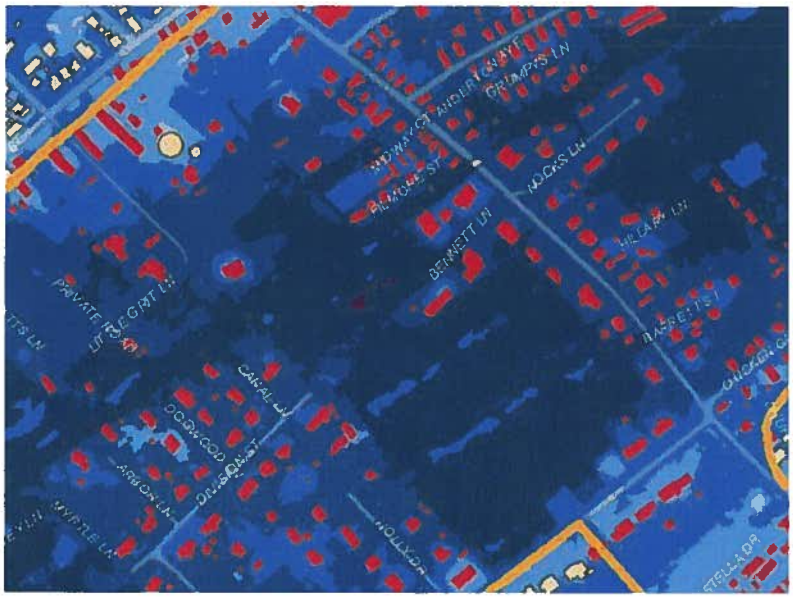
This writer can personally attest to the morale-booster these machines are to the cleaning crew, and to the improved cleanliness of restrooms. When I was director, the department purchased a couple of the

machines, and every time I saw the restroom cleaning crew, the employees thanked me, and patrons began giving us compliments instead of complaints.

Information is also available at http://www.kaivac.com

FLOOD EVALUATION FOR FOWLING GUT

Draft Report



PREPARED FOR:

TOWN OF CHINCOTEAGUE
VIRGINIA

July 2013

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Introduction

Clark Nexsen was tasked by the Town of Chincoteague to evaluate flooding at Fowling Gut and to determine the effectiveness of providing a flood gate at the outlet for Fowling Gut. The evaluation includes flood inundation mapping and a discussion of the critical impacts associated with assumed flood elevations.

Flood Elevation Mapping

Methodology

Flooding was evaluated per one foot interval using the existing Town aerials, GIS and LiDAR data. The analysis includes the island parcels, structures/buildings, roadways, drainage and critical infrastructure. Polygons were developed in GIS to represent each one foot interval of flooding and impacts to the various GIS features were determined for each one foot interval. Buildings were assumed to be impacted by the lowest flood elevation to intersect the building outline in GIS, which may not reflect actual damage to the structure. Accuracy of the flood impact elevations can be improved by future survey of the finished floor elevations of the structures. All elevations referenced in this report are datum NAVD 88.

Existing drainage patterns, watershed description

The normal tidal range for the Chincoteague Channel is between elevations –1.01 and 1.39-feet. Extreme tide events, such as those that result from nor'easters or tropical storms, can cause localized flooding even with the absence of additional rainfall. In the cases of extreme high tide, the drainage system will backflow and result in tidal flooding for more inland areas that are usually not directly impacted by tidal flooding. The problem is compounded when a heavy rainfall event coincides with a high tide and storm generated waves. The rainfall runoff is prevented from draining through the inadequate drainage system. The small pipes reduce the rate at which water can drain once the tide subsides effectively trapping storm water for an extended period of time. The combination of heavy rain and high tides can result in prolonged flooding even after the storm has passed, flooding under these conditions can last several days.

The watershed tributary to Fowling Gut is approximately 565 acres (0.88 square miles). Fowling Gut ultimately drains to the Chincoteague Channel at the southern end of the island near the Ocean Breeze community. The northern limit of Fowling Gut begins just north of Maddox Boulevard. From this point Fowling Gut flows approximately 15,350 linear feet and drains southerly through the center of the island to the two large arch culverts beneath Main Street. There are several culverts crossing Fowling Gut including Maddox Boulevard, Church Street, Bunting Road, Beebe Road, and Main Street. These crossings are characterized by corrugated metal arches 10 feet or larger in width and smaller crossings such as a 30-inch pipe at Church Street and an 18-inch pipe at Maddox Boulevard interconnecting Fowling Gut and drainage to Assateague Channel.

Most of the drainage systems discharging to Fowling Gut are characterized by small 8-inch to 12-inch diameter pipes. Several storm drainage systems discharge to Fowling Gut are also interconnected to storm drainage systems discharging to Chincoteague Channel and Assateague Channel. The interconnected storm drainage systems are located on the following streets:

- Seaweed Drive
- Cropper Street and Cleveland Street at Willow Street
- Mumford Street
- Church Street
- Clark Street
- Maddox Boulevard (at the headwater for Fowling Gut)
- Chicken City Road (ditch connections to Assateague Channel)
- Ridge Road (between Holly Street and Sunset Drive)
- Sunset Drive

The elevation of the drainage boundary ridge for Fowling Gut generally ranges between elevation 3 at the southwestern limits of the watershed (with low areas along Main Street at elevation 2.5) to elevation 4. Portions of the ridge line along Willow Street and high points along Ridge Road range between elevation 4 and elevation 6.

Flood Impacts

Identification of critical elevations for flood impacts

Based on the effective elevations of the existing drainage boundary the critical elevations for the Fowling Gut Watershed are between elevation 2 and elevation 4. Once the flood elevation of the Chincoteague Bay or Assateague Bay reaches elevation 4, flooding would breach the existing ridge line for much of the Fowling Gut Watershed.

Parcel/buildings

Based on the GIS mapping there are approximately 1,128 buildings located within the Fowling Gut Watershed, which represents approximately 18% of the total structures within the Town's GIS database. The commercial and out building structures are categorized within the GIS database, unclassified structures are assumed to be residential. The structures consist of 474 residential dwellings, 389 outbuildings and 265 commercial buildings. The Table No. 1 below summarizes the number of structures potentially impacted at each flood elevation.

Table No.1 Impacted Structures by Elevation and Type					
Elevation Range	Residential	Commercial	Outbuilding	Total Structures per Elevation	Cumulative Total
0 to 1	6	0	0	6	6
1 to 2	17	34	45	96	102
2 to 3	179	128	193	500	602
3 to 4	212	65	112	389	991
4 to 5	55	37	36	128	1119
5 to 6	5	1	3	9	1128

In addition to the building impacts listed above many residents and businesses begin to experience significant flooding impacts to the property (not necessarily impacting structures) starting at elevation 2.

Roadway

Many of the roadways within the Fowling Gut Watershed are at elevation 3 and become completely submerged between elevation 3 and 4. Some of the main through roads within the watershed experience isolated areas of roadway flooding between elevations 2 and 3 including areas of Main Street, Ridge Road, Beebe Road, Bunting Road, Maddox Boulevard and Church Street.

Critical infrastructure

The majority of the infrastructure that can be impacted by flooding within the Fowling Gut watershed include utility services to the structures and private septic systems. There is a water tower located off Willow Street, which may experience flooding impacts to the support buildings if flooding reaches elevation 3 or higher. The Primary Emergency Operations Center for the Island is located at the Municipal Center on Deep Hole Road, outside of the Fowling Gut watershed.

Sea Level Rise

NOAA defines global sea-level rise as the change in the global average sea level due to more water in the world's oceans. This is generally attributed to the effects of climate change particularly related to melting glaciers. Melting glaciers in or near the polar regions is also causing the ground to lift because of less weight from the ice. Local sea-level, known as relative sea-level change, includes both global sea-level rise and changes in the land elevation. Local impacts can include ground-raising or ground-lowering, subsidence. The global sea level change is approximately 1.8 mm/yr increase over the past century (0.60 feet). The general trend along the east coast is a rising sea-level.

NOAA lists the regional mean sea level rise for Ocean City, Maryland as 5.48 mm/yr with a 95% confidence interval of +/- 1.67 mm/yr based on monthly data from 1975 to 2006, which is 1.80 feet in 100 years. This value is only an approximation for Chincoteague. This affects current and future development for coastal communities such as Chincoteague. The changes will be used to determine

coastal protection options and establishment of policies on development. NOAA continues to establish new stations to identify changes in sea-level and to correlate this effort with land elevation changes.

Improvement Options

In order to isolate Fowling Gut from the Chincoteague Channel two main flood gates would be required, one at each arch culvert crossing beneath Main Street. The effective level of flood protection is dependent on the extent of additional improvements provided in conjunction with the flood gates. At a minimum all of the interconnected drainage systems between Fowling Gut and the Chincoteague and Assateague Bays will need to be disconnected or isolated with additional flood gates to prevent the flood waters from back flowing through the drainage systems into the Fowling Gut Watershed.

The flood gates alone may only be effective against tidal inundation. In order to provide flood protection for events where heavy rainfall coincides with high tide events a pump would be needed to maintain the flood water elevation within the watershed. To maximize the effective storage within the Fowling Gut the flood gates would have to be closed at the lowest possible tide cycle prior to an event.

The discussion below summarizes the additional improvements required to achieve the desired level of flood protection and the benefits provided. Buildings were assumed to be impacted by the lowest flood elevation to intersect the building outline in GIS which may not reflect actual damage to the structure. Road raising may require adjustments to driveways and entrances and have right-of-way and environmental impacts which may result in isolated drainage problems for lot owners that would need to be addressed if the road is raised above existing lot levels.

Elevation 2 – No additional roadway improvements appear to be necessary to provide flood protection up to elevation 2 however the interconnected drainage system will need to be disconnected or isolated and potential pump station provided.

Approximately 102 structures (consisting mostly of commercial and out buildings) that may experience flooding up to elevation 2 in the existing condition would be protected, which represents approximately 9% of the structures within the study area and 1.7% of the total structures within the Chincoteague GIS database.

Elevation 3 – In order to provide flood protection up to elevation 3 isolated locations along the ridge line may need to be raised a maximum of 6 inches in addition to disconnecting or isolating the interconnected drainage systems and providing a pump station.

Approximately 602 structures that may experience flooding up to elevation 3 in the existing condition would be protected, a third of which are residential structures. The 602 structures represent approximately 53% of the structures within the study area and 9.8% of the total structures within the Chincoteague GIS database.

Elevation 4 – In order to provide flood protection up to elevation 4 approximately 3.6 miles of roadway along the ridgeline would need to be raised approximately 6 inches to 1.5 feet in addition to disconnecting or isolating the interconnected drainage systems and providing a pump station. The roads include Seaweed Drive, Main Street, Bunting Road, Church Street, Pension Street, Clark Street, Deep Hole Road, Maddox Boulevard, Chicken city Road, and Ridge Road. Raising Main Street between Beacon Street and Bunting Road may also provide additional protection to the structures along Main Street which are currently outside of the Fowling Gut Watershed Study Area.

Approximately 991 structures that may experience flooding up to elevation 4 in the existing condition would be protected, a third of which are residential structures. The 991 structures represent approximately 88% of the structures within the study area and 16% of the total structures within the Chincoteague GIS database.

Elevation 5 – In order to provide flood protection up to elevation 5 approximately 5.5 miles of roadway, almost the entire ridgeline, would need to be raised approximately 6 inches to 2.5 feet in addition to disconnecting or isolating the interconnected drainage systems and providing a pump station. Raising Main Street between Beacon Street and Bunting Road may also provide additional protection to the structures along Main Street which are currently outside of the Fowling Gut Watershed Study Area.

Approximately 1,119 structures that may experience flooding up to elevation 5 in the existing condition would be protected, a third of which are residential structures. The 1,119 structures represent approximately 99% of the structures within the study area and 18% of the total structures within the Chincoteague GIS database. Protection beyond elevation 5 only affords protection to an additional 9 structures within the watershed.

Summary / Conclusion

The critical elevations for the Fowling Gut Watershed are between elevation 2 and elevation 4. Much of the watershed ridgeline for Fowling Gut is between elevations 3 and 4 with isolated areas at approximately elevation 2.5. When the flood waters reach elevation 4 most of the ridgeline has been breached.

In order to isolate Fowling Gut from the Chincoteague Channel two flood gates would be required at the Main Street arch culverts. Other improvements would also be required:

- Disconnect or isolate inter connected drainage systems
- Provide a pump station to address rainfall runoff from within the line of protection (a detailed analysis would be required for the design of the pump)
- Road raising to bring the watershed ridge line up to the desired level of protection.

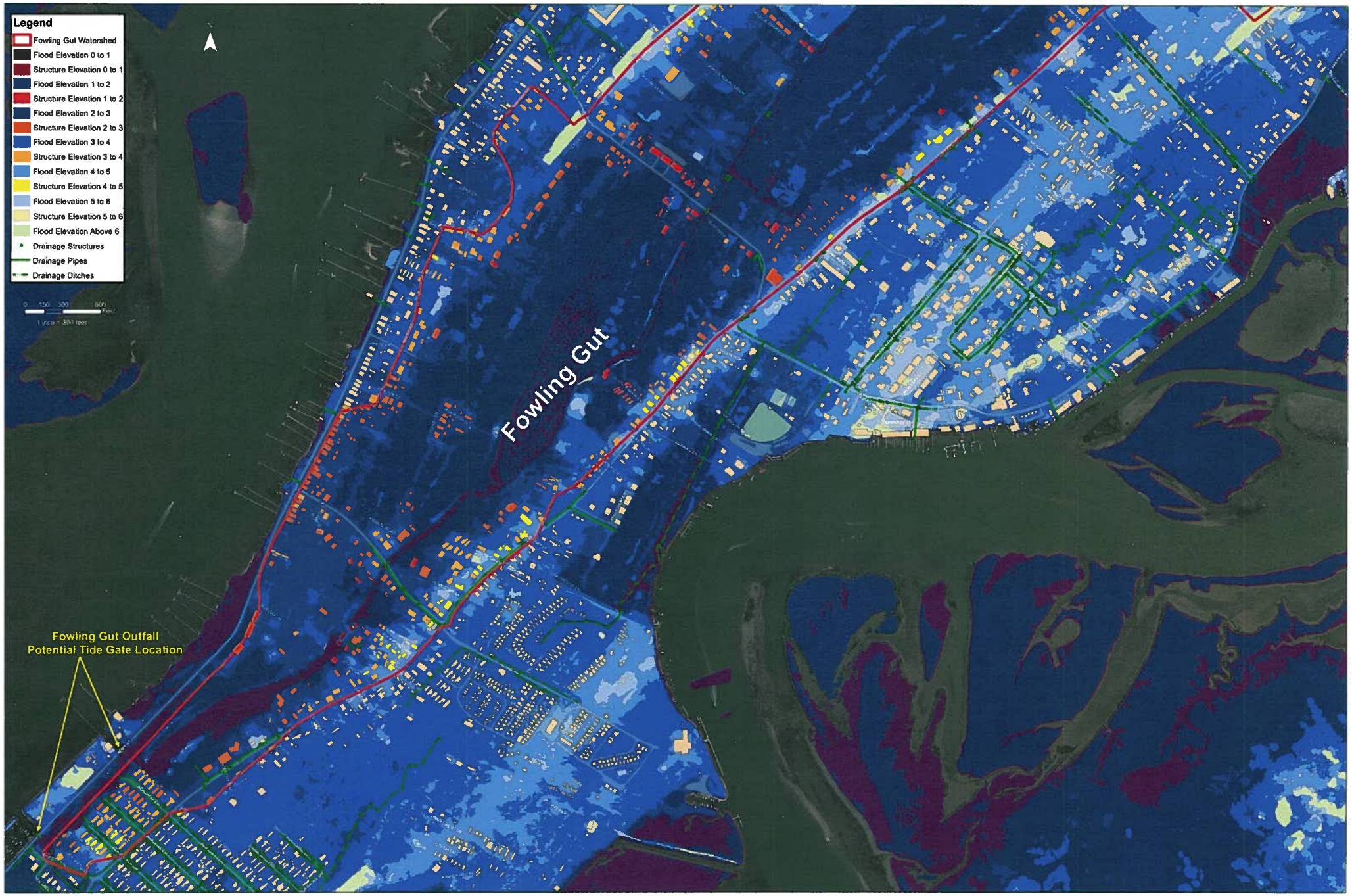
Table No.2 below summarizes the number of structures impacted at each flood elevation.

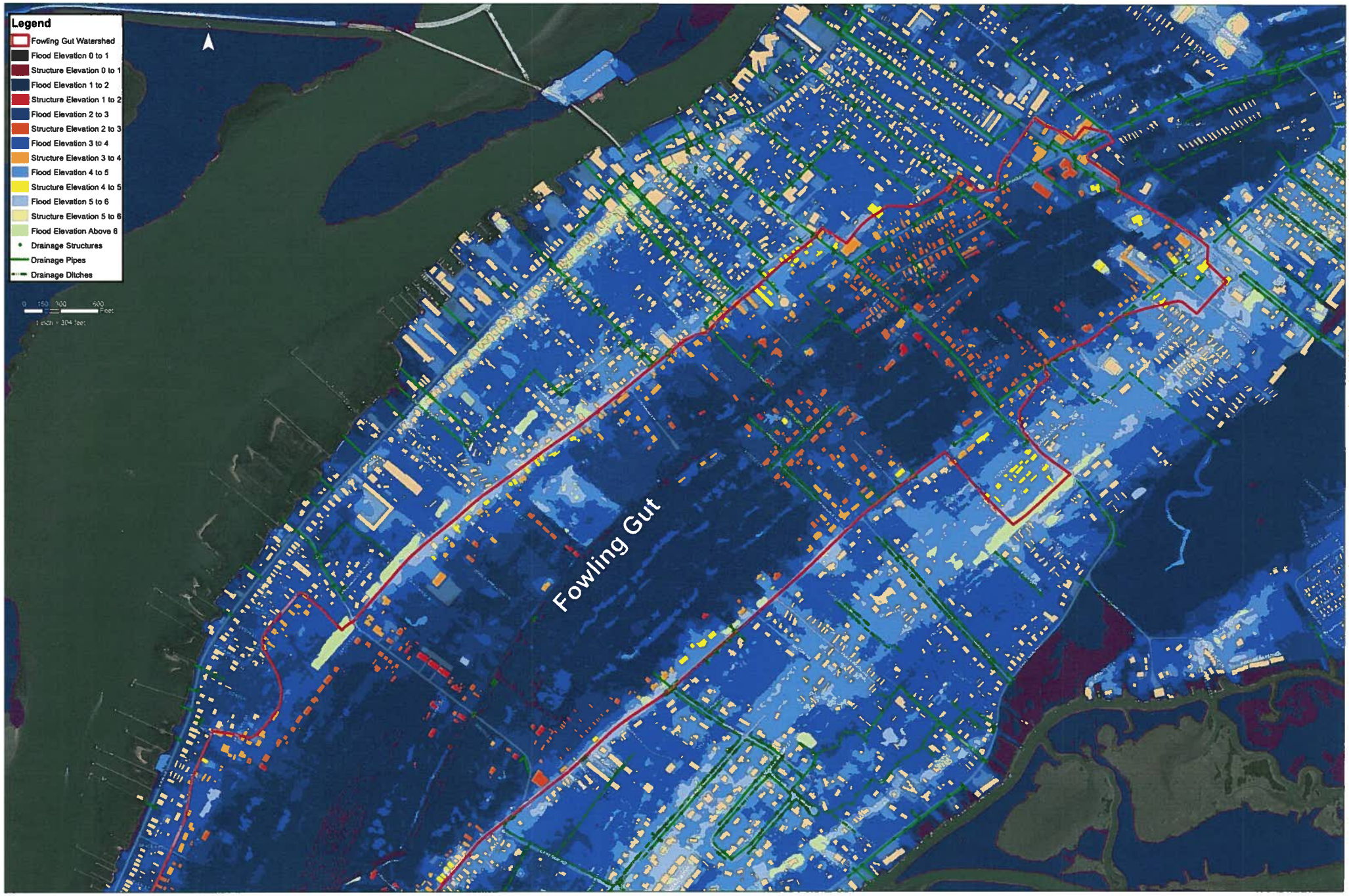
Table No.2 Summary Impacted Structures by Elevation		
Elevation Range	**Total Structures per Elevation**	**Cumulative Total**
0 to 1	6	6
1 to 2	96	102
2 to 3	500	602
3 to 4	389	991
4 to 5	128	1119
5 to 6	9	1128

The addition of the flood gates at Main Street could provide reasonable protection up to elevation 3 without the need for further improvements beyond disconnecting or isolating the interconnected drainage systems. However a pump station may be needed to address rainfall runoff while the tide gates are closed. A detailed survey analysis is required to determine accurate structure damage elevations and to determine if additional road raising is required to provide a continuous level of protection. Based on the current trend in sea level rise of 1.80 feet in 100 years the flood gate protection to elevation 3 may become ineffective in the future.

Protection beyond elevation 3 is likely cost prohibitive due to the amount of improvements needed to provide a continuous level of protection including road raising and the addition of a pump station.

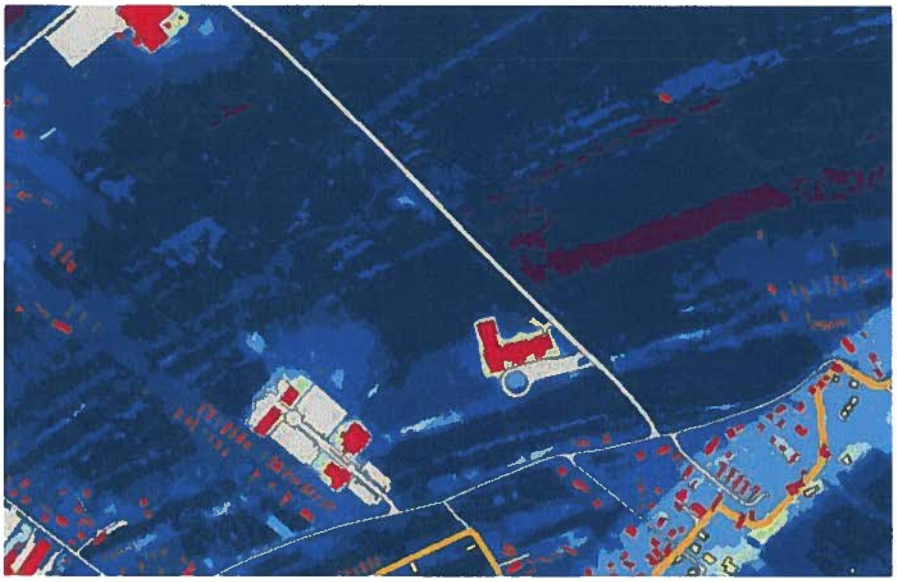
Appendix A – Flood Mapping


Legend
Fowling Gut Watershed
Flood Elevation 0 to 1
Structure Elevation 0 to 1
Flood Elevation 1 to 2
Structure Elevation 1 to 2
Flood Elevation 2 to 3
Structure Elevation 2 to 3
Flood Elevation 3 to 4
Structure Elevation 3 to 4
Flood Elevation 4 to 5
Structure Elevation 4 to 5
Flood Elevation 5 to 6
Structure Elevation 5 to 6
Flood Elevation Above 6
Drainage Structures
Drainage Pipes
Drainage Ditches
Fowling Gut
Fowling Gut Outfall
Potential Tide Gate Location


Legend
Fowling Gut Watershed
Flood Elevation 0 to 1
Structure Elevation 0 to 1
Flood Elevation 1 to 2
Structure Elevation 1 to 2
Flood Elevation 2 to 3
Structure Elevation 2 to 3
Flood Elevation 3 to 4
Structure Elevation 3 to 4
Flood Elevation 4 to 5
Structure Elevation 4 to 5
Flood Elevation 5 to 6
Structure Elevation 5 to 6
Flood Elevation Above 6
Drainage Structures
Drainage Pipes
Drainage Ditches
0 150 300 600 Feet
1 inch = 304 feet
Fowling Gut

FLOOD EVALUATION FOR HALLIE WHEALTON SMITH DRIVE

Draft Report



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Appendix B – Pond Pack Time vs. Elevation Tables ..... B

Introduction

Clark Nexsen was tasked by the Town of Chincoteague to evaluate flooding for Hallie Whealton Smith Drive and the surrounding watershed and to determine the effectiveness of providing drainage improvements for the Hallie Whealton Smith Drive drainage system which outfalls across Main Street. The evaluation includes flood inundation mapping, a discussion of the critical impacts associated with assumed flood elevations and an analysis for potential improvements to the existing drainage system.

Flood Elevation Mapping

Methodology

Flooding was evaluated per one foot interval using the existing Town aerials, GIS and LiDAR data. The mapping includes the island parcels, structures/buildings, roadways, drainage and critical infrastructure. Polygons were developed in GIS to represent each one foot interval of flooding and impacts to the various GIS features were determined for each one foot interval. Buildings were assumed to be impacted by the lowest flood elevation to intersect the building outline in GIS which may not reflect actual damage to the structure. Accuracy of the flood impact elevations can be improved by future survey of the finished floor elevations of the structures. All elevations referenced in this report are datum NAVD 88. The Flood Elevation Map is provided in Appendix A.

Existing drainage patterns, watershed description

The normal tidal range for the Chincoteague Channel is between elevations –1.01 and 1.39-feet. Extreme tide events, such as those that result from nor'easters or tropical storms, can cause localized flooding even with the absence of additional rainfall. In the cases of extreme high tide, the drainage system will backflow and result in tidal flooding for more inland areas that are usually not directly impacted by tidal flooding. The problem is compounded when a heavy rainfall event coincides with a high tide and storm generated waves. The rainfall runoff is prevented from draining through the inadequate drainage system. The combination of heavy rain and high tides can result in prolonged flooding even after the storm has passed, flooding under these conditions can last several days.

During Hurricane Sandy flood waters were pushed inland across Hallie Whealton Smith Drive from the prevailing winds of the storm inundating the study area. The flood waters collected in the low lying maritime forested area and took an extended period of time to drain. Based on discussions with Public Works the area remained flooded for longer than 24 hours after the storm passed the island.

The Hallie Whealton Smith Drive Study Area is approximately 550 acres (0.86 square miles) and is generally defined by Hibiscus Drive to the north, Deep Hole Road to the east, Taylor Street to the south and Main Street to the west. The main drainage system for the study area consists of open ditches (approximately 10 to 12 feet wide and 4 feet deep) and 30" culverts along Hallie Whealton Smith Drive from Deep Hole Road to Main Street. Three 24" culverts and a 12" culvert cross beneath Hallie Whealton Smith Drive connecting the ditches on the north and south sides of the road. The Hallie

Whealton Smith Drive drainage system ultimately drains to the Chincoteague Channel at the northwestern end of the island near the combined High School / Middle School. The closed drainage system along Deep Hole Road ultimately outfalls to the Hallie Whealton Smith Drive roadside ditch.

Other drainage systems within the study area include ditches and a 12" pipe system at Taylor Street, a ditch and culvert system along Main Street near North Hibiscus Drive, 12" pipe systems draining the High School / Middle School parking lot across Main Street and a ditch and 12" pipe system along Deep Hole Road near Fir Landing Road. These systems likely have little direct influence on the Hallie Whealton Smith Drive drainage. Additional culvert crossings may be located along North Hibiscus Drive which will need to be field verified.

The elevation of the drainage boundary ridge for Hallie Whealton Smith Drive Study Area generally ranges between elevation 2 and 3 to the North along Hibiscus Drive, elevation 4 and 5 to the East near Deep Hole Road, elevation 2 to 3 near Taylor Street to the South and 2 to 4 along Main Street to the West.

Flood Impacts

Identification of critical elevations for flood impacts

Based on the effective elevations of the existing drainage boundary the critical elevations for the Whealton Smith Drive Study Area are between elevation 2 and elevation 4. Once the flood elevation of the Chincoteague Bay or Assateague Bay reaches elevation 4, flooding would breach the existing ridge line for much of the study area.

Parcel/buildings

Based on the GIS mapping there are approximately 679 buildings located within the Whealton Smith Drive Study Area, which represents approximately 11% of the total structures within the Town's GIS database. The commercial and out building structures are categorized within the GIS database, unclassified structures are assumed to be residential. The structures consist of 364 residential dwellings, 208 outbuildings and 107 commercial buildings. The Table No. 1 below summarizes the number of structures potentially impacted at each flood elevation.

Table No.1 Impacted Structures by Elevation and Type

Elevation Range	Residential	Commercial	Outbuilding	Total Structures per Elevation	Cumulative Total
0 to 1	0	1	2	3	3
1 to 2	28	7	15	50	53
2 to 3	183	45	86	314	367
3 to 4	87	40	68	195	562
4 to 5	65	9	34	108	670
5 to 6	1	3	2	6	676
Above 6	0	2	1	3	679

In addition to the building impacts listed above many residents and businesses begin to experience significant flooding impacts to the property (not necessarily impacting structures) starting at elevation 2.

Roadway

Main Street, Taylor Street, Deep Hole Road, Hallie Whealton Smith Drive, and Hibiscus Drive are the main roadways within the study area. The roads along the ridge line are generally between elevation 2 and 3 with areas of Deep Hole Road between elevations 3 to 5.

Hallie Whealton Smith Drive itself ranges between elevations 2 to 3 with higher elevations at the intersection with Main Street and Deep Hole Road. Much of Hallie Whealton Smith Drive is below or approximately even with the lower elevations along surrounding ridgeline, as a result the flood waters from Hurricane Sandy that were pushed inland became trapped behind the ridge line and resulted in prolonged inundation of Hallie Whealton Smith Drive that exceeded the capacity of the existing 30" outfall at Main Street to drain.

Critical infrastructure

The majority of the infrastructure that can be impacted by flooding within the Hallie Whealton Smith Drive Study Area includes utility services to the structures and private septic systems. The Primary Emergency Operations Center for the Island located at the Municipal Center and two schools are located within the study area. The main buildings of the Municipal Center and the Elementary School are at elevation 6 or higher; however the roads accessing both complexes become inundated between elevations 3 and 4. The combined Middle School / High School building is at elevation 5. The access roads to the Middle School / High School become inundated between elevations 2 and 3.

Sea Level Rise

NOAA defines global sea-level rise as the change in the global average sea level due to more water in the world's oceans. This is generally attributed to the effects of climate change particularly related to melting glaciers. Melting glaciers in or near the polar regions is also causing the ground to lift because of less weight from the ice. Local sea-level, known as relative sea-level change, includes both global sea-level rise and changes in the land elevation. Local impacts can include ground-raising or ground-lowering, subsidence. The global sea level change is approximately 1.8 mm/yr increase over the past century (0.60 feet). The general trend along the east coast is a rising sea-level.

NOAA lists the regional mean sea level rise for Ocean City, Maryland as 5.48 mm/yr with a 95% confidence interval of +/- 1.67 mm/yr based on monthly data from 1975 to 2006, which is 1.80 feet in 100 years. This value is only an approximation for Chincoteague. This affects current and future development for coastal communities such as Chincoteague. The changes will be used to determine coastal protection options and establishment of policies on development. NOAA continues to establish new stations to identify changes in sea-level and to correlate this effort with land elevation changes.

Improvement Options

Hurricane Sandy resulted in a tidal surge inundating the Hallie Whealton Smith Drive Study Area. Once inundated the area around Hallie Whealton Smith Drive took an extended period of time to drain because flood waters became trapped within the low-lying area and an inadequate drainage system to discharge water. Because of the storm's position and path, the island was subject to a longer period of flooding from wind effects. Most of the ridgeline for the Hallie Whealton Smith Drive Study Area is between elevation 2 and 4, raising the roads along the ridgeline (approximately 3 miles) to provide a continuous level of protection against tidal inundation is likely cost prohibitive. The average watershed elevation is approximately elevation 3 or more particularly to the south and west and even higher to the east.

Hallie Whealton Smith Drive ranges between elevations 2 to 3 and raising the road between 1 to 2 feet (for approximately 0.4 miles) to an elevation higher than the ridgeline would reduce the impacts to the roadway from high tides and some storm surges that are trapped within the surrounding low-lying area. Environmental impacts would need to be considered in raising Hallie Whealton Smith Drive and hydraulic connectivity between the low-lying areas on either side of the road would have to be maintained to ensure the road raising does not trap flood waters and cause prolonged flooding to the south.

Drainage improvements were considered to allow the trapped flood waters to drain out faster once the tide subsided. The existing drainage system along Hallie Whealton Smith Drive is restricted by the existing 30" outfall pipe at Main Street and higher ground elevations cause water to become trapped within the region. Flap gates would be required on pipes or culverts within the study area to control tidal backflow into the drainage systems. A simple model was created in Bentley Pond Pack (v8i) to compare the elevation/time relationship of the existing drainage system to the improvement options.

Drainage Analysis

The analysis assumed a starting water surface elevation of 4 and accounted for the available storage of the study area at each elevation in relation to the discharge capacity of a free outfall, assuming the tide receded. The analysis does not consider the timing effect of water moving through the watershed. Connectivity, channel geometry and obstructions within the forested regions can cause the water volume to take longer to reach an outfall. Rainfall was not included in the analysis and is often a small part of larger storms and flooding impacts caused by tidal inundation. Hallie Whealton Smith Drive is assumed to be accessible once the flood waters have recede to elevation 2.25. The model assumes the existing ridgeline (approximate elevation 2.5 along Hibiscus Drive to the north) acts as a weir to allow the receding tide to drain out of the study area. However, a persistent northerly wind, pushing Chincoteague Bay into the island from the north, would likely flood to a higher elevation of roughly 3 before leaving the island on the west side into Chincoteague Channel. This situation potentially created long term flooding on the northern part of the island. Times vs. Elevation tables for the Pond Pack Model are provided in Appendix B.

The model for the existing 30" outfall pipe indicates the maximum discharge rate for the pipe is approximately 19 cubic feet per second (cfs) when the flood waters are at elevation 3 and most of Hallie Whealton Smith Drive is inundated. The analysis shows the flood waters take approximately 3 days or longer to drain from elevation 3 to elevation 2.25. Once the flood waters reach the ridge line elevation of 2.5 the model assumes the outfall pipe to be the sole point of discharge.

The first improvement option analyzed provides two additional 30" culverts at the outfall on Hallie Whealton Smith Drive. The maximum discharge rate for the three combined pipes is approximately 58 cfs when the flood waters are at elevation 3. The analysis shows the flood waters take approximately 1.25 days to drain from elevation 3 to elevation 2.25, reducing the existing drain time by approximately 58%.

The second improvement option provides a double 5-ft wide by 3-ft high box culvert at the existing berm between Hibiscus Drive and Hibiscus Drive North, west of Oyster Bay subdivision. The culvert would function as an auxiliary drainage structure to help drain the flooded inland areas following storm events where flood water would pond within the area and would likely not have a direct impact to the ordinary function of the Hallie Whealton Smith Drive drainage system during typical rainfall events. The maximum discharge rate for the box culverts is approximately 145 cfs when the flood waters are at elevation 3. The analysis shows the flood waters take approximately 12 hours to drain from elevation 3 to elevation 2.25, reducing the existing drain time by approximately 83%. The hydraulic link to Hallie Whealton Smith Drive would need to be confirmed in order for culverts at this location to be an effective means to lower the flood elevations on the roadway. Flap gates should be provided on the existing and proposed pipe to minimize nuisance tidal flooding.

Summary / Conclusion

The critical elevations for the Hallie Whealton Smith Drive Study Area are between elevation 2 and elevation 4. Much of the watershed ridgeline is between elevations 2 and 4. The average watershed elevation is approximately elevation 3 or more particularly to the south and west and even higher to the east. When the flood waters reach elevation 3 or more, much of the ridgeline is overtopped.

Table No.2 below summarizes the number of structures impacted at each flood elevation.

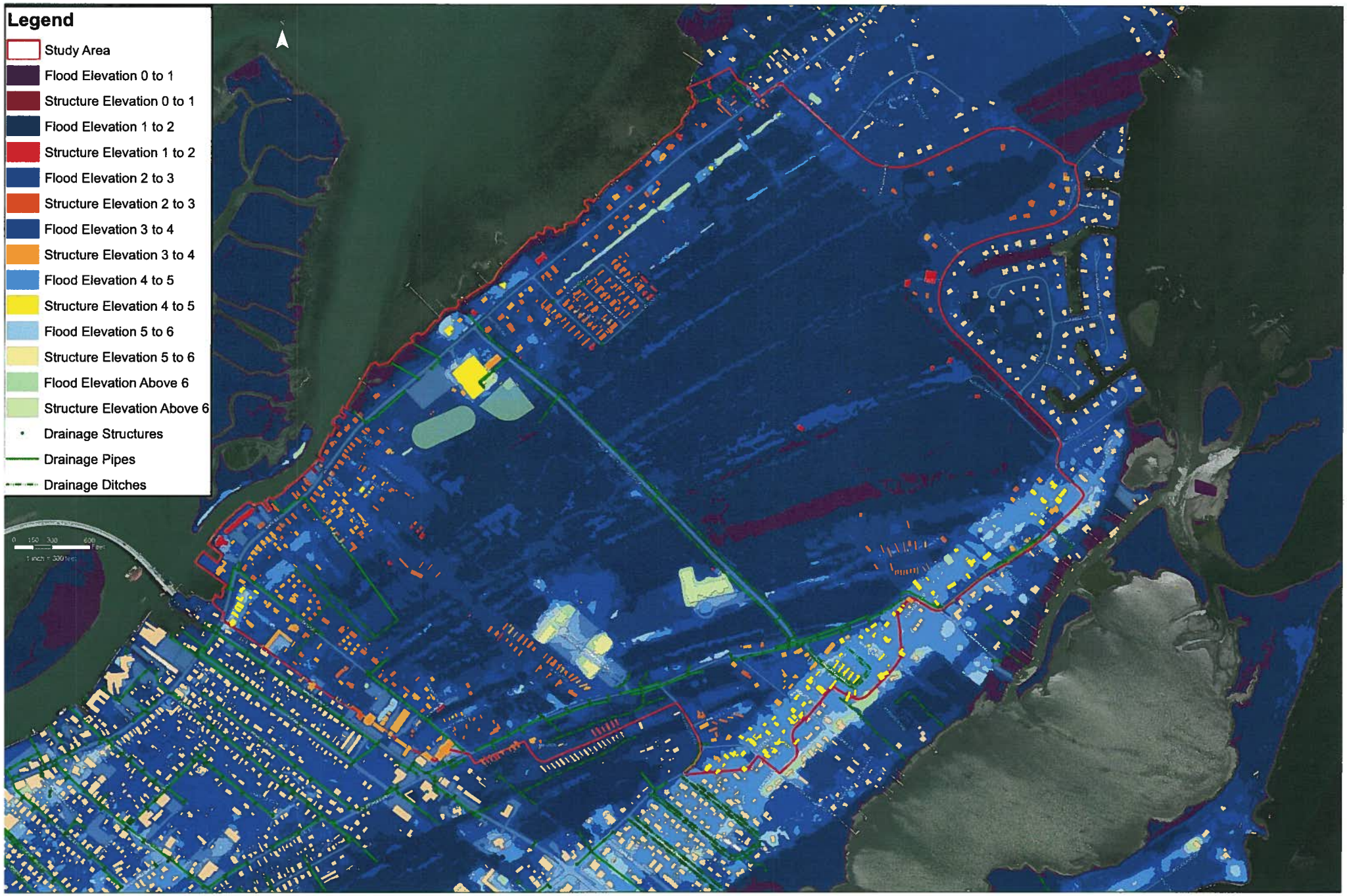
Table No.2 Summary Impacted Structures by Elevation

Elevation Range	Total Structures per Elevation	Cumulative Total
0 to 1	3	3
1 to 2	50	53
2 to 3	314	367
3 to 4	195	562
4 to 5	108	670
5 to 6	6	676
Above 6	3	679

Raising the roads along the ridgeline (approximately 3 miles) to provide a continuous level of protection against tidal inundation is likely cost prohibitive. Elevating parts of Hallie Whealton Smith Drive 1 to 2 feet to provide a greater level of flood protection to the roadway may also be cost prohibitive as well. Raising any roads in addition to the material and construction expense, can include right-of-way impacts, utility relocation impacts, environmental impacts, and affect residents and businesses adversely.

The drainage analysis shows that providing drainage improvements could reduce the inundation time from higher tides and storm flooding within the study area.

Appendix A – Flood Mapping


Legend
Study Area
Flood Elevation 0 to 1
Structure Elevation 0 to 1
Flood Elevation 1 to 2
Structure Elevation 1 to 2
Flood Elevation 2 to 3
Structure Elevation 2 to 3
Flood Elevation 3 to 4
Structure Elevation 3 to 4
Flood Elevation 4 to 5
Structure Elevation 4 to 5
Flood Elevation 5 to 6
Structure Elevation 5 to 6
Flood Elevation Above 6
Structure Elevation Above 6
Drainage Structures
Drainage Pipes
Drainage Ditches
0 150 300 600 Feet
1 inch = 300 feet

Appendix B – Pond Pack Time vs. Elevation Tables

Existing Hallie Whealton Smith Drive Drainage System
Subsection: Time vs. Elevation
Label: PO-1 (OUT)
Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	4.00	3.95	3.90	3.86	3.82
0.250	3.78	3.74	3.70	3.66	3.63
0.500	3.60	3.57	3.54	3.51	3.48
0.750	3.45	3.42	3.40	3.37	3.35
1.000	3.32	3.30	3.28	3.26	3.24
1.250	3.22	3.20	3.18	3.16	3.15
1.500	3.13	3.11	3.10	3.09	3.07
1.750	3.06	3.05	3.03	3.02	3.01
2.000	3.00	2.99	2.97	2.96	2.95
2.250	2.94	2.93	2.92	2.91	2.90
2.500	2.89	2.88	2.87	2.86	2.85
2.750	2.84	2.84	2.83	2.82	2.81
3.000	2.80	2.80	2.79	2.78	2.77
3.250	2.77	2.76	2.75	2.75	2.74
3.500	2.74	2.73	2.72	2.72	2.71
3.750	2.71	2.70	2.70	2.69	2.69
4.000	2.68	2.68	2.67	2.67	2.67
4.250	2.66	2.66	2.65	2.65	2.65
4.500	2.64	2.64	2.64	2.63	2.63
4.750	2.63	2.62	2.62	2.62	2.61
5.000	2.61	2.61	2.60	2.60	2.60
5.250	2.60	2.59	2.59	2.59	2.59
5.500	2.58	2.58	2.58	2.58	2.58
5.750	2.57	2.57	2.57	2.57	2.57
6.000	2.56	2.56	2.56	2.56	2.56
6.250	2.56	2.56	2.55	2.55	2.55
6.500	2.55	2.55	2.55	2.55	2.54
6.750	2.54	2.54	2.54	2.54	2.54
7.000	2.54	2.54	2.54	2.53	2.53
7.250	2.53	2.53	2.53	2.53	2.53
7.500	2.53	2.53	2.53	2.53	2.52
7.750	2.52	2.52	2.52	2.52	2.52
8.000	2.52	2.52	2.52	2.52	2.52
8.250	2.52	2.52	2.52	2.52	2.52
8.500	2.51	2.51	2.51	2.51	2.51
8.750	2.51	2.51	2.51	2.51	2.51
9.000	2.51	2.51	2.51	2.51	2.51
9.250	2.51	2.51	2.51	2.51	2.51

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
9.500	2.51	2.51	2.51	2.51	2.51
9.750	2.51	2.50	2.50	2.50	2.50
10.000	2.50	2.50	2.50	2.50	2.50
10.250	2.50	2.50	2.50	2.50	2.50
10.500	2.50	2.50	2.50	2.50	2.50
10.750	2.50	2.50	2.50	2.50	2.50
11.000	2.50	2.50	2.50	2.50	2.50
11.250	2.50	2.50	2.50	2.50	2.50
11.500	2.50	2.50	2.50	2.50	2.50
11.750	2.50	2.50	2.50	2.50	2.50
12.000	2.50	2.50	2.50	2.50	2.50
12.250	2.49	2.49	2.49	2.49	2.49
12.500	2.49	2.49	2.49	2.49	2.49
12.750	2.49	2.49	2.49	2.49	2.49
13.000	2.49	2.49	2.49	2.49	2.49
13.250	2.49	2.49	2.49	2.49	2.49
13.500	2.49	2.49	2.49	2.49	2.49
13.750	2.49	2.49	2.49	2.49	2.49
14.000	2.49	2.49	2.49	2.49	2.49
14.250	2.49	2.49	2.49	2.49	2.49
14.500	2.49	2.49	2.49	2.49	2.49
14.750	2.49	2.49	2.49	2.48	2.48
15.000	2.48	2.48	2.48	2.48	2.48
15.250	2.48	2.48	2.48	2.48	2.48
15.500	2.48	2.48	2.48	2.48	2.48
15.750	2.48	2.48	2.48	2.48	2.48
16.000	2.48	2.48	2.48	2.48	2.48
16.250	2.48	2.48	2.48	2.48	2.48
16.500	2.48	2.48	2.48	2.48	2.48
16.750	2.48	2.48	2.48	2.48	2.48
17.000	2.48	2.48	2.48	2.48	2.48
17.250	2.48	2.48	2.48	2.48	2.48
17.500	2.47	2.47	2.47	2.47	2.47
17.750	2.47	2.47	2.47	2.47	2.47
18.000	2.47	2.47	2.47	2.47	2.47
18.250	2.47	2.47	2.47	2.47	2.47
18.500	2.47	2.47	2.47	2.47	2.47
18.750	2.47	2.47	2.47	2.47	2.47
19.000	2.47	2.47	2.47	2.47	2.47
19.250	2.47	2.47	2.47	2.47	2.47
19.500	2.47	2.47	2.47	2.47	2.47
19.750	2.47	2.47	2.47	2.47	2.47
20.000	2.47	2.47	2.47	2.47	2.46

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
20.250	2.46	2.46	2.46	2.46	2.46
20.500	2.46	2.46	2.46	2.46	2.46
20.750	2.46	2.46	2.46	2.46	2.46
21.000	2.46	2.46	2.46	2.46	2.46
21.250	2.46	2.46	2.46	2.46	2.46
21.500	2.46	2.46	2.46	2.46	2.46
21.750	2.46	2.46	2.46	2.46	2.46
22.000	2.46	2.46	2.46	2.46	2.46
22.250	2.46	2.46	2.46	2.46	2.46
22.500	2.46	2.46	2.46	2.46	2.46
22.750	2.46	2.46	2.45	2.45	2.45
23.000	2.45	2.45	2.45	2.45	2.45
23.250	2.45	2.45	2.45	2.45	2.45
23.500	2.45	2.45	2.45	2.45	2.45
23.750	2.45	2.45	2.45	2.45	2.45
24.000	2.45	2.45	2.45	2.45	2.45
24.250	2.45	2.45	2.45	2.45	2.45
24.500	2.45	2.45	2.45	2.45	2.45
24.750	2.45	2.45	2.45	2.45	2.45
25.000	2.45	2.45	2.45	2.45	2.45
25.250	2.45	2.45	2.45	2.45	2.45
25.500	2.45	2.44	2.44	2.44	2.44
25.750	2.44	2.44	2.44	2.44	2.44
26.000	2.44	2.44	2.44	2.44	2.44
26.250	2.44	2.44	2.44	2.44	2.44
26.500	2.44	2.44	2.44	2.44	2.44
26.750	2.44	2.44	2.44	2.44	2.44
27.000	2.44	2.44	2.44	2.44	2.44
27.250	2.44	2.44	2.44	2.44	2.44
27.500	2.44	2.44	2.44	2.44	2.44
27.750	2.44	2.44	2.44	2.44	2.44
28.000	2.44	2.44	2.44	2.44	2.44
28.250	2.44	2.43	2.43	2.43	2.43
28.500	2.43	2.43	2.43	2.43	2.43
28.750	2.43	2.43	2.43	2.43	2.43
29.000	2.43	2.43	2.43	2.43	2.43
29.250	2.43	2.43	2.43	2.43	2.43
29.500	2.43	2.43	2.43	2.43	2.43
29.750	2.43	2.43	2.43	2.43	2.43
30.000	2.43	2.43	2.43	2.43	2.43
30.250	2.43	2.43	2.43	2.43	2.43
30.500	2.43	2.43	2.43	2.43	2.43
30.750	2.43	2.43	2.43	2.43	2.43

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
31.000	2.43	2.42	2.42	2.42	2.42
31.250	2.42	2.42	2.42	2.42	2.42
31.500	2.42	2.42	2.42	2.42	2.42
31.750	2.42	2.42	2.42	2.42	2.42
32.000	2.42	2.42	2.42	2.42	2.42
32.250	2.42	2.42	2.42	2.42	2.42
32.500	2.42	2.42	2.42	2.42	2.42
32.750	2.42	2.42	2.42	2.42	2.42
33.000	2.42	2.42	2.42	2.42	2.42
33.250	2.42	2.42	2.42	2.42	2.42
33.500	2.42	2.42	2.42	2.42	2.42
33.750	2.42	2.41	2.41	2.41	2.41
34.000	2.41	2.41	2.41	2.41	2.41
34.250	2.41	2.41	2.41	2.41	2.41
34.500	2.41	2.41	2.41	2.41	2.41
34.750	2.41	2.41	2.41	2.41	2.41
35.000	2.41	2.41	2.41	2.41	2.41
35.250	2.41	2.41	2.41	2.41	2.41
35.500	2.41	2.41	2.41	2.41	2.41
35.750	2.41	2.41	2.41	2.41	2.41
36.000	2.41	2.41	2.41	2.41	2.41
36.250	2.41	2.41	2.41	2.41	2.41
36.500	2.41	2.41	2.40	2.40	2.40
36.750	2.40	2.40	2.40	2.40	2.40
37.000	2.40	2.40	2.40	2.40	2.40
37.250	2.40	2.40	2.40	2.40	2.40
37.500	2.40	2.40	2.40	2.40	2.40
37.750	2.40	2.40	2.40	2.40	2.40
38.000	2.40	2.40	2.40	2.40	2.40
38.250	2.40	2.40	2.40	2.40	2.40
38.500	2.40	2.40	2.40	2.40	2.40
38.750	2.40	2.40	2.40	2.40	2.40
39.000	2.40	2.40	2.40	2.40	2.40
39.250	2.40	2.40	2.40	2.40	2.39
39.500	2.39	2.39	2.39	2.39	2.39
39.750	2.39	2.39	2.39	2.39	2.39
40.000	2.39	2.39	2.39	2.39	2.39
40.250	2.39	2.39	2.39	2.39	2.39
40.500	2.39	2.39	2.39	2.39	2.39
40.750	2.39	2.39	2.39	2.39	2.39
41.000	2.39	2.39	2.39	2.39	2.39
41.250	2.39	2.39	2.39	2.39	2.39
41.500	2.39	2.39	2.39	2.39	2.39

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
41.750	2.39	2.39	2.39	2.39	2.39
42.000	2.39	2.39	2.39	2.39	2.39
42.250	2.39	2.38	2.38	2.38	2.38
42.500	2.38	2.38	2.38	2.38	2.38
42.750	2.38	2.38	2.38	2.38	2.38
43.000	2.38	2.38	2.38	2.38	2.38
43.250	2.38	2.38	2.38	2.38	2.38
43.500	2.38	2.38	2.38	2.38	2.38
43.750	2.38	2.38	2.38	2.38	2.38
44.000	2.38	2.38	2.38	2.38	2.38
44.250	2.38	2.38	2.38	2.38	2.38
44.500	2.38	2.38	2.38	2.38	2.38
44.750	2.38	2.38	2.38	2.38	2.38
45.000	2.38	2.38	2.38	2.37	2.37
45.250	2.37	2.37	2.37	2.37	2.37
45.500	2.37	2.37	2.37	2.37	2.37
45.750	2.37	2.37	2.37	2.37	2.37
46.000	2.37	2.37	2.37	2.37	2.37
46.250	2.37	2.37	2.37	2.37	2.37
46.500	2.37	2.37	2.37	2.37	2.37
46.750	2.37	2.37	2.37	2.37	2.37
47.000	2.37	2.37	2.37	2.37	2.37
47.250	2.37	2.37	2.37	2.37	2.37
47.500	2.37	2.37	2.37	2.37	2.37
47.750	2.37	2.37	2.37	2.37	2.37
48.000	2.37	2.37	2.36	2.36	2.36
48.250	2.36	2.36	2.36	2.36	2.36
48.500	2.36	2.36	2.36	2.36	2.36
48.750	2.36	2.36	2.36	2.36	2.36
49.000	2.36	2.36	2.36	2.36	2.36
49.250	2.36	2.36	2.36	2.36	2.36
49.500	2.36	2.36	2.36	2.36	2.36
49.750	2.36	2.36	2.36	2.36	2.36
50.000	2.36	2.36	2.36	2.36	2.36
50.250	2.36	2.36	2.36	2.36	2.36
50.500	2.36	2.36	2.36	2.36	2.36
50.750	2.36	2.36	2.36	2.36	2.36
51.000	2.35	2.35	2.35	2.35	2.35
51.250	2.35	2.35	2.35	2.35	2.35
51.500	2.35	2.35	2.35	2.35	2.35
51.750	2.35	2.35	2.35	2.35	2.35
52.000	2.35	2.35	2.35	2.35	2.35
52.250	2.35	2.35	2.35	2.35	2.35

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
52.500	2.35	2.35	2.35	2.35	2.35
52.750	2.35	2.35	2.35	2.35	2.35
53.000	2.35	2.35	2.35	2.35	2.35
53.250	2.35	2.35	2.35	2.35	2.35
53.500	2.35	2.35	2.35	2.35	2.35
53.750	2.35	2.35	2.35	2.35	2.34
54.000	2.34	2.34	2.34	2.34	2.34
54.250	2.34	2.34	2.34	2.34	2.34
54.500	2.34	2.34	2.34	2.34	2.34
54.750	2.34	2.34	2.34	2.34	2.34
55.000	2.34	2.34	2.34	2.34	2.34
55.250	2.34	2.34	2.34	2.34	2.34
55.500	2.34	2.34	2.34	2.34	2.34
55.750	2.34	2.34	2.34	2.34	2.34
56.000	2.34	2.34	2.34	2.34	2.34
56.250	2.34	2.34	2.34	2.34	2.34
56.500	2.34	2.34	2.34	2.34	2.34
56.750	2.34	2.34	2.34	2.34	2.33
57.000	2.33	2.33	2.33	2.33	2.33
57.250	2.33	2.33	2.33	2.33	2.33
57.500	2.33	2.33	2.33	2.33	2.33
57.750	2.33	2.33	2.33	2.33	2.33
58.000	2.33	2.33	2.33	2.33	2.33
58.250	2.33	2.33	2.33	2.33	2.33
58.500	2.33	2.33	2.33	2.33	2.33
58.750	2.33	2.33	2.33	2.33	2.33
59.000	2.33	2.33	2.33	2.33	2.33
59.250	2.33	2.33	2.33	2.33	2.33
59.500	2.33	2.33	2.33	2.33	2.33
59.750	2.33	2.33	2.33	2.33	2.32
60.000	2.32	2.32	2.32	2.32	2.32
60.250	2.32	2.32	2.32	2.32	2.32
60.500	2.32	2.32	2.32	2.32	2.32
60.750	2.32	2.32	2.32	2.32	2.32
61.000	2.32	2.32	2.32	2.32	2.32
61.250	2.32	2.32	2.32	2.32	2.32
61.500	2.32	2.32	2.32	2.32	2.32
61.750	2.32	2.32	2.32	2.32	2.32
62.000	2.32	2.32	2.32	2.32	2.32
62.250	2.32	2.32	2.32	2.32	2.32
62.500	2.32	2.32	2.32	2.32	2.32
62.750	2.32	2.32	2.32	2.32	2.32
63.000	2.31	2.31	2.31	2.31	2.31

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
63.250	2.31	2.31	2.31	2.31	2.31
63.500	2.31	2.31	2.31	2.31	2.31
63.750	2.31	2.31	2.31	2.31	2.31
64.000	2.31	2.31	2.31	2.31	2.31
64.250	2.31	2.31	2.31	2.31	2.31
64.500	2.31	2.31	2.31	2.31	2.31
64.750	2.31	2.31	2.31	2.31	2.31
65.000	2.31	2.31	2.31	2.31	2.31
65.250	2.31	2.31	2.31	2.31	2.31
65.500	2.31	2.31	2.31	2.31	2.31
65.750	2.31	2.31	2.31	2.31	2.31
66.000	2.31	2.30	2.30	2.30	2.30
66.250	2.30	2.30	2.30	2.30	2.30
66.500	2.30	2.30	2.30	2.30	2.30
66.750	2.30	2.30	2.30	2.30	2.30
67.000	2.30	2.30	2.30	2.30	2.30
67.250	2.30	2.30	2.30	2.30	2.30
67.500	2.30	2.30	2.30	2.30	2.30
67.750	2.30	2.30	2.30	2.30	2.30
68.000	2.30	2.30	2.30	2.30	2.30
68.250	2.30	2.30	2.30	2.30	2.30
68.500	2.30	2.30	2.30	2.30	2.30
68.750	2.30	2.30	2.30	2.30	2.30
69.000	2.30	2.30	2.30	2.29	2.29
69.250	2.29	2.29	2.29	2.29	2.29
69.500	2.29	2.29	2.29	2.29	2.29
69.750	2.29	2.29	2.29	2.29	2.29
70.000	2.29	2.29	2.29	2.29	2.29
70.250	2.29	2.29	2.29	2.29	2.29
70.500	2.29	2.29	2.29	2.29	2.29
70.750	2.29	2.29	2.29	2.29	2.29
71.000	2.29	2.29	2.29	2.29	2.29
71.250	2.29	2.29	2.29	2.29	2.29
71.500	2.29	2.29	2.29	2.29	2.29
71.750	2.29	2.29	2.29	2.29	2.29
72.000	2.29	2.29	2.29	2.29	2.29
72.250	2.29	2.28	2.28	2.28	2.28
72.500	2.28	2.28	2.28	2.28	2.28
72.750	2.28	2.28	2.28	2.28	2.28
73.000	2.28	2.28	2.28	2.28	2.28
73.250	2.28	2.28	2.28	2.28	2.28
73.500	2.28	2.28	2.28	2.28	2.28
73.750	2.28	2.28	2.28	2.28	2.28

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
74.000	2.28	2.28	2.28	2.28	2.28
74.250	2.28	2.28	2.28	2.28	2.28
74.500	2.28	2.28	2.28	2.28	2.28
74.750	2.28	2.28	2.28	2.28	2.28
75.000	2.28	2.28	2.28	2.28	2.28
75.250	2.28	2.28	2.28	2.28	2.27
75.500	2.27	2.27	2.27	2.27	2.27
75.750	2.27	2.27	2.27	2.27	2.27
76.000	2.27	2.27	2.27	2.27	2.27
76.250	2.27	2.27	2.27	2.27	2.27
76.500	2.27	2.27	2.27	2.27	2.27
76.750	2.27	2.27	2.27	2.27	2.27
77.000	2.27	2.27	2.27	2.27	2.27
77.250	2.27	2.27	2.27	2.27	2.27
77.500	2.27	2.27	2.27	2.27	2.27
77.750	2.27	2.27	2.27	2.27	2.27
78.000	2.27	2.27	2.27	2.27	2.27
78.250	2.27	2.27	2.27	2.27	2.27
78.500	2.27	2.27	2.27	2.26	2.26
78.750	2.26	2.26	2.26	2.26	2.26
79.000	2.26	2.26	2.26	2.26	2.26
79.250	2.26	2.26	2.26	2.26	2.26
79.500	2.26	2.26	2.26	2.26	2.26
79.750	2.26	2.26	2.26	2.26	2.26
80.000	2.26	2.26	2.26	2.26	2.26
80.250	2.26	2.26	2.26	2.26	2.26
80.500	2.26	2.26	2.26	2.26	2.26
80.750	2.26	2.26	2.26	2.26	2.26
81.000	2.26	2.26	2.26	2.26	2.26
81.250	2.26	2.26	2.26	2.26	2.26
81.500	2.26	2.26	2.26	2.26	2.26
81.750	2.26	2.26	2.26	2.25	2.25
82.000	2.25	2.25	2.25	2.25	2.25
82.250	2.25	2.25	2.25	2.25	2.25
82.500	2.25	2.25	2.25	2.25	2.25
82.750	2.25	2.25	2.25	2.25	2.25
83.000	2.25	2.25	2.25	2.25	2.25
83.250	2.25	2.25	2.25	2.25	2.25
83.500	2.25	2.25	2.25	2.25	2.25
83.750	2.25	2.25	2.25	2.25	2.25
84.000	2.25	2.25	2.25	2.25	2.25
84.250	2.25	2.25	2.25	2.25	2.25
84.500	2.25	2.25	2.25	2.25	2.25

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
84.750	2.25	2.25	2.25	2.25	2.25
85.000	2.25	2.25	2.25	2.24	2.24
85.250	2.24	2.24	2.24	2.24	2.24
85.500	2.24	2.24	2.24	2.24	2.24
85.750	2.24	2.24	2.24	2.24	2.24
86.000	2.24	2.24	2.24	2.24	2.24
86.250	2.24	2.24	2.24	2.24	2.24
86.500	2.24	2.24	2.24	2.24	2.24
86.750	2.24	2.24	2.24	2.24	2.24
87.000	2.24	2.24	2.24	2.24	2.24
87.250	2.24	2.24	2.24	2.24	2.24
87.500	2.24	2.24	2.24	2.24	2.24
87.750	2.24	2.24	2.24	2.24	2.24
88.000	2.24	2.24	2.24	2.24	2.24
88.250	2.24	2.24	2.24	2.24	2.23
88.500	2.23	2.23	2.23	2.23	2.23
88.750	2.23	2.23	2.23	2.23	2.23
89.000	2.23	2.23	2.23	2.23	2.23
89.250	2.23	2.23	2.23	2.23	2.23
89.500	2.23	2.23	2.23	2.23	2.23
89.750	2.23	2.23	2.23	2.23	2.23
90.000	2.23	2.23	2.23	2.23	2.23
90.250	2.23	2.23	2.23	2.23	2.23
90.500	2.23	2.23	2.23	2.23	2.23
90.750	2.23	2.23	2.23	2.23	2.23
91.000	2.23	2.23	2.23	2.23	2.23
91.250	2.23	2.23	2.23	2.23	2.23
91.500	2.23	2.23	2.23	2.23	2.23
91.750	2.22	2.22	2.22	2.22	2.22
92.000	2.22	2.22	2.22	2.22	2.22
92.250	2.22	2.22	2.22	2.22	2.22
92.500	2.22	2.22	2.22	2.22	2.22
92.750	2.22	2.22	2.22	2.22	2.22
93.000	2.22	2.22	2.22	2.22	2.22
93.250	2.22	2.22	2.22	2.22	2.22
93.500	2.22	2.22	2.22	2.22	2.22
93.750	2.22	2.22	2.22	2.22	2.22
94.000	2.22	2.22	2.22	2.22	2.22
94.250	2.22	2.22	2.22	2.22	2.22
94.500	2.22	2.22	2.22	2.22	2.22
94.750	2.22	2.22	2.22	2.22	2.22
95.000	2.22	2.22	2.21	2.21	2.21
95.250	2.21	2.21	2.21	2.21	2.21

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
95.500	2.21	2.21	2.21	2.21	2.21
95.750	2.21	2.21	2.21	2.21	2.21
96.000	2.21	(N/A)	(N/A)	(N/A)	(N/A)

	Bentley Systems, Inc.	Bentley
	Haestad Methods	PondPack
HWS.ppc	Solution Center	V8i

3 - 30" Pipes @ Main Street

Subsection: Time vs. Elevation

Label: PO-1 (OUT)

Time vs. Elevation (ft)

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	4.00	3.95	3.90	3.86	3.81
0.250	3.77	3.73	3.70	3.66	3.63
0.500	3.59	3.56	3.53	3.50	3.47
0.750	3.44	3.42	3.39	3.36	3.34
1.000	3.32	3.29	3.27	3.25	3.23
1.250	3.21	3.19	3.17	3.15	3.14
1.500	3.12	3.11	3.09	3.08	3.06
1.750	3.05	3.04	3.02	3.01	3.00
2.000	2.99	2.98	2.96	2.95	2.94
2.250	2.93	2.92	2.91	2.90	2.89
2.500	2.88	2.87	2.86	2.85	2.84
2.750	2.83	2.82	2.81	2.81	2.80
3.000	2.79	2.78	2.78	2.77	2.76
3.250	2.75	2.75	2.74	2.74	2.73
3.500	2.72	2.72	2.71	2.71	2.70
3.750	2.69	2.69	2.68	2.68	2.67
4.000	2.67	2.67	2.66	2.66	2.65
4.250	2.65	2.64	2.64	2.64	2.63
4.500	2.63	2.62	2.62	2.62	2.61
4.750	2.61	2.61	2.61	2.60	2.60
5.000	2.60	2.59	2.59	2.59	2.59
5.250	2.58	2.58	2.58	2.58	2.57
5.500	2.57	2.57	2.57	2.56	2.56
5.750	2.56	2.56	2.56	2.55	2.55
6.000	2.55	2.55	2.55	2.55	2.54
6.250	2.54	2.54	2.54	2.54	2.54
6.500	2.54	2.53	2.53	2.53	2.53
6.750	2.53	2.53	2.53	2.53	2.52
7.000	2.52	2.52	2.52	2.52	2.52
7.250	2.52	2.52	2.52	2.52	2.52
7.500	2.51	2.51	2.51	2.51	2.51
7.750	2.51	2.51	2.51	2.51	2.51
8.000	2.51	2.51	2.51	2.51	2.50
8.250	2.50	2.50	2.50	2.50	2.50
8.500	2.50	2.50	2.50	2.50	2.50
8.750	2.50	2.50	2.50	2.50	2.50
9.000	2.50	2.50	2.49	2.49	2.49
9.250	2.49	2.49	2.49	2.49	2.49

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
9.500	2.49	2.49	2.49	2.49	2.49
9.750	2.49	2.49	2.49	2.49	2.49
10.000	2.48	2.48	2.48	2.48	2.48
10.250	2.48	2.48	2.48	2.48	2.48
10.500	2.48	2.48	2.48	2.48	2.48
10.750	2.48	2.48	2.47	2.47	2.47
11.000	2.47	2.47	2.47	2.47	2.47
11.250	2.47	2.47	2.47	2.47	2.47
11.500	2.47	2.47	2.47	2.47	2.47
11.750	2.46	2.46	2.46	2.46	2.46
12.000	2.46	2.46	2.46	2.46	2.46
12.250	2.46	2.46	2.46	2.46	2.46
12.500	2.46	2.46	2.46	2.45	2.45
12.750	2.45	2.45	2.45	2.45	2.45
13.000	2.45	2.45	2.45	2.45	2.45
13.250	2.45	2.45	2.45	2.45	2.45
13.500	2.45	2.44	2.44	2.44	2.44
13.750	2.44	2.44	2.44	2.44	2.44
14.000	2.44	2.44	2.44	2.44	2.44
14.250	2.44	2.44	2.44	2.44	2.43
14.500	2.43	2.43	2.43	2.43	2.43
14.750	2.43	2.43	2.43	2.43	2.43
15.000	2.43	2.43	2.43	2.43	2.43
15.250	2.43	2.43	2.42	2.42	2.42
15.500	2.42	2.42	2.42	2.42	2.42
15.750	2.42	2.42	2.42	2.42	2.42
16.000	2.42	2.42	2.42	2.42	2.42
16.250	2.42	2.41	2.41	2.41	2.41
16.500	2.41	2.41	2.41	2.41	2.41
16.750	2.41	2.41	2.41	2.41	2.41
17.000	2.41	2.41	2.41	2.41	2.41
17.250	2.40	2.40	2.40	2.40	2.40
17.500	2.40	2.40	2.40	2.40	2.40
17.750	2.40	2.40	2.40	2.40	2.40
18.000	2.40	2.40	2.40	2.39	2.39
18.250	2.39	2.39	2.39	2.39	2.39
18.500	2.39	2.39	2.39	2.39	2.39
18.750	2.39	2.39	2.39	2.39	2.39
19.000	2.39	2.39	2.38	2.38	2.38
19.250	2.38	2.38	2.38	2.38	2.38
19.500	2.38	2.38	2.38	2.38	2.38
19.750	2.38	2.38	2.38	2.38	2.38
20.000	2.38	2.38	2.37	2.37	2.37

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
20.250	2.37	2.37	2.37	2.37	2.37
20.500	2.37	2.37	2.37	2.37	2.37
20.750	2.37	2.37	2.37	2.37	2.37
21.000	2.37	2.36	2.36	2.36	2.36
21.250	2.36	2.36	2.36	2.36	2.36
21.500	2.36	2.36	2.36	2.36	2.36
21.750	2.36	2.36	2.36	2.36	2.36
22.000	2.36	2.35	2.35	2.35	2.35
22.250	2.35	2.35	2.35	2.35	2.35
22.500	2.35	2.35	2.35	2.35	2.35
22.750	2.35	2.35	2.35	2.35	2.35
23.000	2.34	2.34	2.34	2.34	2.34
23.250	2.34	2.34	2.34	2.34	2.34
23.500	2.34	2.34	2.34	2.34	2.34
23.750	2.34	2.34	2.34	2.34	2.34
24.000	2.33	2.33	2.33	2.33	2.33
24.250	2.33	2.33	2.33	2.33	2.33
24.500	2.33	2.33	2.33	2.33	2.33
24.750	2.33	2.33	2.33	2.33	2.33
25.000	2.32	2.32	2.32	2.32	2.32
25.250	2.32	2.32	2.32	2.32	2.32
25.500	2.32	2.32	2.32	2.32	2.32
25.750	2.32	2.32	2.32	2.32	2.32
26.000	2.31	2.31	2.31	2.31	2.31
26.250	2.31	2.31	2.31	2.31	2.31
26.500	2.31	2.31	2.31	2.31	2.31
26.750	2.31	2.31	2.31	2.31	2.31
27.000	2.31	2.30	2.30	2.30	2.30
27.250	2.30	2.30	2.30	2.30	2.30
27.500	2.30	2.30	2.30	2.30	2.30
27.750	2.30	2.30	2.30	2.30	2.30
28.000	2.30	2.30	2.29	2.29	2.29
28.250	2.29	2.29	2.29	2.29	2.29
28.500	2.29	2.29	2.29	2.29	2.29
28.750	2.29	2.29	2.29	2.29	2.29
29.000	2.29	2.29	2.28	2.28	2.28
29.250	2.28	2.28	2.28	2.28	2.28
29.500	2.28	2.28	2.28	2.28	2.28
29.750	2.28	2.28	2.28	2.28	2.28
30.000	2.28	2.28	2.28	2.28	2.27
30.250	2.27	2.27	2.27	2.27	2.27
30.500	2.27	2.27	2.27	2.27	2.27
30.750	2.27	2.27	2.27	2.27	2.27

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
31.000	2.27	2.27	2.27	2.27	2.27
31.250	2.26	2.26	2.26	2.26	2.26
31.500	2.26	2.26	2.26	2.26	2.26
31.750	2.26	2.26	2.26	2.26	2.26
32.000	2.26	2.26	2.26	2.26	2.26
32.250	2.26	2.25	2.25	2.25	2.25
32.500	2.25	2.25	2.25	2.25	2.25
32.750	2.25	2.25	2.25	2.25	2.25
33.000	2.25	2.25	2.25	2.25	2.25
33.250	2.25	2.25	2.25	2.24	2.24
33.500	2.24	2.24	2.24	2.24	2.24
33.750	2.24	2.24	2.24	2.24	2.24
34.000	2.24	2.24	2.24	2.24	2.24
34.250	2.24	2.24	2.24	2.24	2.24
34.500	2.23	2.23	2.23	2.23	2.23
34.750	2.23	2.23	2.23	2.23	2.23
35.000	2.23	2.23	2.23	2.23	2.23
35.250	2.23	2.23	2.23	2.23	2.23
35.500	2.23	2.23	2.22	2.22	2.22
35.750	2.22	2.22	2.22	2.22	2.22
36.000	2.22	2.22	2.22	2.22	2.22
36.250	2.22	2.22	2.22	2.22	2.22
36.500	2.22	2.22	2.22	2.22	2.22
36.750	2.21	2.21	2.21	2.21	2.21
37.000	2.21	2.21	2.21	2.21	2.21
37.250	2.21	2.21	2.21	2.21	2.21
37.500	2.21	2.21	2.21	2.21	2.21
37.750	2.21	2.21	2.20	2.20	2.20
38.000	2.20	2.20	2.20	2.20	2.20
38.250	2.20	2.20	2.20	2.20	2.20
38.500	2.20	2.20	2.20	2.20	2.20
38.750	2.20	2.20	2.20	2.20	2.20
39.000	2.19	2.19	2.19	2.19	2.19
39.250	2.19	2.19	2.19	2.19	2.19
39.500	2.19	2.19	2.19	2.19	2.19
39.750	2.19	2.19	2.19	2.19	2.19
40.000	2.19	2.19	2.19	2.18	2.18
40.250	2.18	2.18	2.18	2.18	2.18
40.500	2.18	2.18	2.18	2.18	2.18
40.750	2.18	2.18	2.18	2.18	2.18
41.000	2.18	2.18	2.18	2.18	2.18
41.250	2.18	2.18	2.17	2.17	2.17
41.500	2.17	2.17	2.17	2.17	2.17

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
41.750	2.17	2.17	2.17	2.17	2.17
42.000	2.17	2.17	2.17	2.17	2.17
42.250	2.17	2.17	2.17	2.17	2.17
42.500	2.16	2.16	2.16	2.16	2.16
42.750	2.16	2.16	2.16	2.16	2.16
43.000	2.16	2.16	2.16	2.16	2.16
43.250	2.16	2.16	2.16	2.16	2.16
43.500	2.16	2.16	2.16	2.16	2.15
43.750	2.15	2.15	2.15	2.15	2.15
44.000	2.15	2.15	2.15	2.15	2.15
44.250	2.15	2.15	2.15	2.15	2.15
44.500	2.15	2.15	2.15	2.15	2.15
44.750	2.15	2.15	2.15	2.14	2.14
45.000	2.14	2.14	2.14	2.14	2.14
45.250	2.14	2.14	2.14	2.14	2.14
45.500	2.14	2.14	2.14	2.14	2.14
45.750	2.14	2.14	2.14	2.14	2.14
46.000	2.14	2.14	2.14	2.13	2.13
46.250	2.13	2.13	2.13	2.13	2.13
46.500	2.13	2.13	2.13	2.13	2.13
46.750	2.13	2.13	2.13	2.13	2.13
47.000	2.13	2.13	2.13	2.13	2.13
47.250	2.13	2.13	2.13	2.12	2.12
47.500	2.12	2.12	2.12	2.12	2.12
47.750	2.12	2.12	2.12	2.12	2.12
48.000	2.12	2.12	2.12	2.12	2.12
48.250	2.12	2.12	2.12	2.12	2.12
48.500	2.12	2.12	2.12	2.11	2.11
48.750	2.11	2.11	2.11	2.11	2.11
49.000	2.11	2.11	2.11	2.11	2.11
49.250	2.11	2.11	2.11	2.11	2.11
49.500	2.11	2.11	2.11	2.11	2.11
49.750	2.11	2.11	2.11	2.10	2.10
50.000	2.10	2.10	2.10	2.10	2.10
50.250	2.10	2.10	2.10	2.10	2.10
50.500	2.10	2.10	2.10	2.10	2.10
50.750	2.10	2.10	2.10	2.10	2.10
51.000	2.10	2.10	2.10	2.10	2.09
51.250	2.09	2.09	2.09	2.09	2.09
51.500	2.09	2.09	2.09	2.09	2.09
51.750	2.09	2.09	2.09	2.09	2.09
52.000	2.09	2.09	2.09	2.09	2.09
52.250	2.09	2.09	2.09	2.09	2.09

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
52.500	2.08	2.08	2.08	2.08	2.08
52.750	2.08	2.08	2.08	2.08	2.08
53.000	2.08	2.08	2.08	2.08	2.08
53.250	2.08	2.08	2.08	2.08	2.08
53.500	2.08	2.08	2.08	2.08	2.08
53.750	2.08	2.07	2.07	2.07	2.07
54.000	2.07	2.07	2.07	2.07	2.07
54.250	2.07	2.07	2.07	2.07	2.07
54.500	2.07	2.07	2.07	2.07	2.07
54.750	2.07	2.07	2.07	2.07	2.07
55.000	2.07	2.07	2.07	2.06	2.06
55.250	2.06	2.06	2.06	2.06	2.06
55.500	2.06	2.06	2.06	2.06	2.06
55.750	2.06	2.06	2.06	2.06	2.06
56.000	2.06	2.06	2.06	2.06	2.06
56.250	2.06	2.06	2.06	2.06	2.06
56.500	2.05	2.05	2.05	2.05	2.05
56.750	2.05	2.05	2.05	2.05	2.05
57.000	2.05	2.05	2.05	2.05	2.05
57.250	2.05	2.05	2.05	2.05	2.05
57.500	2.05	2.05	2.05	2.05	2.05
57.750	2.05	2.05	2.04	2.04	2.04
58.000	2.04	2.04	2.04	2.04	2.04
58.250	2.04	2.04	2.04	2.04	2.04
58.500	2.04	2.04	2.04	2.04	2.04
58.750	2.04	2.04	2.04	2.04	2.04
59.000	2.04	2.04	2.04	2.04	2.04
59.250	2.03	2.03	2.03	2.03	2.03
59.500	2.03	2.03	2.03	2.03	2.03
59.750	2.03	2.03	2.03	2.03	2.03
60.000	2.03	2.03	2.03	2.03	2.03
60.250	2.03	2.03	2.03	2.03	2.03
60.500	2.03	2.03	2.03	2.02	2.02
60.750	2.02	2.02	2.02	2.02	2.02
61.000	2.02	2.02	2.02	2.02	2.02
61.250	2.02	2.02	2.02	2.02	2.02
61.500	2.02	2.02	2.02	2.02	2.02
61.750	2.02	2.02	2.02	2.02	2.02
62.000	2.02	2.01	2.01	2.01	2.01
62.250	2.01	2.01	2.01	2.01	2.01
62.500	2.01	2.01	2.01	2.01	2.01
62.750	2.01	2.01	2.01	2.01	2.01
63.000	2.01	2.01	2.01	2.01	2.01

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
63.250	2.01	2.01	2.01	2.01	2.01
63.500	2.00	2.00	2.00	2.00	2.00
63.750	2.00	2.00	2.00	2.00	2.00
64.000	2.00	2.00	2.00	2.00	2.00
64.250	2.00	2.00	2.00	2.00	2.00
64.500	2.00	2.00	2.00	1.99	1.99
64.750	1.99	1.99	1.99	1.99	1.99
65.000	1.99	1.99	1.99	1.99	1.99
65.250	1.99	1.99	1.99	1.99	1.99
65.500	1.98	1.98	1.98	1.98	1.98
65.750	1.98	1.98	1.98	1.98	1.98
66.000	1.98	1.98	1.98	1.98	1.98
66.250	1.98	1.98	1.97	1.97	1.97
66.500	1.97	1.97	1.97	1.97	1.97
66.750	1.97	1.97	1.97	1.97	1.97
67.000	1.97	1.97	1.97	1.97	1.97
67.250	1.96	1.96	1.96	1.96	1.96
67.500	1.96	1.96	1.96	1.96	1.96
67.750	1.96	1.96	1.96	1.96	1.96
68.000	1.96	1.96	1.96	1.95	1.95
68.250	1.95	1.95	1.95	1.95	1.95
68.500	1.95	1.95	1.95	1.95	1.95
68.750	1.95	1.95	1.95	1.95	1.95
69.000	1.95	1.94	1.94	1.94	1.94
69.250	1.94	1.94	1.94	1.94	1.94
69.500	1.94	1.94	1.94	1.94	1.94
69.750	1.94	1.94	1.94	1.94	1.93
70.000	1.93	1.93	1.93	1.93	1.93
70.250	1.93	1.93	1.93	1.93	1.93
70.500	1.93	1.93	1.93	1.93	1.93
70.750	1.93	1.93	1.93	1.92	1.92
71.000	1.92	1.92	1.92	1.92	1.92
71.250	1.92	1.92	1.92	1.92	1.92
71.500	1.92	1.92	1.92	1.92	1.92
71.750	1.92	1.91	1.91	1.91	1.91
72.000	1.91	1.91	1.91	1.91	1.91
72.250	1.91	1.91	1.91	1.91	1.91
72.500	1.91	1.91	1.91	1.91	1.91
72.750	1.90	1.90	1.90	1.90	1.90
73.000	1.90	1.90	1.90	1.90	1.90
73.250	1.90	1.90	1.90	1.90	1.90
73.500	1.90	1.90	1.90	1.90	1.89
73.750	1.89	1.89	1.89	1.89	1.89

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
74.000	1.89	1.89	1.89	1.89	1.89
74.250	1.89	1.89	1.89	1.89	1.89
74.500	1.89	1.89	1.89	1.89	1.88
74.750	1.88	1.88	1.88	1.88	1.88
75.000	1.88	1.88	1.88	1.88	1.88
75.250	1.88	1.88	1.88	1.88	1.88
75.500	1.88	1.88	1.88	1.88	1.87
75.750	1.87	1.87	1.87	1.87	1.87
76.000	1.87	1.87	1.87	1.87	1.87
76.250	1.87	1.87	1.87	1.87	1.87
76.500	1.87	1.87	1.87	1.86	1.86
76.750	1.86	1.86	1.86	1.86	1.86
77.000	1.86	1.86	1.86	1.86	1.86
77.250	1.86	1.86	1.86	1.86	1.86
77.500	1.86	1.86	1.86	1.86	1.85
77.750	1.85	1.85	1.85	1.85	1.85
78.000	1.85	1.85	1.85	1.85	1.85
78.250	1.85	1.85	1.85	1.85	1.85
78.500	1.85	1.85	1.85	1.85	1.84
78.750	1.84	1.84	1.84	1.84	1.84
79.000	1.84	1.84	1.84	1.84	1.84
79.250	1.84	1.84	1.84	1.84	1.84
79.500	1.84	1.84	1.84	1.84	1.84
79.750	1.83	1.83	1.83	1.83	1.83
80.000	1.83	1.83	1.83	1.83	1.83
80.250	1.83	1.83	1.83	1.83	1.83
80.500	1.83	1.83	1.83	1.83	1.83
80.750	1.83	1.82	1.82	1.82	1.82
81.000	1.82	1.82	1.82	1.82	1.82
81.250	1.82	1.82	1.82	1.82	1.82
81.500	1.82	1.82	1.82	1.82	1.82
81.750	1.82	1.82	1.81	1.81	1.81
82.000	1.81	1.81	1.81	1.81	1.81
82.250	1.81	1.81	1.81	1.81	1.81
82.500	1.81	1.81	1.81	1.81	1.81
82.750	1.81	1.81	1.81	1.81	1.80
83.000	1.80	1.80	1.80	1.80	1.80
83.250	1.80	1.80	1.80	1.80	1.80
83.500	1.80	1.80	1.80	1.80	1.80
83.750	1.80	1.80	1.80	1.80	1.80
84.000	1.80	1.79	1.79	1.79	1.79
84.250	1.79	1.79	1.79	1.79	1.79
84.500	1.79	1.79	1.79	1.79	1.79

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
84.750	1.79	1.79	1.79	1.79	1.79
85.000	1.79	1.79	1.79	1.78	1.78
85.250	1.78	1.78	1.78	1.78	1.78
85.500	1.78	1.78	1.78	1.78	1.78
85.750	1.78	1.78	1.78	1.78	1.78
86.000	1.78	1.78	1.78	1.78	1.78
86.250	1.78	1.77	1.77	1.77	1.77
86.500	1.77	1.77	1.77	1.77	1.77
86.750	1.77	1.77	1.77	1.77	1.77
87.000	1.77	1.77	1.77	1.77	1.77
87.250	1.77	1.77	1.77	1.76	1.76
87.500	1.76	1.76	1.76	1.76	1.76
87.750	1.76	1.76	1.76	1.76	1.76
88.000	1.76	1.76	1.76	1.76	1.76
88.250	1.76	1.76	1.76	1.76	1.76
88.500	1.76	1.76	1.75	1.75	1.75
88.750	1.75	1.75	1.75	1.75	1.75
89.000	1.75	1.75	1.75	1.75	1.75
89.250	1.75	1.75	1.75	1.75	1.75
89.500	1.75	1.75	1.75	1.75	1.75
89.750	1.74	1.74	1.74	1.74	1.74
90.000	1.74	1.74	1.74	1.74	1.74
90.250	1.74	1.74	1.74	1.74	1.74
90.500	1.74	1.74	1.74	1.74	1.74
90.750	1.74	1.74	1.74	1.74	1.73
91.000	1.73	1.73	1.73	1.73	1.73
91.250	1.73	1.73	1.73	1.73	1.73
91.500	1.73	1.73	1.73	1.73	1.73
91.750	1.73	1.73	1.73	1.73	1.73
92.000	1.73	1.73	1.73	1.73	1.72
92.250	1.72	1.72	1.72	1.72	1.72
92.500	1.72	1.72	1.72	1.72	1.72
92.750	1.72	1.72	1.72	1.72	1.72
93.000	1.72	1.72	1.72	1.72	1.72
93.250	1.72	1.72	1.72	1.72	1.71
93.500	1.71	1.71	1.71	1.71	1.71
93.750	1.71	1.71	1.71	1.71	1.71
94.000	1.71	1.71	1.71	1.71	1.71
94.250	1.71	1.71	1.71	1.71	1.71
94.500	1.71	1.71	1.71	1.71	1.70
94.750	1.70	1.70	1.70	1.70	1.70
95.000	1.70	1.70	1.70	1.70	1.70
95.250	1.70	1.70	1.70	1.70	1.70

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
95.500	1.70	1.70	1.70	1.70	1.70
95.750	1.70	1.70	1.70	1.70	1.69
96.000	1.69	(N/A)	(N/A)	(N/A)	(N/A)

Bentley Systems, Inc.
Haestad Methods
Solution Center

Bentley
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V8i

HWS Pipe I

Twin 5x3 Box Culvert
Subsection: Time vs. Elevation
Label: PO-1 (OUT)
Time vs. Elevation (ft)

Output Time increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
0.000	4.00	3.95	3.90	3.85	3.81
0.250	3.77	3.73	3.69	3.65	3.62
0.500	3.58	3.55	3.52	3.49	3.46
0.750	3.43	3.40	3.37	3.35	3.32
1.000	3.30	3.27	3.25	3.23	3.21
1.250	3.19	3.17	3.15	3.13	3.12
1.500	3.10	3.08	3.07	3.05	3.04
1.750	3.03	3.01	3.00	2.99	2.97
2.000	2.96	2.95	2.93	2.92	2.91
2.250	2.90	2.89	2.88	2.87	2.86
2.500	2.84	2.83	2.83	2.82	2.81
2.750	2.80	2.79	2.78	2.77	2.76
3.000	2.76	2.75	2.74	2.73	2.73
3.250	2.72	2.71	2.70	2.70	2.69
3.500	2.69	2.68	2.67	2.67	2.66
3.750	2.66	2.65	2.65	2.64	2.64
4.000	2.63	2.63	2.62	2.62	2.61
4.250	2.61	2.61	2.60	2.60	2.59
4.500	2.59	2.59	2.58	2.58	2.58
4.750	2.57	2.57	2.57	2.56	2.56
5.000	2.56	2.55	2.55	2.55	2.55
5.250	2.54	2.54	2.54	2.54	2.53
5.500	2.53	2.53	2.53	2.53	2.52
5.750	2.52	2.52	2.52	2.52	2.51
6.000	2.51	2.51	2.51	2.51	2.51
6.250	2.50	2.50	2.50	2.50	2.50
6.500	2.50	2.49	2.49	2.49	2.49
6.750	2.49	2.49	2.48	2.48	2.48
7.000	2.48	2.48	2.47	2.47	2.47
7.250	2.47	2.47	2.47	2.46	2.46
7.500	2.46	2.46	2.46	2.46	2.45
7.750	2.45	2.45	2.45	2.45	2.45
8.000	2.44	2.44	2.44	2.44	2.44
8.250	2.44	2.43	2.43	2.43	2.43
8.500	2.43	2.43	2.42	2.42	2.42
8.750	2.42	2.42	2.41	2.41	2.41
9.000	2.41	2.41	2.41	2.40	2.40
9.250	2.40	2.40	2.40	2.40	2.39

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
9.500	2.39	2.39	2.39	2.39	2.39
9.750	2.39	2.38	2.38	2.38	2.38
10.000	2.38	2.38	2.37	2.37	2.37
10.250	2.37	2.37	2.37	2.36	2.36
10.500	2.36	2.36	2.36	2.36	2.35
10.750	2.35	2.35	2.35	2.35	2.35
11.000	2.34	2.34	2.34	2.34	2.34
11.250	2.34	2.33	2.33	2.33	2.33
11.500	2.33	2.33	2.33	2.32	2.32
11.750	2.32	2.32	2.32	2.32	2.31
12.000	2.31	2.31	2.31	2.31	2.31
12.250	2.30	2.30	2.30	2.30	2.30
12.500	2.30	2.30	2.29	2.29	2.29
12.750	2.29	2.29	2.29	2.28	2.28
13.000	2.28	2.28	2.28	2.28	2.28
13.250	2.27	2.27	2.27	2.27	2.27
13.500	2.27	2.26	2.26	2.26	2.26
13.750	2.26	2.26	2.26	2.25	2.25
14.000	2.25	2.25	2.25	2.25	2.25
14.250	2.24	2.24	2.24	2.24	2.24
14.500	2.24	2.23	2.23	2.23	2.23
14.750	2.23	2.23	2.23	2.22	2.22
15.000	2.22	2.22	2.22	2.22	2.22
15.250	2.21	2.21	2.21	2.21	2.21
15.500	2.21	2.21	2.20	2.20	2.20
15.750	2.20	2.20	2.20	2.20	2.19
16.000	2.19	2.19	2.19	2.19	2.19
16.250	2.19	2.18	2.18	2.18	2.18
16.500	2.18	2.18	2.18	2.17	2.17
16.750	2.17	2.17	2.17	2.17	2.17
17.000	2.16	2.16	2.16	2.16	2.16
17.250	2.16	2.16	2.15	2.15	2.15
17.500	2.15	2.15	2.15	2.15	2.14
17.750	2.14	2.14	2.14	2.14	2.14
18.000	2.14	2.13	2.13	2.13	2.13
18.250	2.13	2.13	2.13	2.12	2.12
18.500	2.12	2.12	2.12	2.12	2.12
18.750	2.12	2.11	2.11	2.11	2.11
19.000	2.11	2.11	2.11	2.10	2.10
19.250	2.10	2.10	2.10	2.10	2.10
19.500	2.10	2.09	2.09	2.09	2.09
19.750	2.09	2.09	2.09	2.08	2.08
20.000	2.08	2.08	2.08	2.08	2.08

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
20.250	2.08	2.07	2.07	2.07	2.07
20.500	2.07	2.07	2.07	2.06	2.06
20.750	2.06	2.06	2.06	2.06	2.06
21.000	2.06	2.05	2.05	2.05	2.05
21.250	2.05	2.05	2.05	2.05	2.04
21.500	2.04	2.04	2.04	2.04	2.04
21.750	2.04	2.03	2.03	2.03	2.03
22.000	2.03	2.03	2.03	2.03	2.02
22.250	2.02	2.02	2.02	2.02	2.02
22.500	2.02	2.02	2.01	2.01	2.01
22.750	2.01	2.01	2.01	2.01	2.01
23.000	2.00	2.00	2.00	2.00	2.00
23.250	2.00	2.00	1.99	1.99	1.99
23.500	1.99	1.98	1.98	1.98	1.98
23.750	1.98	1.97	1.97	1.97	1.97
24.000	1.97	1.96	1.96	1.96	1.96
24.250	1.96	1.95	1.95	1.95	1.95
24.500	1.95	1.94	1.94	1.94	1.94
24.750	1.94	1.93	1.93	1.93	1.93
25.000	1.93	1.92	1.92	1.92	1.92
25.250	1.92	1.91	1.91	1.91	1.91
25.500	1.91	1.90	1.90	1.90	1.90
25.750	1.90	1.89	1.89	1.89	1.89
26.000	1.89	1.88	1.88	1.88	1.88
26.250	1.88	1.87	1.87	1.87	1.87
26.500	1.87	1.86	1.86	1.86	1.86
26.750	1.86	1.85	1.85	1.85	1.85
27.000	1.85	1.85	1.84	1.84	1.84
27.250	1.84	1.84	1.83	1.83	1.83
27.500	1.83	1.83	1.82	1.82	1.82
27.750	1.82	1.82	1.82	1.81	1.81
28.000	1.81	1.81	1.81	1.80	1.80
28.250	1.80	1.80	1.80	1.80	1.79
28.500	1.79	1.79	1.79	1.79	1.78
28.750	1.78	1.78	1.78	1.78	1.78
29.000	1.77	1.77	1.77	1.77	1.77
29.250	1.77	1.76	1.76	1.76	1.76
29.500	1.76	1.75	1.75	1.75	1.75
29.750	1.75	1.75	1.74	1.74	1.74
30.000	1.74	1.74	1.74	1.73	1.73
30.250	1.73	1.73	1.73	1.73	1.72
30.500	1.72	1.72	1.72	1.72	1.72
30.750	1.71	1.71	1.71	1.71	1.71

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
31.000	1.71	1.70	1.70	1.70	1.70
31.250	1.70	1.70	1.69	1.69	1.69
31.500	1.69	1.69	1.69	1.68	1.68
31.750	1.68	1.68	1.68	1.68	1.67
32.000	1.67	1.67	1.67	1.67	1.67
32.250	1.66	1.66	1.66	1.66	1.66
32.500	1.66	1.66	1.65	1.65	1.65
32.750	1.65	1.65	1.65	1.64	1.64
33.000	1.64	1.64	1.64	1.64	1.63
33.250	1.63	1.63	1.63	1.63	1.63
33.500	1.63	1.62	1.62	1.62	1.62
33.750	1.62	1.62	1.62	1.61	1.61
34.000	1.61	1.61	1.61	1.61	1.60
34.250	1.60	1.60	1.60	1.60	1.60
34.500	1.60	1.59	1.59	1.59	1.59
34.750	1.59	1.59	1.59	1.58	1.58
35.000	1.58	1.58	1.58	1.58	1.57
35.250	1.57	1.57	1.57	1.57	1.57
35.500	1.57	1.56	1.56	1.56	1.56
35.750	1.56	1.56	1.56	1.55	1.55
36.000	1.55	1.55	1.55	1.55	1.55
36.250	1.54	1.54	1.54	1.54	1.54
36.500	1.54	1.54	1.53	1.53	1.53
36.750	1.53	1.53	1.53	1.53	1.53
37.000	1.52	1.52	1.52	1.52	1.52
37.250	1.52	1.52	1.51	1.51	1.51
37.500	1.51	1.51	1.51	1.51	1.50
37.750	1.50	1.50	1.50	1.50	1.49
38.000	1.49	1.48	1.48	1.47	1.47
38.250	1.46	1.46	1.45	1.45	1.44
38.500	1.44	1.44	1.43	1.43	1.42
38.750	1.42	1.41	1.41	1.40	1.40
39.000	1.39	1.39	1.39	1.38	1.38
39.250	1.37	1.37	1.36	1.36	1.35
39.500	1.35	1.35	1.34	1.34	1.33
39.750	1.33	1.33	1.32	1.32	1.31
40.000	1.31	1.31	1.30	1.30	1.29
40.250	1.29	1.29	1.28	1.28	1.27
40.500	1.27	1.27	1.26	1.26	1.25
40.750	1.25	1.25	1.24	1.24	1.24
41.000	1.23	1.23	1.22	1.22	1.22
41.250	1.21	1.21	1.21	1.20	1.20
41.500	1.20	1.19	1.19	1.19	1.18

Output Time increment = 0.050 hours

Time on left represents time for first value in each row.

Time (hours)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)	Elevation (ft)
41.750	1.18	1.17	1.17	1.17	1.16
42.000	1.16	1.16	1.15	1.15	1.15
42.250	1.14	1.14	1.14	1.13	1.13
42.500	1.13	1.13	1.12	1.12	1.12
42.750	1.11	1.11	1.11	1.10	1.10
43.000	1.10	1.09	1.09	1.09	1.08
43.250	1.08	1.08	1.08	1.07	1.07
43.500	1.07	1.06	1.06	1.06	1.06
43.750	1.05	1.05	1.05	1.04	1.04
44.000	1.04	1.04	1.03	1.03	1.03
44.250	1.03	1.02	1.02	1.02	1.01
44.500	1.01	1.01	1.01	1.00	1.00
44.750	0.99	0.97	0.96	0.94	0.93
45.000	0.91	0.90	0.89	0.87	0.86
45.250	0.84	0.83	0.82	0.81	0.79
45.500	0.78	0.77	0.76	0.75	0.74
45.750	0.73	0.72	0.71	0.70	0.69
46.000	0.68	0.67	0.66	0.65	0.64
46.250	0.64	0.63	0.62	0.61	0.60
46.500	0.59	0.58	0.56	0.55	0.53
46.750	0.52	0.51	0.48	0.44	0.40
47.000	0.37	0.34	0.31	0.28	0.26
47.250	0.24	0.22	0.20	0.18	0.16
47.500	0.15	0.14	0.13	0.11	0.10
47.750	0.10	0.09	0.08	0.07	0.07
48.000	0.06	0.06	0.05	0.05	0.04
48.250	0.04	0.04	0.03	0.03	0.03
48.500	0.03	0.02	0.02	0.02	0.02
48.750	0.02	0.01	0.01	0.01	0.01
49.000	0.01	0.01	0.01	0.01	0.01
49.250	0.01	0.01	0.01	0.00	0.00

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