# TOWN COUNCIL
## Work Session
## Town Hall
## December 3, 2013
## 6:00 p.m.

1. Call to Order: Roll Call

2. Order of Business

    A. Capital Improvement Projects

3. Motion to Adjourn

| TOWN OF CAPE CHARLES | **AGENDA TITLE:** Capital Improvement Projects Review | | **AGENDA DATE:** December 3, 2013 |
|---|---|---|---|
| | **SUBJECT/PROPOSAL/REQUEST**: Discussion of Capital Project and financing options | | **ITEM NUMBER:** 2A |
| | **ATTACHMENTS:** Potential Capital Projects | | **FOR COUNCIL:** Action ( ) Information (X) |
| | **STAFF CONTACT (s):** Heather Arcos | **REVIEWED BY:** Heather Arcos, Town Manager | |

**BACKGROUND:**

On November 14, 2013, the Town Council approved by resolution the refinancing of two of the water and wastewater loans at a fixed rate of 2.65% for the first 10 years of a 20 year term. The refinancing would achieve a net savings while decreasing the overall term of the loan.

The second option for consideration by the Town Council is to layer up to $1M of potential new money around the refinancing which would allow the Town to complete much-needed infrastructure projects in the Water and Wastewater, Harbor and General Funds. Financing the capital projects would have a significant impact to minimize the user rates.

A public hearing must be held before the Town can move forward with the financing options and has been advertised for Thursday, December 5, 2013, at 6:00 PM.

**DISCUSSION:**

The purpose of our work session tonight is for the Council to review and discuss the capital needs and prioritize the projects for consideration in preparation for the Public Hearing and Special Meeting.

The Phase 2 Trail match may be rolled into the financing and would not be included in the FY 15 budget.

The Breakwater and A Dock projects are viable projects with the Virginia Port Authority funding to assist the Town. The Harbor Fund is not able to incur additional debt service at this time. The debt service may be included in the General Fund. The debt service for the existing breakwaters is included in the Harbor Fund.

The goal is to provide the scope of the capital projects for consideration and for Council to make a decision whether to move forward after hearing any comments at the Public Hearing.

Attached for Council review are the following:

1. Debt Service Summary Report
2. Davenport & Company – Summaries of Refinancing & New Money Results
3. Public Utilities Rate Review – Financial Impact Comparison
4. Potential Financing of Capital Projects
5. Cape Charles Pump Stations Evaluation – July 2008
6. KECK Wells – Preliminary Engineering Report – May 2012

**RECOMMENDATION:**

Information only in preparation for the December 5, 2013 Public Hearing and Special Meeting.

## Town of Cape Charles

### Remaining Debt as of 11/26/2013

| # | ---FINANCING SOURCE--- | TOTAL |
|---|---|---|
| | | |
| (1) | **1992 FHA General Obligation Water Bond (Refinancing Soon)** | |
| | Water System Bond $1,579,300 - Monthly $7,755 @ 5% - 9/3/1992 to 8/3/2032 | |
| | Public Utilities Fund - Water | **1,744,875.00** |
| | | |
| (2) | **2003 FHA General Obligation Sewer Bond (Refinancing Soon)** | |
| | Sewer Bond $62,500 - Monthly $237 @ 3.25% - 12/28/2003 to 11/28/2043 | |
| | Public Utilities Fund - Wastewater | **85,557.00** |
| | | |
| (3) | **2006B VML/VaCo General Obligation Public Improvement Bond** | |
| | Public Improvement Bond $1,795,000 - 7/1/2006 to 8/1/2026 | |
| | General Fund | **1,080,821.10** |
| | Public Utilities Fund - Wastewater | **218,917.48** |
| | Harbor Fund | **379,076.43** |
| | | |
| (4) | **2010C VRA General Obligation & Revenue Bond** | |
| | Virginia Resources Authority $5,151,627 @ 0.00% - 11/1/2012 to 5/1/2032 | |
| | Public Utilities Fund - Wastewater | **4,765,255.16** |
| | | |
| (5) | **2010D VML/Vaco General Obligation Bond** | |
| | VML/VaCo $2,120,000 - 3/2/2010 to 2/15/2030 | |
| | General Fund | **533,174.13** |
| | Public Utilities Fund - Water | **128,640.04** |
| | Public Utilities Fund - Wastewater | **1,031,060.98** |
| | Harbor Fund | **1,186,625.32** |
| | | |
| (6) | **2010F VML/Vaco General Obligation Bond** | |
| | VML/VACo $500,000 - 8/15/2010 to 2/15/2017 | |
| | Harbor Fund | **298,510.00** |
| | | |
| | **TOTAL DEBT SERVICE - BEFORE REFINANCING** | **11,452,512.62** |
| | | |
| (7) | **2013 PNC Bank Refinancing** | |
| | PNC Bank $1,198,450 @ 2.65% 1st 10 Years - 2014 to 2032 | |
| | Known Savings to Public Utilities Fund (Rate may change 2025-2032) | **(249,386.00)** |
| | | |
| | **TOTAL DEBT SERVICE - AFTER REFINANCING** | **11,203,126.62** |

| **BREAKDOWN BY FUND:** | |
|---|---|
| **General Fund** | **1,613,995.23** |
| **Public Utilities Fund** | **7,724,919.65** |
| **Harbor Fund** | **1,864,211.74** |
| | **11,203,126.62** |

# Summary of Refinancing Results via PNC Proposal - Enterprise Fund Cash-flow Impact



- The **savings** provided by the PNC 2.65% 10-year fixed interest rate proposal is shown below in Column F.
- The New Refunding Enterprise Fund Debt Service (Column D) has been structured to free-up cash flow savings through FY 2017.
- The Town achieves **Known Savings of approximately $231,000** from FY 2018-2024, when the rate is fixed, and from 2033-2044, where the RD loan debt service has been taken out.

| *A* | *B* | *C* | *D* | *E* | *F* |
|---|---|---|---|---|---|
| FY | Total Existing EF Debt Service | Refinanced Enterprise Fund Debt Service | New Refunding Enterprise Fund Debt Service | Total EF Debt Service Post-Refi | EF Savings Before New Money *(B-C)* |
| 2014 | $588,815 | $48,187 | $14,064 | $554,691 | $34,124 |
| 2015 | 579,621 | 95,901 | 49,890 | 533,609 | 46,011 |
| 2016 | 587,673 | 96,048 | 42,471 | 534,096 | 53,577 |
| 2017 | 583,970 | 95,901 | 46,227 | 534,296 | 49,674 |
| 2018 | 580,284 | 95,901 | 93,559 | 577,942 | 2,342 |
| 2019 | 566,661 | 95,901 | 93,559 | 564,319 | 2,342 |
| 2020 | 566,831 | 96,022 | 93,680 | 564,489 | 2,342 |
| 2021 | 568,293 | 95,901 | 93,558 | 565,950 | 2,343 |
| 2022 | 569,121 | 95,901 | 93,559 | 566,779 | 2,342 |
| 2023 | 569,778 | 95,901 | 93,559 | 567,436 | 2,342 |
| 2024 | 565,692 | 95,991 | 93,642 | 563,343 | 2,349 |
| 2025 | 565,853 | 95,901 | 93,405 | 563,358 | 2,496 |
| 2026 | 565,794 | 95,901 | 93,406 | 563,300 | 2,495 |
| 2027 | 569,608 | 95,901 | 93,405 | 567,112 | 2,496 |
| 2028 | 526,793 | 95,954 | 93,458 | 524,297 | 2,496 |
| 2029 | 525,695 | 95,901 | 93,405 | 523,200 | 2,496 |
| 2030 | 524,476 | 95,901 | 93,405 | 521,980 | 2,496 |
| 2031 | 353,482 | 95,901 | 93,406 | 350,987 | 2,495 |
| 2032 | 353,489 | 95,908 | 93,413 | 350,994 | 2,495 |
| 2033 | 2,843 | 2,843 | - | - | 2,843 |
| 2033 - 2045 | 31,516 | 31,516 | - | - | 31,516 |
| **Total** | **$10,374,964** | | | **$10,092,178** | **$251,270** |

*Note: Debt service after FY 2024 assumes rate remains 2.65%; All figures preliminary and include estimated costs of issuance of $37,500. See Appendix A for full cash-flow detail.*

| | |
|---|---|
| **Known Savings:** | **231,305.21** |

# Summary of New Money Results via PNC Proposal – Enterprise Fund Cash-Flow Impact



- The Total Enterprise Fund Debt Service resulting from the Refinancing appears in Column C, and the Total Enterprise Fund Debt Service after the Potential New Money is shown in Column E.
- **The total resulting Cash-Flow Impact to the Town of both the Refinancing and the New Money versus the existing 2014 level is shown in Column F.**

| *A* | *B* | *C* | *D* | *E* | *F* |
|---|---|---|---|---|---|
| FY | Total Existing EF Debt Service | Total EF Debt Service Post-Refi | Enterpise Fund New Money Debt Service | Total EF Debt Service: Refi. + New Money | Total New EF Debt Service Impact vs. FY 14 |
| 2014 | $588,815 | $554,691 | $4,114 | $558,805 | $30,010 |
| 2015 | 579,621 | 533,609 | 36,061 | 569,670 | 19,145 |
| 2016 | 587,673 | 534,096 | 47,584 | 581,679 | 7,135 |
| 2017 | 583,970 | 534,296 | 46,789 | 581,085 | 7,730 |
| 2018 | 580,284 | 577,942 | 25,994 | 603,936 | (15,121) |
| 2019 | 566,661 | 564,319 | 37,263 | 601,582 | (12,767) |
| 2020 | 566,831 | 564,489 | 37,528 | 602,017 | (13,202) |
| 2021 | 568,293 | 565,950 | 37,792 | 603,742 | (14,927) |
| 2022 | 569,121 | 566,779 | 38,058 | 604,837 | (16,022) |
| 2023 | 569,778 | 567,436 | 38,323 | 605,759 | (16,944) |
| 2024 | 565,692 | 563,343 | 41,587 | 604,930 | (16,116) |
| 2025 | 565,853 | 563,358 | 41,773 | 605,131 | (16,316) |
| 2026 | 565,794 | 563,300 | 41,958 | 605,258 | (16,443) |
| 2027 | 569,608 | 567,112 | 40,271 | 607,383 | (18,568) |
| 2028 | 526,793 | 524,297 | 76,900 | 601,197 | (12,383) |
| 2029 | 525,695 | 523,200 | 76,503 | 599,703 | (10,888) |
| 2030 | 524,476 | 521,980 | 76,106 | 598,086 | (9,271) |
| 2031 | 353,482 | 350,987 | 40,314 | 391,300 | 197,514 |
| 2032 | 353,489 | 350,994 | 40,314 | 391,308 | 197,507 |
| 2033 | 2,843 | - | 40,314 | 40,314 | 548,501 |
| 2033 - 2045 | 31,516 | - | | 80,627 | 508,188 |
| **Total** | **$10,374,964** | **$10,092,178** | | **$11,078,665** | |

| | |
|---|---|
| **FY 2014-2017 Cash-flow:** | **$64,019** |

*Note: Debt service after FY 2024 assumes rate remains 2.65%; All figures preliminary and include estimated costs of issuance of $37,500. See Appendix A for full cash-flow detail.*

# Summary of New Money Results via PNC Proposal – General Fund Cash-Flow Impact



- The debt service for the approximately $300,000 in New Money Needs appears in Column C.
- **The Cash-Flow Impact to the Town's General Fund of the New Money versus the existing 2014 General Fund debt service level is shown in Column E.**

| *A* | *B* | *C* | *D* | *E* |
|---|---|---|---|---|
| FY | Total Existing GF Debt Service | General Fund New Money Debt Service | Total Resulting General Fund Debt Service | Total New GF Debt Service Impact vs. FY 14 |
| 2014 | $108,364 | $2,026 | $110,390 | ($2,026) |
| 2015 | 109,154 | 8,896 | 118,050 | (9,686) |
| 2016 | 100,115 | 13,896 | 114,011 | (5,647) |
| 2017 | 106,052 | 8,763 | 114,815 | (6,451) |
| 2018 | 111,232 | 8,763 | 119,996 | (11,632) |
| 2019 | 92,196 | 23,763 | 115,960 | (7,596) |
| 2020 | 89,999 | 23,366 | 113,365 | (5,001) |
| 2021 | 90,800 | 22,968 | 113,768 | (5,405) |
| 2022 | 91,395 | 22,571 | 113,966 | (5,602) |
| 2023 | 91,938 | 22,173 | 114,111 | (5,747) |
| 2024 | 91,874 | 21,776 | 113,650 | (5,286) |
| 2025 | 91,943 | 21,378 | 113,321 | (4,957) |
| 2026 | 91,708 | 22,981 | 114,689 | (6,325) |
| 2027 | 91,672 | 22,530 | 114,202 | (5,838) |
| 2028 | 15,704 | 30,363 | 46,067 | 62,297 |
| 2029 | 15,609 | 30,362 | 45,971 | 62,393 |
| 2030 | 15,508 | 30,362 | 45,870 | 62,494 |
| 2031 | - | 30,362 | 30,362 | 78,002 |
| 2032 | - | 30,362 | 30,362 | 78,001 |
| 2033 | - | 30,362 | 30,362 | 78,001 |
| 2034 | - | 30,362 | 30,362 | 78,002 |
| **Total** | **$1,405,263** | **$458,384** | **$1,863,647** | |

*Note: Debt service after FY 2024 assumes rate remains 2.65%; All figures preliminary and include estimated costs of issuance of $37,500. See Appendix A for full cash-flow detail.*

## Town of Cape Charles

**Public Utilities Rate Review**

**Possible Rate Increase by Adding Capital Projects in Increments of $200,000**

**Based on Figures as of FY14 Budget**

| **WATER RATE** | | |
|---|---|---|
| **FY2014 Water Rate** | **$** | **34.50** |
| Add Capital Projects $200,000 Increments | $ | 200,000 |
| Divide by # of Accounts Billed | | 1,081 |
| | | 185 |
| Divide by # of Months | | 12 |
| **Cost to Add Increments of $200,000 Capital to Water Rate** | **$** | **15.42** |

| **WASTEWATER RATE** | | |
|---|---|---|
| **FY2014 Wastewater Rate** | **$** | **60.85** |
| Add Capital Projects $200,000 Increments | $ | 200,000 |
| Divide by # of Accounts Billed | | 1,075 |
| | | 186 |
| Divide by # of Months | | 12 |
| **Cost to Add Increments of $200,000 Capital to Wastewater Rate** | **$** | **15.50** |

* Depending on year of Capital Project, we will see a savings in Water & Wastewater Departments from refinancing 1992 & 2003 FHA General Obligation Bonds. In FY2015, we will see an approximate savings of $46,011, FY2016 $53,577, FY2017 $49,674 and FY2018 - FY2024 $2,342 to $2,349.
If the number of users does not change, this savings would impact the rate by ($2.83) to ($4.15) range in the first few years and approximately ($0.18) in years 2018 to 2024.

November 26, 2013

Town of Cape Charles
FY 2014-FY2017 Budget
Potential Financing of Capital Projects

A. Water & Wastewater Fund

1. Connection of 2 Keck Wells - $300,000

Establish the connection of the existing wells to the Water Plant. The connection of these wells will increase our production capacity from 360,000 to 500,000 GPD, the design limit for the plant.

Status: PER, May 2012 completed by GHD.
PER review by DEQ is completed.
Awaiting approval of Aquifer Test Report by DEQ.
FY14 – Budget includes $60K Engineering and Design.

Benefits: Quality of the water; improves raw water at plant.
Improvement of quality of water may decrease the TTHMs.
Water System capacity will need to increase to meet the demand.

GHD – May, 2012 – Preliminary Engineering Report (PER)

2. Comminutor (Grinder) – Mason Ave. Pump Station - $30,000

As a part of the Mason Ave. Pump Station upgrades, the Comminutor (Grinder) was removed due to budget restraints, with the intent to replace at a later time. The Comminutor grinds rags, handy-wipes and other debris before it enters into the wet well.

We currently rely on a bar screen that catches 60-80% of these items. The bar screen is cleaned daily. The grinder will eliminate close to 100% of the debris and rarely requires maintenance. Without the grinder, our sewage pumps suck the rags and other debris into the volute where they remain, decreasing the efficiency of the pump or in some cases clogging or stopping the pump completely. This situation is repaired by lifting the pump out of the pit, breaking the pump down to expose the volute and removing the clog. We try to perform this task every other month.

3. Inflow and Infiltration Improvements (I&I) – $560,000

This project consists of two parts:

a. Improvements to Plum and Pine Pump Stations - $460,000

Constructed in 1985, with the same design and at this time are 28 years old. Repairs have been made to the two pumps over the years and both of the emergency generators have been replaced over the past couple of years.

The improvements to be made are the construction of a new precast reinforced concrete wet well and valve vault outside of the existing pumping station building, Two (2) pumps, and upgrade the electric control panel.

SW – July, 2008 - Pump Station Evaluation; followed by a draft PER in October, 2009.

b. Sewage Collection System Manholes – $100,000

Repair 100 manholes at a $1,000 per manhole.

Benefit: This continues our effort to reduce I&I.
This will also lessen the amount of water that is treated at the Wastewater Treatment Plant. O&M expenses may decrease due to less flow to treat.

B. Harbor Fund

1. Offshore Breakwater - $369,000

This project would construct the third segment out of five offshore breakwaters at the entrance of the Harbor. This breakwater is required to afford better protection from wave action caused by prevailing westerly winds. The construction of the remaining breakwaters will protect the stakeholders in the harbor and continue to promote economic development in our Port.

The engineering and design of the breakwaters are completed; the permit expires in April of 2015.

A $500,000 grant was awarded in July of 2012 from the Virginia Port Authority under the Aid to Local Ports (ALP) program.

Debt Service for the 2 segments of the breakwater completed is included in the Harbor Fund. The annual debt service is $110,000 for FY14 budget.

2. Existing A Dock Attenuator - $165,000

Replace and Relocated existing A dock to enhance to protection of the floating slips and the inner basin stakeholders. The wave action substantially decreases at the time when all five (5) breakwaters are constructed at the entrance of the harbor.

A $75,000 grant was awarded in July 2013 from the Virginia Port Authority under the Aid to Local Ports Program. An alternative may be to utilize all resources for the completion of a new breakwater segment.

C. General Fund

1. Cape Charles Multi-use Trail Phase 2 - $300,000

Total Phase 2 estimate is $1,500,000. The Federal share (80%) under the Transportation Alternatives Program (TAP) would be $1,200,000, leaving a Town match requirement of $300,000. The match is spread over two fiscal years; FY 14 budget includes $150,000 and FY 15 budget will include $150,000.

The Master Trail Plan was created to provide an improved means of non-motorized transit for residents and visitors. It will link the major sectors of Town through a safe and attractive hard surface trail, including areas without existing sidewalks (e.g. along Washington Avenue).

## 5. INDIVIDUAL PUMP STATION INSPECTION RESULTS

A summary of the observations and field tests performed at each pumping station is presented in this section.

The same pump draw down test procedure was conducted for each pumping station. The pump draw down tests were performed by measuring the time it took to fill and empty a known volume of water in each wet well.

- The pumps were started and the wet well was drawn down a known volume.
- The time it took to draw down the wet well a known amount was recorded.
- The stop watch was then restarted and stopped when the water level reached its normal level.

The process of timing the pump down and fill up rates was repeated for each pump three (3) times. The three (3) tests were averaged to determine the approximate pumping rate. Raw data is located in the Appendix.

### 5.1 PINE STREET PUMP STATION

**General Station Layout**

The Pine Street pump station consists of two (2) 3 HP vacuum-primed lift pumps on top of a 5-foot diameter circular reinforced concrete wet well. The pumps rely on small 1/10 HP vacuum

pumps and solenoid valves to fill the suction line and pump volute with wastewater prior to starting the pump. Without the vacuum pumps, the main pump could not prime itself. The vacuum primer pumps were installed in 1985. The vacuum pumps have been replaced within the last five (5) years, but the pumps are original with no known replacement or rebuild.

The wet well is located inside a cinderblock/brick building which also houses the emergency generator and electrical control equipment. The generator fuel is supplied by an above ground, external storage tank (see photos) and an internal day tank.

The pumps discharge into a 4-inch PVC force main which discharges into gravity sewer Manhole 4 at the intersection of Mason Avenue and Pine Street.

A layout of the station based upon existing record drawings is presented in Figure 2.

(Insert Figure 2)

A summary of major pumping station components is included in Table 1 below:

**Table 1: Pine Street Pump Station Summary of Equipment Components**

| | |
|---|---|
| Pumps | Year of installation-1983<br>Quantity-2<br>Manufacturer-Smith & Loveless<br>Horsepower: 3HP<br>Model number-18770-xx2977<br>Serial number-855469A-1<br>Capacity-145 gpm |
| Pump Operation/Control System | Floats (4): All Pumps off, Pump 1 on, Pump 2 on, High Water Alarm |
| Levels/Alarms | Loss of Main Power, High Water, Pump No. 1 Failure, Pump No. 2 Failure, and Generator Run |
| Generator | Onan Model # 150-RDSC-50R-14475AD Serial # J850781946 |

The pumping station building was found to be in good condition. Lighting in this station is functional and appears to be adequate for safety and maintenance. The ventilation systems are also fully functional.

**Wet Well Observations**

A large volume of debris and grease was noted in the wet well at the time of inspection. This grease/debris layer was approximately 1-foot thick at the time of inspection. The pump floats were also noted to be covered in 1 to 2-inches of grease, as well. This grease was removed from the floats while the pump tests were being completed. A grease buildup of this type could impact the level controls and pump operation, by causing the pumps to continue to run when not required, or more importantly not turn them on when required due to the floats sticking.

The invert sewer pipe could not be seen when the wet well was inspected. Conversations with operating personnel confirmed that the wet well is surcharged continuously, since all pump floats are set approximately 2.5-feet above the inlet sewer invert. Town personnel have indicated that this was done because they believe that the existing pumps are not capable of operating at lower wet well levels. This is likely due to the type of pumping system installed. The lower the water level in the wet well, the more difficult it is for the small vacuum pumps to prime the main pumps. This is a difficult balancing act for the Town to handle. A lower water level could

prevent surcharging of the sewer, but the pumps may not prime themselves. Raising the floats will help prime the pumps, but can cause the sewer to be surcharged, reducing the buffer in the system during wet weather events.

The manhole just upstream of the pump station was opened during the station inspection and found to be surcharged with an estimated 2-3 feet of water.

**Pump Operation**

As stated earlier, the existing pumps rely upon a vacuum priming system to allow them to pump sewage from the wet well. The bottom of the wet well is approximately 20-feet below the pumping station floor and the influent sewer is nearly 15-feet below the floor, hence the priming system is expected to lift over 15-feet prior to starting the main pump. Per the pump manufacturer, normal operation of this type of system results in pumps being primed and operational within 30 – 45 seconds. However per manufacturer's literature a suction lift of 15 to 20-feet is near the maximum that this pump can handle. It was noted that the pumps at the Pine Street station took over 15 minutes to prime before beginning to pump wastewater. During the pump drawdown tests, it was noticed that the swing arms on the force main discharge check valves did not appear to be closing all the way. Town personnel had to physically "step" on the arms to help them seat properly. Once this was done, the pumps appeared to prime themselves a little quicker. With the check valve not seating properly, the priming time is significantly increased. Lack of proper priming impacts the ability of these pump stations to respond to wet weather flows.

Once the surcharged condition in the wet well was noted, an attempt was made to bring the water level in the wet well down below the sewer invert by turning the pumps on manually. It took 45-50 minutes with one pump running, to get the water level below the invert of the inlet pipe. Large pieces of grease and debris were noted to be entering the system from the inlet sewer. Again with a suction lift of nearly 20-feet, the existing pumps can be expected to struggle at these wet well levels.

The pump drawdown tests obtained the following results:

Table 2: Pump Drawdown Tests (typical for all tables)

| TEST | MEASURED PUMP RATE (GPM) | DESIGN RATE (GPM)[2] | UNDER/OVER DESIGN CAPACITY (%) |
|---|---|---|---|
| Pump #1 | 123 gpm | 145 gpm | 16% under |
| Pump #2 | 112 gpm | 145 gpm | 23% under |
| Pump #1 & #2 | 154 gpm[1] | N/A | N/A |

[1] Although the pump station was designed with one pump capable of handling peak flows, a test was also conducted with both pumps operating, to determine the maximum pump station capacity.
[2] Design rate obtained from pumping station Operation & Maintenance Manual.

Per the table, the pumps are operating between 15 – 25% below their rated design capacity. However, it is clear that improvements at this station are needed to allow the pump floats to be reset below the sewer invert and eliminate the surcharged condition, yet reliably be able to pump at the lower wet well levels. This pumping station, and associated upstream sewers, is being limited by the ability of the pumps to properly prime themselves.

## Recommendations

Recommendations for Pine Street pumping station are classified below as "immediate" vs. "long-term", although long term in the context of the report is suggested to be within 2-3 years. Immediate improvements could be implemented by the Town without much additional planning, engineering, or costs. It should be noted that the Town has implemented a Grease Ordinance over a year ago, requiring certain sewer customers to install grease traps to help minimize the amount of grease that enters the collection system. They have also sent out informational letters to sewer customers to help educate them on grease/debris and its potential impact to the sewer system and the environment. Continued efforts by the Town to enforce the ordinance and promote education on grease control will continue to assist in keeping the system well maintained and operating effectively.

### Immediate

As a first step, the pump station wet well must be thoroughly cleaned (high-pressure blast) to remove all grease and solids buildups. These deposits have likely occurred over a long time period. The washing down of the wet well should also be a task added as a general pumping station maintenance task. This should be performed as manpower and equipment allows, but as

a minimum all wet wells should be pumped down and cleaned out quarterly with a high pressure wash. This could be reduced over time if the amount of grease witnessed is decreasing as a result of other on-going efforts.

The check valves on the force main discharge line are not operating properly. These could be the cause of some of the operational problems being encountered with the sewage pumps, since air may enter the system if the valve does not close completely preventing the pumps from being primed efficiently. Flow from an open check valve could also be recirculated from the force main back into the wet well (through the off-line pump), causing a drop in overall pumping capacity.

The existing check valves were supplied by Smith & Loveless. The Town had tried to replace a check valve at the Washington Avenue pumping station with a valve by a different manufacturer, and they experienced a number of problems with its installation/operation. It is therefore recommended that the valves be replaced with Smith & Loveless valves to match existing. Stearns & Wheler contacted Smith & Loveless to obtain a price for new valves, and found that replacement of the two (2) 4" check valves is fairly inexpensive at a cost of $500/valve plus the labor costs to replace them. The correct valve can be obtained by contacting Smith & Loveless and telling them the specific pump station for which the valve is needed. The Town has indicated that their maintenance personnel are physically capable of providing the labor to replace the valves. It is therefore recommended that these valves be replaced immediately. Once the valves have been replaced, the drawdown tests could be repeated to determine the net impact to the pump operation.

Regular scheduled and recorded maintenance
report would also fall under this immediate improvements category.

**Short Term**

Even if the pump operation is improved by the check valve replacement, the existing pumps are nearing the end of their useful life (25 years), and pump replacement is something that should be considered within the next few years. In addition, flows measured during the Phase I I&I study

indicated flows to this pumping station exceeded design capacity (157 vs. 145 gpm). New pumps should be slightly over-sized to better accommodate existing flows.

Should the Town proceed with new pumps, there are two main options:

Option No. 1: Replacement with New Vertical Lift Pumps (self-priming centrifugal, more reliable):

One option for pump replacement is replacement with a vertical lift pump manufactured by Gorman-Rupp. These pumps operate in a similar manner to the existing pumps, however, they are self priming and do not rely upon a vacuum pump to prime the main sewage pumps. This therefore requires less maintenance than the existing units. The new pumps could be installed on top of the existing wet well and be connected into the existing discharge piping fairly easily. During the preparation of this report, Stearns & Wheler sent the Pine Street record drawing information to Gorman-Rupp, to determine if their pump could fit and work properly. Gorman Rupp has confirmed that these pumps will operate properly. The proposed pump motors are 7.5 HP, which is larger than the existing 3 HP units. Hence, electrical modifications will be required at the pump station to accommodate the higher load. A layout of this alternative is presented in Figure 3.

Option No. 2: Replacement with Submersible Pumps:

Another option is the installation of submersible sewage pumps instead of the vertical lift pumps. Stearns & Wheler typically recommends the use of submersible pumps as a standard for smaller and medium sized sewage pumping stations. Submersible pumps have a number of advantages, including:

- They do not require a vacuum pump to prime them like Smith & Loveless;
- They are installed at the bottom of a wet well, with guide rails that allow them to be easily removed, if necessary;

- Their location at the bottom of a wet well allows them to keep the wet well contents better mixed, as compared to a vertical lift pump, thus minimizing grease and solids buildups within the wet well.
- They are more space efficient.
- They are better applied to deep wet wells where vertical lift pumps could have suction lift problems.

Submersible pumps manufactured by Vaughn were used as a design basis for this option. The pump manufacturer indicated that a Vaughn Model SE3G - 5 HP pump would be sufficient to meet the pumping requirements at this station. Other manufacturers of wastewater duty pumps are: Flygt, Haywood Gordon, and KSB. Exact pump selections and specifications would be developed and discussed with the Town should they proceed with either of the pump replacement alternatives.

Two sub-options of the submersible pump alternative were evaluated for Pine Street:

2A. Installation of pumps within the existing wet well along with construction of new force main piping and valves within the pumping station building;

~~2B.~~ Installation of a new wet well outside the station with a valve vault and discharge force main ~~that could~~ connect to the existing ~~force main outside the building~~.

A discussion of each option follows:

Option 2A: It would be relatively straightforward to install submersible pumps with a guide rail system within the existing wet well at the Pine Street pump station. This option would require a new slab top and hatch to be installed on the wet well with the hatch opening centered over the pumps and a davit crane installed so that the pumps could be removed for maintenance as required. A new pump control panel would replace the existing unit.

It would also be necessary to install new discharge piping and valves from each pump which would then connect into the existing force main. The general layout would remain similar to the existing piping, with the force main passing back into the wet well and through the wet well wall outside the building. A sample layout is presented in Figure 4.
(Insert Figure 4)

Option 2B: This alternative involves the construction of a new precast reinforced concrete wet well and valve vault outside of the existing pumping station building. The wet well would house new submersible pumps and could be installed over the inlet sewer line to avoid construction of a new sewer manhole. The valve vault would be installed in front of the pump station building, with a connection being made to the existing force main within the pumping station site. Electrical feeders for the pumps would be run from the wet well into the existing building. Once the new facilities have been installed, the existing wet well can be abandoned and the building can then be used to house the generator and electrical controls only. A layout of this alternative is presented in Figure 5.

(Insert Figure 5)

Discussions with Town personnel have indicated that it is also possible to expand the overall size of the pump station site, especially to the south but there is also room for expansion to the west. A field survey should be performed to confirm site conditions. If necessary, the valve vault could be located south of the existing driveway in lieu of where it is shown on the plans.

**Cost Estimates**

Construction cost estimates for each of the pump replacement alternatives are summarized below. Itemized breakdowns of each option are included in Appendix A. A 25% allowance is included for electrical upgrades necessary to accommodate the new pumps. This allowance would not be adequate to cover replacement of the emergency generator system. Also, no costs are assumed for building improvements (lighting, HVAC, etc). If any additional improvements

are deemed necessary during the design, those costs would be in addition to that estimated below.

| | |
|---|---|
| Option 1: | $175,000 |
| Option 2A: | $150,000 |
| Option 2B: | $230,000 |

Costs associated with odor control measures are also not budgeted for in the above estimates.

**Comparison of Options**

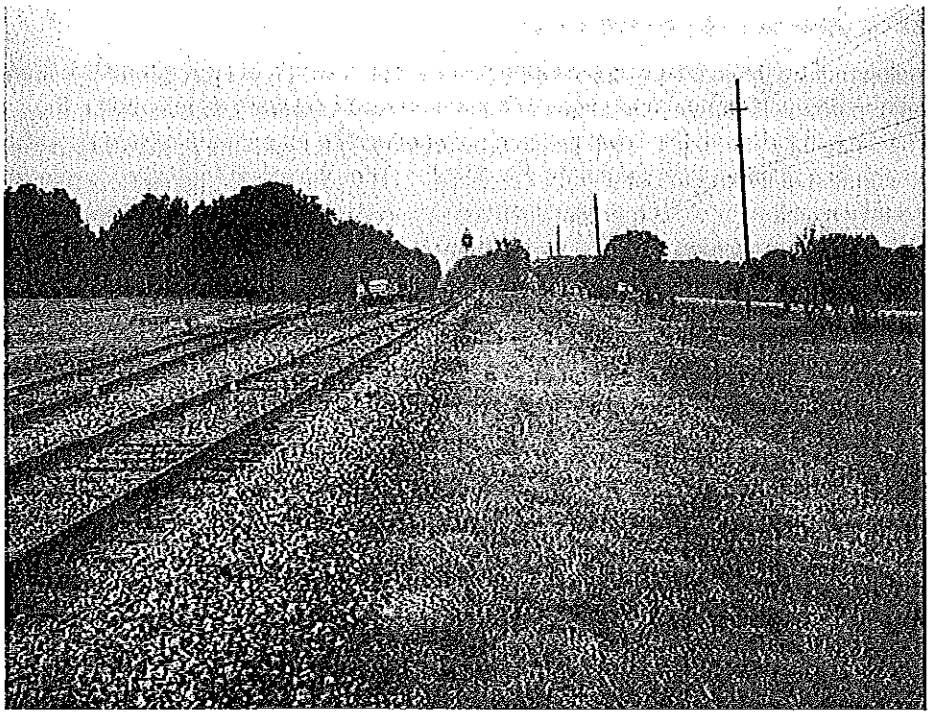
All of the options will require that flow be bypassed around the station while new pumps are being installed. The total amount of bypassing required can be minimized by proper construction sequencing.

Option 2B is clearly the most expensive. However, it provides completely new concrete structures, replaces older technology with more reliable submersible pumps, allows all electrical components to remain inside the existing building (as opposed to exterior pump control panels), and completely separates the electrical components of the pump station from exposure to raw sewage or gasses.

**Controls**

The pumps would be controlled in a similar manner to the existing pumping station. Float switches would be used to control pump operation via a new pump control panel. Pumps would operate in a lead/standby arrangement. Dial-out alarming would be explored during design to notify Town personnel when high wet well conditions are present or a failed pump.

Consideration should also be given to installing a flow meter on the discharge line so the Town can monitor pumping trends and more easily trouble shoot problems within the collection system. This would be accompanied by a chart recorder similar to the one at the existing WWTP.



#### 4.2.1.1 Raw Water Connection Alternative 1

Alternative 1 consists of connecting each of the Keck wells into a common 6-inch raw water pipeline. The raw water pipeline will continue beneath the VA Port Authority's dredging containment area located approximately 150 feet north of KW2. The raw water pipeline will be directionally drilled beneath the dredging containment area and will continue beneath the railroad tracks located directly north of the dredging containment area. The Port Authority indicated that the Town would need to submit documents and drawings to both the Port Authority and the Army Corps of Engineer for review, if the Town were to pursue Alternative 1.

After the crossing beneath the railroad, the raw water pipeline would turn west and follow Route 184 for approximately 1,400 feet, staying inside the VDOT right of way, before the raw water pipeline ties into the existing 8-inch raw water pipeline that connects EW3 to the WTP. Figure 1 (Appendix A) includes proposed alignment for Alternative 1.

#### 4.2.1.2 Raw Water Connection Alternative 2

Alternative 2 also consists of connecting each of the Keck wells into a common 6-inch raw water pipeline. Alternative 2 raw water pipeline will not continue beneath the dredging containment area, but will be routed east for approximately 400 feet to avoid the dredging area before turning north towards the railroad tracks. After avoiding the dredging containment area, the raw water pipeline will be installed beneath the rail road tracks and then will turn west and follow Route 184 for approximately 2,300 feet, staying inside the VDOT right of way. The raw water pipeline will connect to an existing 8-inch raw water pipeline that connects EW3 to the WTP. Figure 1 (Appendix A) shows the proposed alignment of Alternative 2.

### 4.2.2 Opinions of Probable Cost

An opinion of probable cost was developed for the construction of both Alternative 1 and Alternative 2 and an opinion of probable annual operations and maintenance cost were developed for the both of the Keck wells. The Town has indicated the Town plans to provide funding for both the cost of the connection and the annual operation and maintenance cost of the Keck wells. The Opinion of Probable Cost for Alternative 1 and 2 differed by less than 5%. The greatest differences in cost appeared to be due the construction cost associated with directionally drilling beneath the Virginia Port Authority dredging containment area.

Alternative 1 proposes to connect the KW1 and KW2 to existing WTP. The opinion of probable cost includes 2,500 linear feet of 6-inch ductile iron pipe, a check valve, 2 isolation valves, 4-inch water meter, meter box, and a blow off valve at each well. The opinion of probable cost also includes 650 linear feet of 12-inch HDPE containment pipe that will be installed beneath the dredging containment area and the railroad.

Future maintenance of the raw water pipeline will be extremely difficult due to the pipe located beneath the dredging containment area. Estimating the cost of this potential maintenance is difficult to account for in the cost estimate. Table 11 is a summary of the opinion of probable cost for Alternative 1 for connecting KW1 and KW2 to the WTP.

**Table 10: Engineer's Opinion of Probable Cost**

| Alternative 1: Keck Well 1 &2 Connection | |
|---|---|
| **Description** | **Cost** |
| **Mobilization** | $18,000 |
| **Well Connection** | $339,000 |
| **Erosion & Sediment Control** | $16,000 |
| **Total Construction Cost** | **$373,000** |

Alternative 2 also proposes to connect the KW1 and KW2 to existing WTP. The opinion of probable cost includes approximately 3,700 linear feet of 6-inch ductile iron pipe, a check valve, 2 isolation valves, 4-inch water meter, meter box, and a blow off valve at each well. The opinion of probable cost also includes approximately 150 feet of 12-inch HDPE that will be directionally drilled beneath the railroad. Approximately 1,200 linear feet of additional raw water pipeline is needed to avoid the dredging containment area. Table 12 shows the opinion of probable cost for Alternative 2.

Table 11: Engineer's Opinion of Probable Cost

| Alternative 2: Keck Well 1 &2 Connection | |
|---|---|
| **Description** | **Cost** |
| **Mobilization** | $18,000 |
| **Well Connection** | $334,000 |
| **Erosion & Sediment Control** | $19,000 |
| **Total Construction Cost** | **$371,000** |

#### 4.2.2.1 Opinion of Probable Annual Operation & Maintenance Cost

Annual operation and maintenance costs associated with the use of the Keck wells should reflect the energy cost of operating the pumps and the maintenance of each of the pumps for one year. The most significant contributor to the annual O&M cost is the energy consumptions. TW1, EW3, KW1, and KW2 all have similar pumps installed the in the well and all have similar well source capacities as show in Section 3.3. Operating two pumps for 14.2 hours a day, the combined input energy is estimated to be 170,000 kWh per year. The energy cost is estimated to be approximately $26,000 per year at a rate of $0.15 per kWh. Assuming that each of the Keck wells would be paired to operate with one of the existing wells, we can conclude that one of the two Keck wells will likely be operating each day. The combined energy cost of the Keck wells is then estimated to be $13,000 per year.

The annual maintenance cost of each pump can be estimated to be 10 percent of the cost of the pump combined with the capital replacement cost of the pump over ten years. Table 13 shows the opinion of annual operation and maintenance cost for the Keck wells to be $33,000.

Table 12: Opinion of Probable Annual Operation & Maintenance Cost of Keck Wells

| | $/Year |
|---|---|
| Energy Operations Cost | $13,000 |
| Maintenance Cost KW1 | $5,000 |
| Maintenance Cost KW2 | $5,000 |
| Capital Replacement Cost KW1 | $5,000 |
| Capital Replacement Cost KW2 | $5,000 |
| Total | $33,000 |

## 4.3 Additional Soil Testing and Land Easements Requirements

The Town has submitted Geophysical logs for the Keck wells (Appendix D) to VDH for review and VDH has reviewed the information responded to the Town in a letter sent in January, 2012, as shown in Appendix D. The Geophysical data indicates that Keck wells were screened in a mixture of sand, gravel, shell, and clay soil conditions.

According to the USDA Map Unit Description, the Northampton County area consists of BoA and MuA map units as shown in Appendix F. The BoA map unit is made up of 85 percent Bojac fine sandy loam with a 0 to 2 percent slope. The MuA map unit consists of 80 percent Munden sandy loam with a 0 to 2 percent slope. The USDA Engineering Report, shown in Appendix F, describes the soil conditions of between the ground surface and 60 feet below the surface. The consistent soil conditions and relatively flat terrain provide ideal constructability conditions for the installation of the raw water pipeline connecting the Keck wells to the WTP.

The Town does not appear to need any additional soil testing for the Keck wells raw water pipeline unless the Town decides to pursue Alternative 1. Installing the raw water pipeline beneath the dredging containment area will require additional soil testing beneath the dredging area to evaluate the soil conditions for constructability and for possible contamination issues with the dredging material.

For both of the alternatives, land easements will need to be obtained from Railroad Company, VA Port Authority, VDOT, Reliable Coal & Lumber CO. Inc., Reliable Building Supplies & Coal Corp., and Bay Creek L.L.C, for the raw water pipeline alignment that connects the Keck wells to the WTP. The Town will need to submit drawings and design documents for review by VDOT for the water proposed to be installed in the VDOT right of way along Route 184. The Town will also need to submit drawings and design plans to the railroad company for the raw water pipeline proposed to be installed beneath the railroad.

## 4.4 Instrumentation and Controls

Currently, the Town manually turns on and manually turns off the pumps to provide raw water to the WTP. For the purpose of this PER, the Town has indicated that the proposed wells will have the same manual operation as the existing wells.

# 5. Conclusions and Recommendations

The current raw water supply is the limiting capacity of the water treatment system and as the water demand continues to increase, the water system capacity needs to increase to meet that demand. If blended with existing wells (1:1), the water quality of the Keck wells improves the raw water quality to the WTP and likely improves the overall treatability of the water. The water quality, treatability, and well capacity of TW2 is unknown will need to be evaluated before the well is connected to the WTP.

After the proposed wells are connected to the WTP, the raw water supply will exceed the current WTP capacity and the WTP capacity will need to be evaluated how to further increase the water system capacity when the average daily demand approaches 460,000 gpd.

Although the two alternatives have a similar initial opinion of probable cost, the difficulty of future maintenance, additional risk of damage to the raw water pipeline, additional review time, and additional approvals needed from the VA Port Authority and the Army Corp of Engineers to install the raw water pipeline beneath the dredging containment area; Alternative 1 could prove to be more costly and difficult.

Based on the similarities of the well capacities of the Keck wells and the existing wells, pairing the wells provides similar combined capacities as shown in Table 7. By pairing each of the existing wells with each of the Keck wells, the combined water quality is more consistent and has a better overall raw water quality, as shown in Table 8. Having consistent water quality will help the operation of the WTP to be more consistent.

There does not appear to be adequate water quality test data and well testing data for TW2 per VDH requirements. It is required by DEQ to have water quality data and a GW-2 form for TW2 before the well is connected to the system. The Keck wells have been tested for physical and chemical characteristics but have not been tested for the radiological quality stated in Appendix G.

Utility locations and documentation are needed before the installation of the raw water pipelines to the proposed wells in order to avoid or minimize issues with installation of the proposed raw water pipelines.

The recommendations developed from this preliminary engineering report include the following:

1. We recommend that the Town connect the Keck wells to the WTP and wait to connect TW2 until further testing is conducted to verify the water quality and the well capacity.
2. We recommend the Town conduct well pump testing for TW2 and provide the DEQ with the GW-2 form for TW2.
3. We recommend that Town conduct water testing for chemical, physical, and radiological qualities on the Lower Yorktown Eastover Aquifer to evaluate the treatability of the water.
4. We recommend that the Town pursue Alternative 2 to connect KW1 and KW2 to the WTP to avoid the VA Port Authority dredging containment area.
5. We recommend acquiring all land and construction easements from the Railroad Company, VA Port Authority, VDOT, Reliable Coal & Lumber CO. Inc., Reliable Building Supplies & Coal Corp., and Bay Creek L.L.C, associated with Alternative 2.

6. We recommend that the Town pair each of the Keck wells with each of the existing wells, alternate the operation of the pairs daily or weekly, and keep TW2 available as a stand-by source.
7. We recommend the Town conduct further analysis of the proposed wells for radiological quality and verify the Keck wells have been constructed with at least a distance of 50 ft between the Wells and any property line or any potential source of contamination and record a dedication document in conformance with VDH requirements.
8. We recommend the Town survey all the utilities on the WTP site and for the Alternative 2 raw water pipeline alignment.