Appendix B

Station Descriptions by Operations Staff

(2) Village Pump Station
System Description
June 2004

Background

The Village, Highway 305, Lower Hawley, Sunday Cove, Lower Lovell, Wing Point, and High School pump stations were constructed as part of the same project around 1979. Based on flow the Village pump station is the second largest station in the system. The electrical control cabinet has been rewired numerous times and is in overall poor condition. The cathodic protection system has not been maintained and the drywell is showing signs of advanced corrosion. In addition, some wet well controls do not meet current intrinsic safety standards. .In spite of these deficiencies and general lack of maintenance the mechanical systems continue to function well.

Description

The station is of the dry well/wet well package station design. by Ideal Pump and Equipment and is equipped with two Cornell vertical, powered by 480 volt, three phase, 3 HP General Electric motors. The pumps are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. The Chemithon main control panel provides liquid level control through an air compressor and bubbler system. The bubbler system utilizes three mercury switches with differential adjustments for control. One switch for lead pump control, one switch for lag pump control, and one switch for high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A used 1970's vintage White, 100 kw, portable generator was converted to stationary use and installed at the station in 1992 to provide back up power during utility outages. The generator is equipped with an automatic transfer switch as well as a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe and in case of complete systems failure overflow will occur out the wet well manhole.

Gravity Collection System and Force Main

From the pump station the 8" PVC force main generally runs east under Highway 305 for 500 ft and then south 600 ft to a clean out. From the clean out the main runs east for100 ft and then south 600 ft to a second clean out. From the second clean out the main then runs east 850 ft to MH #11-40 where the flow turns to gravity. It is believed that the 90 degree bends in the main are made up of two 45 degree elbows. No known air release valves, blow off valves, or pig ports are part of the system.

2003—2004 Major Maintenance Summary

8/03 Rebuilt pump #1. Replaced bearing, mechanical seal, dipped, and baked windings.
9/03 Rebuilt pump #2. Replaced bearing, mechanical seal, dipped, and baked windings.
8/03 Replaced galvanized bubbler line.
6/04 Redundant float, relay, and timer installation in progress.

(3) Old Treatment Plant Pump Station
System Description
June 2004

Background

The Old Treatment Plant pump station is one of the oldest in the system. The station was in service before the new WWTP was constructed in 1978. In spite of the age and general lack of maintenance the mechanical systems continue to function well.

Description

The station is a Lakeside, model LCV dry well/wet well concrete package unit. Pumping is accomplished with two Cornell centrifugal pumps powered by 208 volt, three phase, 10 HP, General Electric motors. The pumps are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. During utility outages emergency power is supplied by a Isuzu generator equipped with an automatic transfer switch. The generator is a 1980's vintage portable unit that was retrofitted and permanently installed at the station in 1992. In case of main generator failure the station is equipped with a portable generator auxiliary connection.

Wet well measurement is accomplished with a Druke PTX 1290 analog level probe. The probe sends a 4-20 mA signal to the Koyo, Direct Logic PLC installed by S&B in 1994. The S&B programmed PLC controls station logic and communicates with the Master Telemetry Unit at John Nelson Park. Logic includes communication with the Highway 305 pump station. If communications indicate station high water level or complete failure of Highway 305 the Old Treatment Plant pumps will stop operating and send an alarm. A Seimens DV 1000 provides an operator interface to the PLC. All control in the PLC requires the associated equipment switches to be placed in the "Auto" position. The PLC control is electrically disconnected when the switch is placed in either the "Hand" or the "Off" positions. This logic provides manual operation of equipment through the use of the local "HOA" switch. Two floats provide redundant system control. The first float provides a second high level alarm and a timed pump down sequence in case of pressure transducer failure. The second float provides a low level alarm. The wet well does not have an overflow pipe and in case of complete systems failure overflow will at the manhole located at Parfitt and Madison.

Gravity Collection System and Force Main

The station receives residential and commercial gravity flow from the downtown Winslow area. In general, from the station the 8" AC force main travels 600 ft north to a manhole at the Madison Avenue and Bjune Drive where the flow turns to gravity.

2003—2004 Major Maintenance Summary

7/03 Rebuilt pump #2. Replaced bearing, mechanical seal, dipped, and baked windings.
9/03 Rebuilt pump #1. Replaced bearing, mechanical seal, dipped, and baked windings.
6/04 Installed redundant float, relay, and timer to provide back up timed pump down sequence.

(4) Lower Hawley Pump Station
System Description
June 2004

Background

The Lower Hawley, Lower Lovell, Wing Point, Village, Highway 305, Sunday Cove, and High School pump stations were constructed as part of the same project around 1979. The station has generally lacked maintenance over the years. The status of the cathodic protection is unknown and some wet well controls do not meet current intrinsic safety standards. Although the overall condition of the station is only fair the mechanical systems continue to function well.

Description

The station is of the dry well/wet well package station design. Pumping is accomplished with two Crane Deming centrifugal pumps powered by 480 volt, three phase, 3 HP motors manufactured by the US Motor Corporation. The pumps are set to operate in an alternating manner based on the level in the 4 ft diameter wet well. The Chemithon main control panel provides liquid level control through an air compressor and bubbler system. The bubbler system utilizes three mercury switches with differential adjustments for control. One switch for lead pump control, one switch for lag pump control, and one switch for high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Yan Mar, 10 kw generator set was installed in 1997 to provide back up power during utility outages. The generator is equipped with an automatic transfer switch as well as a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe. In case of complete station failure sewage will back up and overflow a manhole at the east end of Irene Place.

Gravity Collection System and Force Main

The station receives residential gravity flow from a limited area. From the station the 4" DI force main generally travels east and then north for about 800 ft before it discharges to gravity at the WWTP on Donald Avenue.

2003—2004 Major Maintenance Summary

6/04 Redundant float, relay, and timer installation in progress.

(5) **Sunday Cove Pump Station**
System Description
June 2004

Background

The Sunday Cove, Lower Lovell, Lower Hawley, Wing Point, Village, Highway 305, and High School pump stations were constructed as part of the same project around 1979. The Sunday Cove station has generally lacked maintenance over the years. The condition of the cathodic protection is unknown and some wet well controls do not meet current intrinsic safety standards. The electrical panel and station subsystems have been rewired numerous times and are in poor condition. In December of 1998 the High School pump station was removed and much of the gravity flow was rerouted to Sunday Cove. In spite of the poor condition of the station the mechanical systems continue to function well.

Description

The station is of the dry well/wet well package station design. Pumping is accomplished with two Crane Deming centrifugal pumps powered by 480 volt, three phase, 7.5 HP US Electric motors. The pumps are set to operate in an alternating manner based on the level in the 4 ft diameter wet well. The Chemithon main control panel provides liquid level control through an air compressor and bubbler system. The bubbler system utilizes three mercury switches with differential adjustments for control. One switch for lead pump control, one switch for lag pump control, and one switch for high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Yan Mar, 10 kw generator set was installed in 1995 to provide back up power during utility outages. The generator is equipped with an automatic transfer switch as well as a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe. In case of complete station failure sewage will back up the 10" beach line to the southeast and overflow the manhole located near the beach at Stetsen Place and Wood Avenue.

Gravity Collection System and Force Main

The station receives limited residential gravity flow. From the station the 4" force main generally heads 200 feet north on Lovell Avenue and then 475 feet east on Parfitt Way to the point where the flow turns to gravity in MH 3-5. From the station the first 14 ft of force main is DI and the remainder is PVC.

2003—2004 Major Maintenance Summary

10/03 Rebuilt pump #1. Replaced bearing, mechanical seal, dipped, and baked windings.
11/03 Rebuilt pump #2. Replaced bearing, mechanical seal, dipped, and baked windings.
11/03 Rebuild spare pump and motor for station.
6/04 Redundant float, relay, and timer installation in progress.
6/04 Replaced galvanized bubbler line.

(6) **Lower Lovell Pump Station**
System Description
June 2004

Background

The Lower Lovell, Lower Hawley, Wing Point, Village, Highway 305, Sunday Cove, and High School pump stations were constructed as part of the same project around 1979. The station has generally lacked maintenance over the years. The status of the cathodic protection is unknown and some wet well controls do not meet current intrinsic safety standards. Salt water intrusion into the wet well has been observed. Although the overall condition of the station is only fair the mechanical systems continue to function well.

Description

The station is of the dry well/wet well package station design. Pumping is accomplished with two Crane Deming centrifugal pumps powered by 480 volt, three phase, 7.5 HP US Electric motors. The pumps are set to operate in an alternating manner based on the level in the 4 ft diameter wet well. The Chemithon main control panel provides liquid level control through an air compressor and bubbler system. The bubbler system utilizes three mercury switches with differential adjustments for control. One switch for lead pump control, one switch for lag pump control, and one switch for high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Yan Mar, 10 kw generator set was installed in 1995 to provide back up power during utility outages. The generator is equipped with an automatic transfer switch as well as a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe. In case of complete station failure sewage will back up the 10" beach line to the southeast and overflow the manhole located above the beach at Stetsen Place and Wood Avenue.

Gravity Collection System and Force Main

The station receives limited residential gravity flow. From the station the 4" force main generally heads 200 feet north on Lovell Avenue and then 475 feet east on Parfitt Way to the point where the flow turns to gravity in MH 3-5. From the station the first 14 ft of force main is DI and the remainder is PVC.

2003—2004 Major Maintenance Summary

2/03 Rebuilt pump #1. Replaced bearing, mechanical seal, dipped, and baked windings.
10/03 Replaced galvanized bubbler line.
6/04 Redundant float, relay, and timer installation in progress.

(7) **Wing Point Pump Station**
System Description
June 2004

Background

The Wing Point, Village, Highway 305, Lower Hawley, Sunday Cove, Lower Lovell, and High School pump stations were constructed as part of the same project around 1979. The station has a water tight dry well hatch for flood protection during extremely high tides. There are several areas worth of consideration. The electrical control cabinet has been rewired numerous times and is in overall fair condition. The cathodic protection system has not been maintained and some wet well controls do not meet current intrinsic safety standards. In spite of the age and general lack of maintenance the mechanical systems continue to function well.

Description

The station is of the dry well/wet well package station design. Pumping is accomplished with two Crane Deming centrifugal pumps powered by 480 volt, three phase, 5 HP Gould motors. The pumps are set to operate in an alternating manner based on the level in the 4 ft diameter wet well. The Chemithon main control panel provides liquid level control through an air compressor and bubbler system. The bubbler system utilizes three mercury switches with differential adjustments for control. One switch for lead pump control, one switch for lag pump control, and one switch for high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Lugger, 12 kw generator set was installed in 1993 to provide back up power during utility outages. The generator is equipped with an automatic transfer switch as well as a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe and in case of complete systems failure overflow will occur out the shallow gravity manholes located just east of the station near the beach.

Gravity Collection System and Force Main

The station receives gravity flow from the Wing Point residential community. From the station the 6" DI force main generally follows the Wing Point shoreline on the beach to the WWTP located on Donald Avenue. From the station the main generally heads 724 feet N-NW to a clean out, then 551 feet NW to second clean out, then 905 feet NW to a third clean out, and then 161 feet NW to a forth clean out. Just beyond the forth clean out the main turns west and runs 714 feet to a fifth clean out. Just beyond the fifth clean out the main turns north and runs 952 feet to just above the Donald Avenue WWTP to a manhole where and runs 952 feet to just above the Donald Avenue WWTP to a manhole where the flow turns to gravity. The clean outs have been lost for years. Currently, efforts are under way to locate clean outs and assess main condition.

2003—2004 Major Maintenance Summary

8/03 Replaced galvanized bubbler line.
6/04 Redundant float, relay, and timer installation in progress.

(9) **Highway 305 Pump Station**
System Description
June 2004

Background

The Highway 305, Wing Point, Village, Lower Hawley, Sunday Cove, Lower Lovell, and High School pump stations were constructed as part of the same project around 1979. Highway 305 is the largest pump station in the system and is equipped with three pumps. The cathodic protection system has not been maintained and some wet well controls do not meet current intrinsic safety standards. Major pump components have required machining during past overhauls and replacement parts can delay rebuilds for over six months. In the past during sewer main cleaning the debris from line cleaning has been allowed to collect in the wet well. The wet well is very difficult to enter and clean, thus the debris has accumulated. Sewer main cleaning procedures have been revised to prevent debris accumulation in the wet well. Overall, in spite of age and lack of maintenance the mechanical and electrical systems operate satisfactory.

Description

The station is of the dry well/wet well package station design. Pumping is accomplished with three Cornell centrifugal pumps powered by 480 volt, three phase, 25 HP GE motors. Two of the three pumps are set to operate in an alternating manner based on the level in the wet well. The Superior Custom Controls main control panel provides liquid level control through an air compressor and bubbler system. The bubbler system utilizes three mercury switches with differential adjustments for control. One switch for lead pump control, one switch for lag pump control, and one switch for high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. In 1992 a used 1970's vintage 100 kw, White portable generator was converted to permanent mounting and installed at the station to provide back up power during utility outages. The generator is equipped with an automatic transfer switch as well as a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe and should the station fail completely sewage will first back up into the manholes and elevator shaft of the Eagle Harbor Condominiums south of the station.

Gravity Collection System and Force Main

The station receives gravity inflow from most of the downtown Winslow area. From the pump station the 12" DI force main generally travels in a northeastward direction for about 3000 ft along the beach until it discharges to gravity just above the WWTP on Donald Avenue.

2003—2004 Major Maintenance Summary

4/03	Rebuilt pump #2. Replaced bearing and mechanical seal. Dipped and baked windings. Machined shaft and replaced impeller.
6/03	Replaced galvanized bubbler line.
2/04	Installed redundant float, relay, and timer to provide back up timed pump down sequence.

(9) **Island Terrace Pump Station**
System Description
June 2004

Background

The Island Terrace lift station was built around 1984. Some institutional memory suggests that the pump impellers were upsized from 100 to 150 gpm capacity after original construction. No data to support that information is available. Although some wet well controls do not meet current intrinsic safety standards and the condition of the cathodic protection is unknown, overall the station is solidly built and functions well.

Description

The station is of the dry well/wet well package design by Ideal Pump and Equipment. Pumping is accomplished with two Cornell centrifugal pumps powered by 480 volt, three phase, 3 HP General Electric motors. The pumps are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. The Superior Custom Controls main control panel provides liquid level control through a bubbler system and a series of pressure switches. The pressure switches provide control for the lead pump, lag pump, and high level alarm. A back up float provides a second high level alarm and a timed pump down sequence in case of bubbler system failure. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Cummins/Onan generator set equipped with an automatic transfer switch was installed in 2002 to provide back up power during utility outages. The station is equipped with a portable generator auxiliary connection in case of stationary generator failure. The wet well has an overflow pipe and in case of complete station failure sewage overflow to the forest land east of the wet well.

Collection System and Force Main

The station receives gravity flow from a limited residential and commercial area. From the station the 4" force main runs approximately 440 feet south on Ferncliff Avenue to the intersection of Eaglecliff and Ferncliff where the flow turns to gravity at MH 9-41.

2003—2004 Major Maintenance Summary

4/03	Rebuilt pump #2. Replaced bearing, mechanical seal, dipped, and baked windings.
6/03	Rebuilt pump #1. Replaced bearing, mechanical seal, dipped, and baked windings.
4/04	Replaced galvanized bubbler line.
6/04	Redundant float, relay, and timer installation in progress.

(12) **Ferry Terminal Pump Station**
System Description
June 2004

Background

Little history is available for the Ferry Terminal pump station. It is believed to have been constructed by the State Ferry System and subsequently turned over to the city for operation and maintenance. Currently, the wet well controls do not meet intrinsic safety standards and the wet well piping and concrete is in rough condition. In spite of many discrepancies the station operates reliable and meets operational needs. Recent discussions indicate the Ferry System may wish to relocate the station in the near future when the loading zone is upgraded.

Description

The station is of the wet well submersible design and was constructed on site. Site inspection indicates that the original pumps were of the line shaft design with the motors mounted above the wet well. Information in the electrical control cabinet indicates the panel was installed around 1980. It is believed that the panel was replaced during the station upgrade. Following original construction the pumps have been replaced with true submersible pumps and motors. The 480 volt, 3 phase, Reliance motors power 150 gpm Paco submersible pumps that are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. The Superior Custom Controls main control panel provides liquid level control through a series of four floats. From the bottom of the wet well the floats act in the following manner. The lowest float is the normal all pumps off float. The next is the lead pump start float. The next is the lag pump start float. The next and highest is the high level alarm float. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. During utility outages, the main ferry terminal generator provides emergency power. The station is not equipped with a portable generator auxiliary connection in case of main generator failure. The wet well has a 4" overflow pipe that will discharge over the bank, on to the beach, and finally into Eagle Harbor in case of complete station failure.

Gravity Collection System and Force Main

The Ferry Terminal pump station only receives inflow from Washington State Ferry Terminal. From the pump station the 6", class 100 AC force main generally heads north for about 756 ' to the intersection of Ferncliff Avenue and Winslow Way where the flow turns to gravity.

2003—2004 Major Maintenance Summary

4/03 Repaired wet well basin concrete, replaced corroded 4" pump discharge columns in wet well, and fabricated new above ground piping sheet metal cover.

(13) **Klickitat Pump Station**
System Description
June 2004

Background
The Klickitat pump station was built around 1992. The condition of the cathodic protection is unknown. Overall the station is solidly built and functions well.

Description
The station is of the dry well/wet well package design by Cascade/Ideal Pump and Equipment. Pumping is accomplished with two Cornell centrifugal pumps powered by 480 volt, three phase, 7.5 HP, Marathon Electric motors. The pumps are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. The main control panel provides liquid level control through a bubbler system and a series of pressure switches. The three pressure switches provide control for the lead pump, lag pump, and high level alarm. Two floats provide redundant system control. The first float activates a second high level alarm and a timed pump down sequence in case of bubbler system failure. The second float provides redundant pump stop control and low level alarm. Manual control is possible through local HOA switches located on the control panel.

Station telemetry is limited to monitoring only and was designed and installed by S&B Inc. in 1994. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Cummins/Onan generator set equipped with an automatic transfer switch was installed in 2003 to provide back up power during utility outages. The station is equipped with a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe and in case of complete station failure sewage will back up and overflow the wet well manhole.

Collection System and Force Main
The station receives gravity flow from a limited residential area. It is believed that from the station the force main runs approximately 200 feet north through an easement and then connects to the force main from the Village pump station. The combined force main for both stations then travels about 600 ft east to MH #11-40 where the flow turns to gravity on Ferncliff Avenue.

2003—2004 Major Maintenance Summary
2/04 Installed redundant float, relay, and timer to provide back up timed pump down sequence.

(14) **Woodward School Pump Station**
System Description
June 2004

Background
The Woodward School pump station and force main was constructed by Oien Construction for the Bainbridge Island School District around 1995. Initially the District was to retain operation and maintenance responsibilities however some time after construction the station was turned over to the city. Overall the station is in good condition and functions well.

Description
The Woodward School station is of the wet well submersible design with the pumps located outside and the electrical control systems located in the basement of the school 200 ft to the north. The pumps and motors are of an unknown make, model, and size. The 480 volt, 3 phase, submersible pumps are set to operate in an alternating manner based on the level in the ?? ft diameter wet well. The Elpack main control panel provides liquid level control through a series of five floats. From the bottom of the wet well the floats act in the following manner. The lowest activates the low wet well alarm and redundant off signal. The next is the normal all pumps off float. The next is the lead pump start float. The next is the lag pump start float. The next and highest is the high level alarm float. Manual control is possible through local HOA switches located on the control panel in the basement of the school.

Station telemetry was designed and installed by S&B Inc. some time after original construction around 1996 and is limited to monitoring only. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. During utility outages, the main school generator provides emergency power. The station is not equipped with a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe and in case of complete systems failure overflow will occur out the wet well manhole.

Collection System and Force Main
The Woodward School pump station only receives flow from two school campuses. From the pump station the 4" DI force main travels about 700 ft to the intersection of Sportsman Club and New Brooklyn where it connects with the 4" HDPE force main from the North Town Woods pump station. The combined force main travels about 4000 ft the to the intersection of High School Road and Madison where the flow turns to gravity. Several small pump stations and the Sakai Village pump station contribute to this force main causing some unusual varying head conditions. See the North Town Woods pump station description for more detail.

2003—2004 Major Maintenance Summary
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Lynnwood Center Pump Station
System Description
June 2004

Background

The Lynnwood Center lift station was built by Lydell Construction under contract to Harley Unruh. The developer built station was fabricated on site and placed in service around 1998. Herbert Armstrong of ADA Engineering and Howard Taub of Correct Equipment were both involved with station engineering and design. Overall the station is solidly built and has performed well since it went into service.

Description

The station is of the dry well/wet well concrete package design and is equipped with two Fairbanks Morse centrifugal pumps powered by 480 volt, 3 phase, 40 HP, motors manufactured by the US Motor corporation. The pumps are set to operate in an alternating manner based on the level in the 8 ft diameter wet well. During power outages emergency power is supplied by a Cummins/Onan generator set equipped with an automatic transfer switch. The station is not equipped with a portable generator auxiliary connection in case of stationary generator failure.

Wet well measurement is accomplished with a Consolidated Electric analog level probe. The probe sends a 4-20 mA signal to the Koyo, Direct Logic PLC. The S&B programmed PLC controls station logic and communicates with the Master Telemetry Unit at John Nelson Park. A Seimens DV 1000 provides an operator interface to the PLC. All control in the PLC requires the associated equipment switches to be placed in the "Auto" position. The PLC control is electrically disconnected when the switch is placed in either the "Hand" or the "Off" positions. This logic provides manual operation of equipment through the use of the local "HOA" switch. In case of level probe failure a back up float will activate an alarm and initiate a second timed pump down sequence. The wet well does not have an overflow pipe and in case of complete systems failure overflow will occur out the wet well manhole.

Gravity Collection System and Force Main

Currently the gravity collection system is collects residential and commercial flows from the Lynnwood Center area. In the future the system will support areas involved with the South End Sewer LID. The 6" force main discharges to the Fort Ward WWTP operated by Sewer District 7. The 12,468 ft main includes 12,200 ft of 6" DI and 268 ft of 6" C-900 PVC pipe. From the pump station the main generally heads 4100 ft south then east on Pleasant Beach Drive NE, then 2,800 ft west on Oddfellows Road, then 2000 ft west on Blakely Avenue NE, then 3,568 ft south on NE Country Club Road then parallel to Fort Ward Hill Road to the point where the flow turns to gravity near the entrance to the Fort Ward WWTP operated by Sewer District 7. The invert elevation at the point of gravity flow is 155.58'. The last 268 feet of FM is 6" C-900 PVC. The force main includes four air release valves and four pressure clean outs.

2003—2004 Major Maintenance Summary

3/04 Replaced failed DSI PLC controller with Koyo Direct Logic – 405 PLC

North Town Woods Lift Station
System Description
June 2004

Background

The North Town Woods lift station was built by Oien Construction under contract to Madison Avenue Development. The developer built station was fabricated on site and placed in service in 2000. Prior to transfer to the city for operation and maintenance the station dry well flooded and subsequently required significant motor and electrical refurbishment before being placed back in service. Overall the station mechanical was poorly constructed and since transfer of station responsibilities numerous deficiencies have been identified for correction by the developer. To date little corrective action has taken place.

Description

The station is of the concrete dry well/wet well design and is equipped with two Fairbanks Morse centrifugal pumps powered by 480 volt, 3 phase, 25 HP, General Electric motors. The pumps are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. Station electrical and telemetry were designed and supplied by S&B Inc. The Furnas Main Control Center features removable buckets. Because of force main limitations the electrical supply transformer for the station has been downsized and the station control logic is limited to one pump run only. Two pump capabilities during high flows are not available. During power outages emergency power is supplied by a Cummins/Onan generator set equipped with an automatic transfer switch. The station is not equipped with a portable generator auxiliary connection in case of stationary generator failure.

The wet well level is measured by a Druke PTX 1290 analog level probe. The probe sends a 4-20 mA signal to the 440 Seimens PLC. The S&B programmed PLC controls station logic and communicates with the Master Telemetry Unit at John Nelson Park. A Seimens DV 1000 provides an operator interface to the PLC. All control in the PLC requires the associated equipment switches to be placed in the "Auto" position. The PLC control is electrically disconnected when the switch is placed in either the "Hand" or the "Off" positions. This logic provides manual operation of equipment through the use of the local "HOA" switch. In case of level probe failure a back up float will activate and initiate a 180 second timed pump down sequence. The wet well does not have an overflow pipe and in case of complete systems failure overflow will occur out the wet well manhole.

Gravity Collection System and Force Main

The station wet well receives inflow from the North Town Woods residential gravity collection system. The North Town Woods gravity system receives pumped discharge from two grinder pumps located in the growing Sportsman Club business park. A third grinder pump is planned to pump into the gravity collection system as well as gravity flow from the Coultas short plat. The force main discharge has some unique characteristics with combine to produce varying head conditions and velocities in the mains. The lift station discharges into 1,800 feet of 4" DI force main that runs south on Sportsman Club Road to the intersection of Sportsman Club and New Brooklyn. The Woodward School pump station also discharges into this section of force main. Woodward School is equipped with two pump run capabilities. At New Brooklyn Road the force main makes a transition to 4" HDPE and heads east to the intersection of New Brooklyn and Madison. At this point the force main heads south before it turns to gravity just north of Madison and High School Road. The Sakai Village and Madison Avenue Fire Station lift stations both of which have two pump run capabilities and one private grinder pump station discharge into this last section of force main. Approximately 4,000 ft of 4" HDPE makes up the total run from Sportsman Club Road to High School Road. 4" HDPE has a smaller inside diameter than 4" DI.

North Town Woods Lift Station
Settings and Parameters
5/24/04

Level Control Settings

Low Alarm	Pump Stop	Pump Start	High Alarm	Back Up Float
2.0 ft	2.5 ft	4.0 ft	6.0 ft	7.0 ft

Pump and Motor Operating Parameters

Parameter	Condition	Pump #1	Pump #2
Flow Rate	Normal	106 gpm	103 gpm
Pressure	Static	25—27 psi	25—27 psi
	Pumping	72 psi	72 psi
Current Draw	Normal	23.5 amps / 17 kw	23.2 amps / 17 kw
	Dead Headed	20.6 amps / 12 kw	20.5 amps / 12 kw
	Air Locked	13.6 amps / 6 kw	15.6 amps / 6 kw
Note: Operating parameters were verified through field tests by LS/JK/RW 5/19/04. Operating status of contributing pumps unknown at time of field measurements.			

2003—2004 Major Maintenance Summary
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Sakai Village Pump Station
System Description
June 2004

Background

The Sakai Village pump station was developer built by Doug Nelson with Engineering by Map Ltd. and mechanical construction by HD Fowler. Overall the station is well built and has been trouble free since it was tested and turned over to the city on 1/28/03.

Description

The station is of the wet well submersible design and was constructed on site. Pumping is provided by two Hydromatic S4PX100, 10 HP, 480 volt, 3 phase, submersible pumps. The pumps are set to operate in an alternating manner based on the level in the 6 ft diameter wet well. The Superior Custom Controls main control panel provides liquid level control through a series of five floats. From the bottom of the wet well the floats act in the following manner. The lowest is a redundant stop float and will stop the pumps even if in the hand position. The next is the normal all pumps off float. The next is the lead pump start float. The next is the lag pump start float. The next and highest is the high level alarm float. The control logic prevents both pumps from starting at the same time should the panel become energized while when both a lead and lag condition exists. A timer will delay the start of the second pump for 10 seconds to prevent excess start up current draw. Manual control is possible through local HOA switches located on the control panel. Manual pump operation will be interrupted by the low level cut off float as described above to prevent damage to the pumps by operating them dry.

Station telemetry was designed and installed by S&B Inc and is limited to monitoring only. The station RTU communicates with the Master Telemetry Unit at John Nelson Park. A Seimens DV 1000 provides a local operator interface to the RTU. A John Deere, model 4045T generator set equipped with an automatic transfer switch and residential sound attenuation provides back up power during utility outages. The station is equipped with a portable generator auxiliary connection in case of stationary generator failure. The wet well does not have an overflow pipe and in case of complete systems failure overflow will occur at the manhole just east of the station.

Collection System and Force Main

The Sakai Village pump station receives flow from the Sakai Village residential area only. From the pump station the 4" class 52, DI main extends 362 feet west to a 90 degree bend, 43 feet south to a second 90 degree bend, and finally 160 feet west to the point of intersection with the 4" SDR-9 HDPE force main from the North Town Woods area. From the point of connection, the 4" SDR-9 HDPE force main extends 1200 feet south to MH #2-51 at which point the flow turns to gravity. Both bends in the 4" DI main are equipped with pressure clean out connections. The North Town Woods force main has some unusual characteristics that could cause varying head conditions. Some information suggests that the force main may be reaching capacity. See the North Town Woods system description for additional detail.

2003—2004 Major Maintenance Summary

na

Appendix C

Sunday Cove Pump Station Flow Test

City of Bainbridge Island

Sunday Cove Pump Station Flow Test
September 3, 2004

City Recorded Results

6 foot diameter wetwell = 211.4 gal/ft

Pump #	Inflow Time	GPM	Pump Time	GPM	TOTAL GPM
1	4 min 11.22 sec	50.49	33.59	377.5	**428**
1	3 min 49.25 sec	55.40	33.21	384.36	**439**
1	4 min 5.28 sec	51.81	34.59	364.48	**416**
2	3 min 57.12 sec	53.52	37.25	340.97	**394.5**
2	2 min 13.37 sec	95.22	37.43	340.97	**436.2**
2	3 min 35.28 sec	58.89	35.12	358.31	**417.2**
2	4 min 11.90 sec	50.33	34.53	364.48	**414.8**
1-2	4 min 20.40 sec	48.71	29.53	431.43	**480.14**
1-2	4 min 37.71 sec	45.66	25.34	500.95	**546.61**
1-2	4 min 50.9 sec	43.59	25.81	491.63	**535.22**
1-2	4 min 50.9 sec	43.59	25.87	491.63	**535.22**

B&H Calculation

6 foot diameter wetwell = 211.49 gal/ft

Pump #	Test No.	Inflow Time (min.)	Inflow GPM	Pump Time (min.)	Pump GPM	TOTAL GPM	Average Total
1	1	4.1870	50.5	0.5598	377.8	**428.3**	
1	2	3.8208	55.4	0.5535	382.1	**437.5**	
1	3	4.0880	51.7	0.5765	366.9	**418.6**	
					Average of Tests 1-3		**428**
2	1	3.9520	53.5	0.6208	340.7	**394.2**	
2	2	2.2228	95.1	0.6238	339.0	**434.2**	
2	3	3.5880	58.9	0.5853	361.3	**420.3**	
2	4	4.1983	50.4	0.5755	367.5	**417.9**	
					Average of Tests 2-4		**424**
1-2	1	4.3400	48.7	0.4922	429.7	**478.4**	
1-2	2	4.6285	45.7	0.4223	500.8	**546.5**	
1-2	3	4.8483	43.6	0.4302	491.7	**535.3**	
1-2	4	4.8483	43.6	0.4312	490.5	**534.1**	
						Average of Tests 2-4	**539**

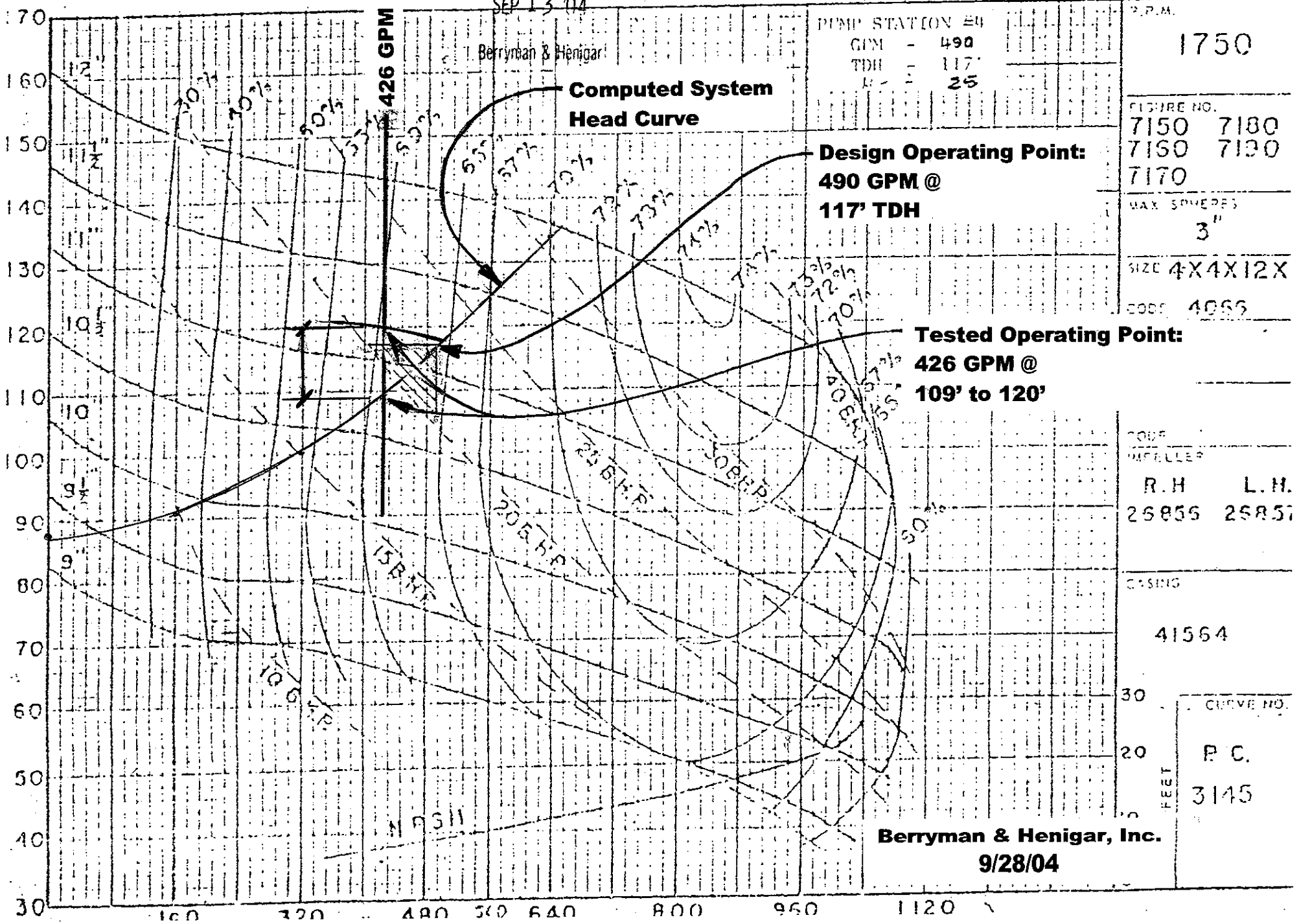
RECEIVED

SEP 13 '04

Berryman & Henigar

Sunday Cove #5
Weaver PS

DEMING [illegible] ON CRANE
SALEM, OHIO U.S.A.



Appendix D

Corrosion Investigation Report

NORTON CORROSION LIMITED

8820 222nd Street SE, Woodinville, WA 98077
Phone (425) 483-1616 • Fax (425) 485-1754
e-mail: sales@nortoncorrosion.com

March 28, 2005

Berryman & Henigar, Inc.
Attention: Larry Amans
720 third Avenue, Suite 1200
Seattle, WA 98104

Subject: **CITY OF BAINBRIDGE ISLAND – DEPT OF PUBLIC WORKS SUNDAY COVE AND VILLAGE LIFT SEWER STATIONS CORROSION INVESTIGATION**

Gentlemen:

On March 23, 2005, Norton Corrosion Limited (NCL) personnel completed an inspection of the subject Sunday Cove and Village Sewer Lift Stations. The purpose of this investigation was to evaluate the present condition of the steel dry well cans and to obtain cathodic protection design information. Authorization to perform this work was issued under your Agreement for Consulting Services dated March 9, 2005.

Work Performed

Evaluation of the existing buried steel dry wells was to be performed as non-destructive testing using NCL's ultrasonic thickness (UT) test instrument. In most cases, NCL is able to obtain thickness readings through a surface coating. The coating is then removed at a single point to determine the coating thickness; then data is adjusted to account for the front side coating thickness. Under the circumstances, NCL was unable to obtain accurate UT measurements through the coating. In order to obtain readings the coating would have to be removed leading to destructive testing. A decision was made with the informed consent of the City to forego any destructive testing at the time of inspection. NCL was able to obtain some UT readings at the Sunday Cove station, predominantly where existing coatings have failed.

Cathodic protection testing performed to obtain design information included structure-to-soil potential measurements, current requirement testing and soil resistivity measurements.

Structure-to-soil potential measurements indicate the level of cathodic protection being obtained. Current requirement testing performed at both stations entailed application of DC current from a remote ground on to the steel dry well. The elapsed time, current output and potential measurements were monitored for a short time to determine the degree of polarization obtained relative to the current applied. In turn, NCL has calculated the CP current required to obtain adequate cathodic protection of the structures.

In-situ soil resistivity measurements were recorded at two locations adjacent to the Sunday Cove station using the Wenner Four-Pin Method per ASTM Standard G-57. Spatial limitations prohibited four-pin testing at the Village station, so NCL obtained one soil sample from near the surface for laboratory testing. Soil resistivity is indicative of the general corrosivity of a soil and is fundamental in CP anode design.

Results and Conclusions

The attached data sheets detail the results of the field inspections.

Sunday Cove Lift Station

The data obtained at the Sunday Cove lift station indicates the steel canister is not cathodically protected.

The UT readings obtained do not indicate any significant metal loss, although these readings were predominantly recorded on the floor over a relatively small area of the station.

Based on internal measurements of the lift station, NCL estimates the buried external surface area to be 1014 ft^2. The total current requirement is estimated not to exceed 3 amps, with a recommended design current rating of 4 amps. This is equivalent to a current requirement of 3 ma/ft^2 on the entire structure, which is relatively high and suggests the steel dry well is bare or the effectiveness of any coating is poor.

Based on the soil resistivity data, this site is considered to be moderately corrosive. Considering its close proximity to marine waters, the site likely has a variable water table and subsurface soils may contain chlorides.

Village Lift Station

The data obtained at the Village lift station indicates the steel canister is not cathodically protected. Based on the soil resistivity data, this site is considered to be mildly to moderately corrosive. The site has a relatively high water table. The soil sample obtained was fine grained (clay or silt) suggesting the soils are poorly drained and moderately corrosive.

Similar to the Sunday Cove lift station, NCL estimates the buried external surface area to be protected at 1014 ft^2. Calculations based on the field test indicate 5.6 amps of protective current would be required to obtain protection at the surface based on the NACE International -0.85 volt criterion. In comparison to other systems, that is an exceptionally high demand, even for a bare dry well. Industry standard for steel buried in soils is 2 ma/ft^2; not 5.6 ma/ft^2. This data suggests that the soil at this site is stratified and that the deeper soils have a lower soil resistivity. It is likely that a higher level of protection will be obtained on the dry well in general, while the level of protection within a few feet of the surface may be less. This is a common issue with dry well cathodic protection. In response, NCL recommends the

installation of an impressed current cathodic protection system with a buried half-cell or monitoring tube adjacent to each lift station.

Budgetary Cost

Total budgetary cost to install an impressed current CP system at either lift station is $10,500 to $12,500. Each CP system will require a rectifier, 4 to 6 canister anodes placed vertically in auger holes, a permanent half-cell installed at depth for monitoring purposes, and all associated wiring. The output rating of the Sunday Cove rectifier will require a lower voltage rating than the rectifier at the Village station. NCL anticipates the Sunday Cove rectifier would be located within the drywell. The Village rectifier may be located within the drywell or on an existing above grade electrical rack. System design life is expected to exceed 20 years; actual design life is based on the current output at which the systems operate.

Based on soil resistivity, a galvanic anode type CP system (using magnesium anodes similar to those supplied by the lift station manufacturer) could not economically assure full protection at either site.

To progress forward with design, NCL will require site drawings detailing subsurface structures including the sewer lines, electrical conduit, services, foreign piping (water line at Sunday Cove) and other foreign structures within 100 ft of the dry well. The type of construction for each service needs to be indicated (i.e. water line is ductile iron).

NCL appreciates this opportunity to serve both Berryman & Henigar and the City of Bainbridge Island. If you have any questions or additional concerns, please contact this office.

Very truly yours,

for John F. Keppler, P.E.
Corrosion Engineer

NACE International Cathodic Protection Specialist

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Enclosures
cc: J. Weiser, NCL

NORTON CORROSION LIMITED

BERRYMAN & HENIGAR
CITY OF BAINBRIDGE ISLAND
SEWER LIFT STATIONS

DATA SHEET: 1 OF 3
NCL JOB NO.: E-17991
DATE: MARCH 23, 2005
BY: KEPPLER/BAILEY

SUNDAY COVE LIFT STATION

In Situ Soil Resistivity Measurements

Field Measurements		Barnes Layer Procedure	
Pin Spacing	Resistivity (ohm-cm)	Soil Layer	Resistivity (ohm-cm)
R1: South of lift station, adjacent waterline at mid tide, E-W			
0 - 5'2"	1,000	2'7" - 5'2"	1000
0 - 10'5"	1,640	5'2" - 10'5"	4556
0 - 15'7"	1,550	10'5" - 15'7"	1670
R2: North of lift station, 40' W cl road, adj. station gate, N-S			
0 - 2'7"	160,000	0 - 2'7"	160,000
0 - 5'2"	76,000	2'7" - 5'2"	49,800
0 - 10'5"	28,000	5'2" - 10'5"	17,200
0 - 15'7"	21,000	10'5" - 15'7"	14,000

Structure-to-Soil Potential Measurements / Current Requirement Testing

Cell located near station vents.
Anode: 4 ft of logging cable placed in seawater ~80 ft S of station.
Power: 12 volt battery pack
Current: varied, increasing with elapsed time
Interruption: 1 sec. off on a 20-sec. cycle

Location	Potential (volts DC ref. CSE) On	Instant Off
Native / start		-0.616
1 minute / 1.23 amps	-0.820	-0.634
8 minutes / 3.00 amps	-1.070	-0.675
22 minutes / 3.62 amps	-1.189	-0.775

Ultrasonic Thickness Measurements

Location	Readings (inches)
Calibration:	two point, 0.125" and 0.250", checked at 0.375"
Floor	0.401, 0.403, 0.400, 0.403, 0.405, 0.404, 0.404, 0.406, 0.402, 0.401, 0.408, 0.399, 0.402, 0.403, 0.401, 0.401, 0.400, 0.400 0.390, 0.386, 0.394, 0.387, 0.400, 0.401, 0.399
Wall, east side at existing chipped coating points	0.277, 0.263, 0.259
Wall on east side, readings through coating	0.280, 0.285, 0.285, 0.290 0.283, 0.292, 0.285 0.281, 0.284, 0.285 0.289, 0.289, 0.283
Wall behind ladder, station side of interface with entry tube, inches below entry tube	0.329

VILLAGE LIFT STATION

Resistivity Measurements

Sample obtained at 1 foot, mixed grey and medium brown clay and silt, moist.
Resistivity: native 15,000 ohm-cm, saturated 12,000 ohm-cm
Water table is 4 ft below grade 50 ft away.

Structure-to-Soil Potential Measurements / Current Requirement Testing

Cell located 2 ft from entry, opposite side from anode
Anode: vertical open culvert, 50 ft toward highway
Power: 12 volt battery pack
Current: 0.48 amps
Interruption: 1 sec. off on a 20-sec. cycle

Location	Potential (volts DC ref. CSE) On	Instant Off
Native / start		-0.545
1 minute	-0.608	-0.561
5 minutes	-0.617	-0.571

Ultrasonic Thickness Measurements

Location	Readings (inches)
Calibration:	two point, 0.125" and 0.250"

Wall behind ladder, bare: 0.253"
Wall behind ladder, station side of interface with entry tube: 0.131"

PUMP INDUSTRIES, INC.

P.O. BOX 3973
SEATTLE, WA 98124

May 5, 2005

City of Bainbridge

Attn: Chuck Dillon
Re: Deming / Cornell Pumps

Chuck,

Per your request, we are pleased to offer the following quotation;

Sunday Cove Station:

For: Figure #7182 4066 1472 Size 4 X 4 X 12 X 3
S/N DP757091

1 EA	#0030904	Mechanical Seal	$221.46	Factory Stock
1 EA	#0074431	Shaft Sleeve	$275.08	4 Weeks
1 EA	#0044757	LH / CI Impeller 11 5/8" diameter	$1,664.39	4-5 Weeks
1 EA	#0074483	Seal Retainer Housing	$333.25	4 Weeks
4 EA	#0079389	Machine Screw	Not in price book	

For: Figure #7182 4066 1472 Size 4 X 4 X 12 X 3
S/N DP757090

1 EA	#0030904	Mechanical Seal	$221.46	Factory Stock
1 EA	#0074431	Shaft Sleeve	$275.08	4 Weeks
1 EA	#0044755	RH / CI Impeller 11 5/8" diameter	$1,664.39	4-5 Weeks
1 EA	#0074483	Seal Retainer Housing	$333.25	4 Weeks
4 EA	#0079389	Machine Screw	Not in price book	

Lovell Pump Station:

For: Figure #7182 Size 4 X 4 X 9 ½ X 3
S/N DP756859

1 EA	#0030904	Double Mechanical Seal	$243.35	4 Weeks
1 EA	#0074431	Shaft Sleeve	$275.08	4 Weeks
1 EA	#0074483	Seal Retainer Housing	$333.25	4 Weeks
4 EA	#0079389	Machine Screw	Not in price book	

Old Treatment Plant:

For: Model 4NNTLMM10-4
S/N 17474

1 EA	Ref# 15	Shaft Sleeve	$60.00	1 Week
~~1 EA~~	~~Ref# 38~~	~~Backplate Single Seal~~	~~$819.91~~	~~1 Week~~
1 EA	Ref# 40	Mechanical Seal	$424.00	1 Week

All parts are FOB: Factory and delivery is as noted above. Thank you for the opportunity to quote our equipment and please do not hesitate to contact us with any further questions.

Sincerely,

Todd Wheatley