Brem - 134 - 12.08.2014

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www.frmahony.com

E/ONE Pressure System Design Report
For
THE BIRCHES

100 Long Ridge Road
Carlisle, MA
December 8, 2014

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December 8, 2014

Jeffrey A. Brem, P.E.
Meisner Brem Corporation
142 Littleton Road, Suite 16
Westford, MA 01886

RE: THE BIRCHES, CARLISLE, MA

Dear Jeff;

This preliminary design analysis examines the use of the E/One Pressure Sewer System for your project. E/One has over 40 years of installation and O&M experience along with considerable research and development leading to continuous product and system improvements. E/One remains the worldwide industry standard and industry leader in the pressure sewer technology. The unique characteristics of the E/One Pressure Sewer approach provides not only a technical solution, but also an economic advantage to be realized with low up front and O&M costs.

System Analysis

This project proposes to collect wastewater from 7 individual residential units and discharge to gravity sewer manhole # 5 as shown in our preliminary layout.

Using the information you provided, we ran the enclosed preliminary pressure sewer pipe sizing analysis. This was run through our Low Pressure Sewer Design Software that employs our Flow Velocity and Friction Head Loss vs. Pumps in Simultaneous Operation Spreadsheet. We have used the surface topography provided to make our analyses.

Zone Layout

Using your site plan we laid out a system of 1 flow zone leading to the final discharge point. The system will follow the Zone designations noted on the attached plan.

Computations are based on the Hazen-Williams formula for friction loss, using calculations of cross-sectional area and flow rate to determine pipe sizes that create "self-cleaning" velocities of 2.0 fps or higher. A "C" factor of 150, SDR 21 PVC pipe and the average expected daily volumes for single family homes are also used in this analysis.

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The highest Total Dynamic Head generated is approximately 18 feet which is predominately friction loss in the pipeline. This is well below our pump's continuous-run rating of 185 ft, and well within its intermittent, i.e., normal, operating range. Flow velocity throughout the system meets or exceeds 2 fps. These characteristics and low retention time indicate that this will be a reliable, low-maintenance system.

Design Flows & System Velocity

We normally use average daily flows for system designs rather than the peak design flows commonly used for gravity sewer sizing. We do this because the system is sealed and void of inflow and infiltration commonly allowed for in gravity sewer designs. We size the system for an average daily flow of 200+/- gpd generally for single family homes. The pumps selected are rated to flows up to 700 gpd thus peak flows are easily handled. We size the pipelines for the proper scouring velocity based on the pump's output which has a consistent flow rate over a wide range of head conditions. We then look at the pipeline retention time to optimize the line size for the lowest retention that will pass wastewater in a short period of time to reduce sediment in the lines and prevent odor issues. This makes for a very reliable and maintenance free wastewater collection system.

Often we are asked to use the published "State" design values from various flow tables in order to secure approval. We can do this; but then we run the reports based on the actual predicted average flow to optimize the line size as mentioned above.

Many of our installations have seen flows that more closely mirror the EPA water use goals of 70 gpd/capita. We also look at seasonal uses a little more closely due to greater reductions in flow in the offseason. In applications of this type we look to find the best for both seasons.

Appurtenances

Our normal recommendations for valve placement are as follows: flushing connections at 1,000' to 1,500' intervals and at branch ends and junctions; isolation valves at branch junctions; and air release valves at peaks of 25 ft or more and/or at intervals of 2,000 to 2,500 ft.

Your project will require terminal flushing manhole near station 10+00.

Common practice in pressure sewers requires the ability to isolate each lot with a corporation stop off the main and service lateral kit to the lot line. E/One has developed a true wastewater rated check valve which is built in to our stainless steel lateral kit shown in this report. These components are rated to 235 psi and with standard connection fittings rated to 150 psi. These items are included in the budget analyses and shown in this report.

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We strongly advise against the use of waterworks check valves as they are not rated for sewage environments. We have also seen PVC body check valves with pressure rating to 150 psi that do not have the same rating for back pressure on the check valve. This can result in damage to the check valve and pumping issues as the check valve disc can become dislodged under pressure.

Connections to the main pressure line do not require WYE type fittings. We commonly use a TEE or saddle connection. We isolate each connection to the main line with a stainless steel corporation valve in the same manner used for other utilities such as gas and water services.

We show both our outdoor Model DH071-93 pumps and indoor Model IH091 pumps as options in this report. We have used the IH091 indoor pump in the budget/takeoff.

Budget Notes

Costs of pipeline excavation and pump installation are best obtained from sources in your region. You may be better able to determine these costs.

I am looking forward to working with you on this and future projects. Please contact me if you have any questions or require additional information.
Best regards,

Henry S. Albro

West Townsend Office
Direct Line 978.597.0703
henryalbro@frmahony.com

Enclosures

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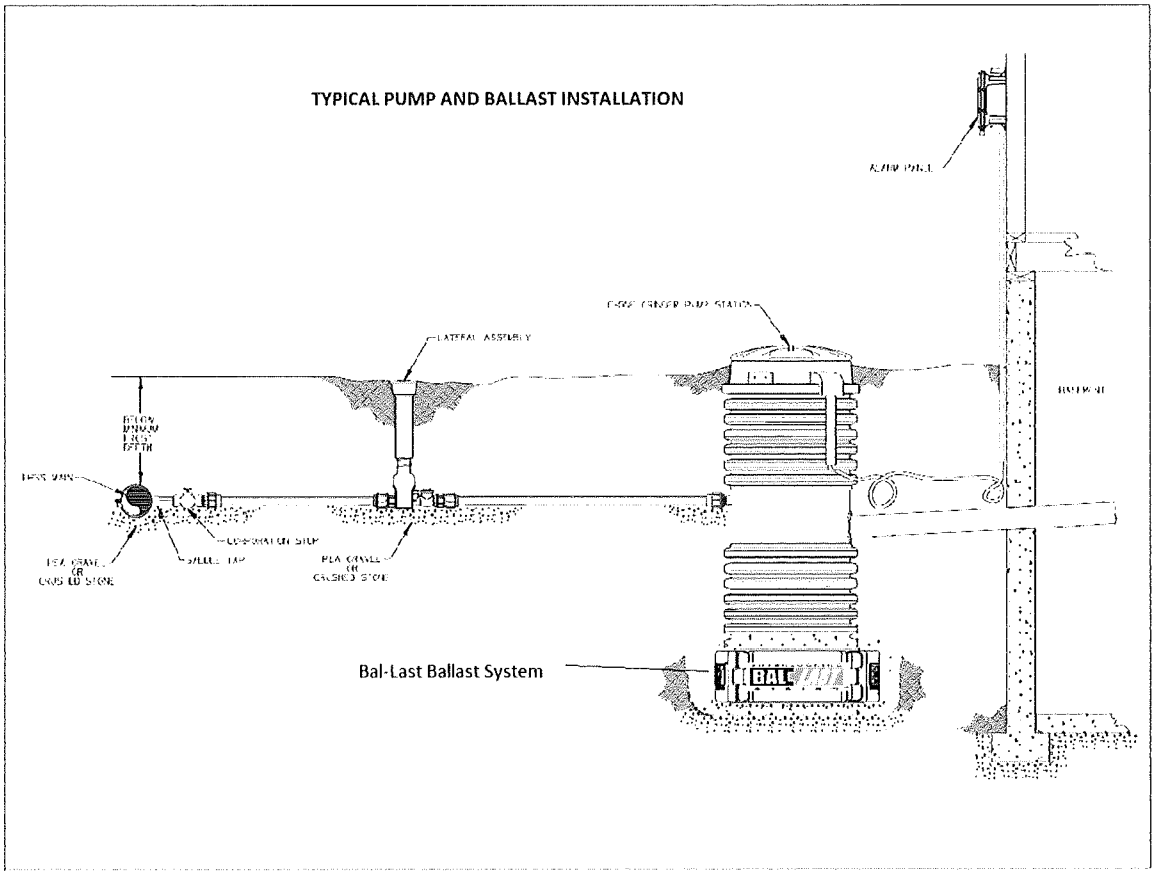
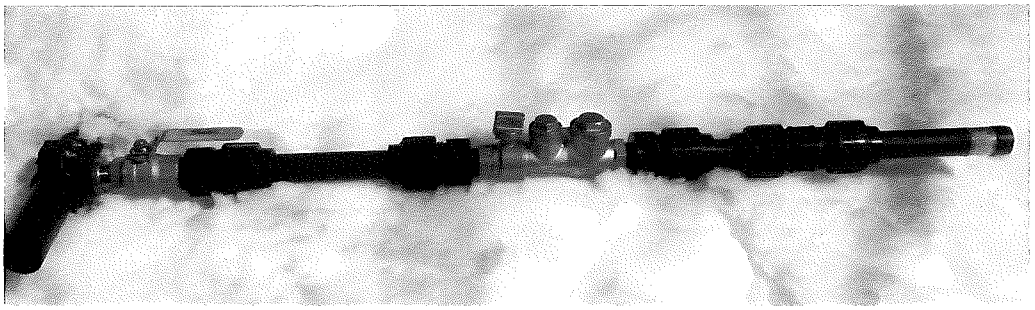


This image shows the typical layout of an outdoor pump unit for single-family home use. The pump unit is furnished complete, ready for installation. The installer needs to confirm the power cord length and discharge and inlet configuration. Standard products are supplied with 32 foot power supply cable. Standard inlets are 4-inch Schedule 40 Grommets (@ zero degrees) with 1-1/4 inch discharge (@ 180 degrees). Other configurations are available.



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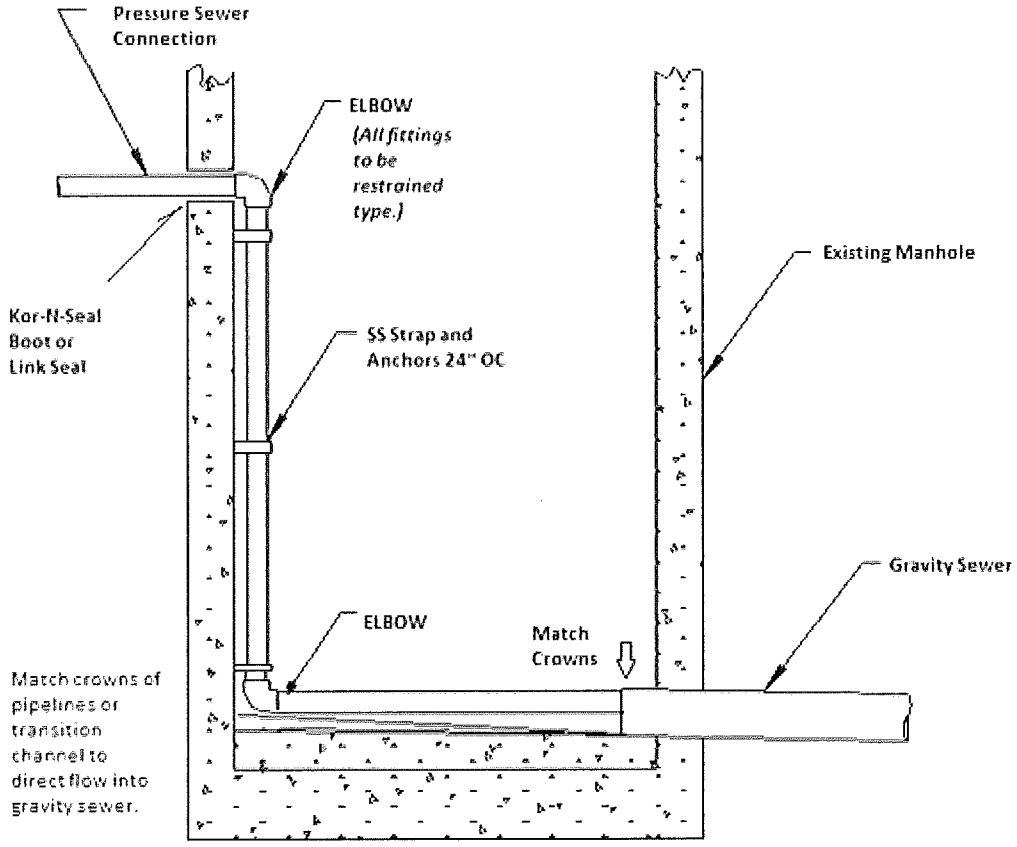
TYPICAL INSIDE DROP DETAIL



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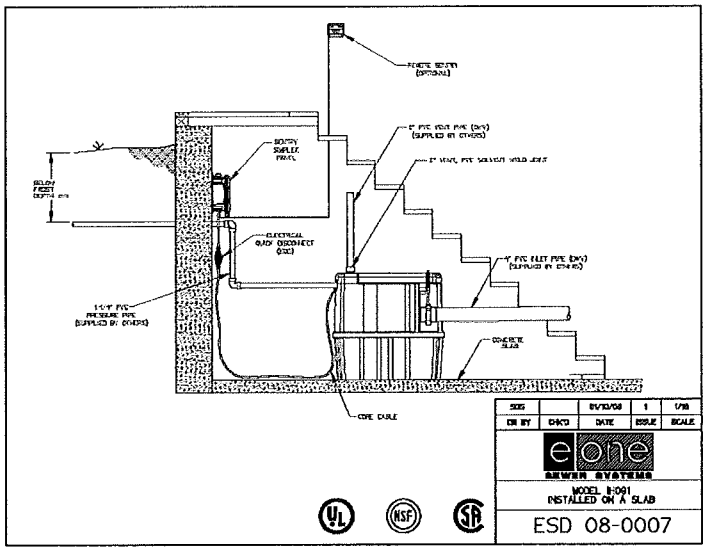
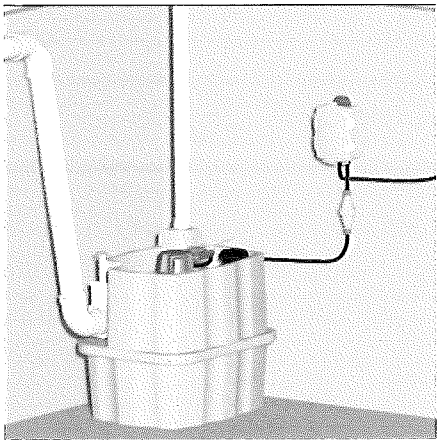
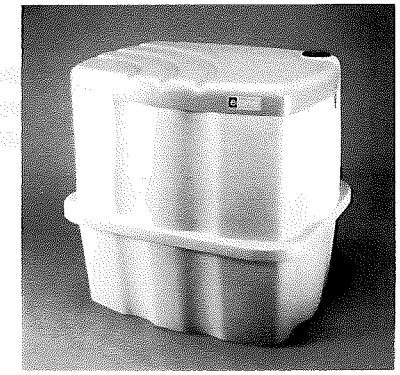
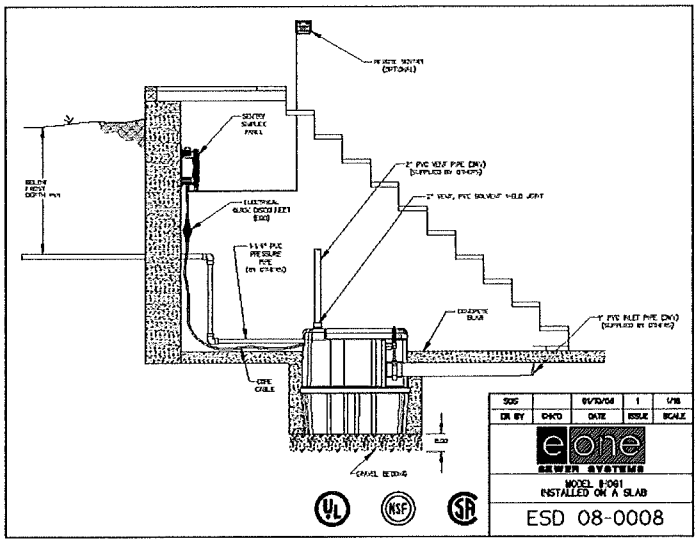
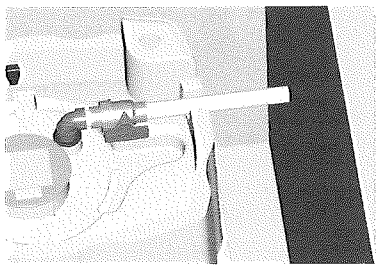
Model IH091 Indoor Pump Connection options for this station can be adapted to connect above the sill plumbing or below slab plumbing as seen in the sketches below.











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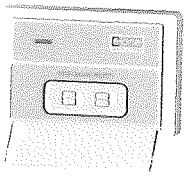
Standard alarm panels are the Sentry® panel mounted outside of the home as shown in the drawing (above).
Options include emergency generator connection (see photo) and Redundant alarm Remote Sentry® panel shown. Other panel configurations are available. See the partial listing of panel options below.



- Basic Panels include circuit breaker for the pump and separate breaker for the alarm. These panels include alarm light, alarm buzzer and alarm silence button. ***All F. R. Mahony panels are equipped with dry contacts to enable the connection of the Remote Sentry® (battery powered redundant alarm panel option)***

- Standard options include auto transfer generator connection shown above. This panel provides automatic power transfer without having to open the alarm panel or having to operate any manual transfer switching. This feature can be added to the basic panel or the panels offered below.

- Popular options include the **"Protection Package"** which monitors and protects the system from:
  - Pump Run Dry Condition (Pump running out of water)
  - Pump Overpressure Condition (Closed valve)
  - Brownout Condition (Main voltage under 12% of nameplate)
  - High Liquid Level

- The **"Protect Plus"** panel features offer the same items in the "Protection Package" plus the following:
  - High & Low Amperage draw by the pump
  - High & Low voltage to the pump
  - Extended Runtime by the pump (indicating wear or excessive flow) (field adjustable settings)
  - Monitoring of:
    - Real-time Pump Voltage and Current
    - Cycles & Hours (can be reset)
    - Minimum & Maximum Amperage (can be reset)
    - Minimum, Maximum, Average, and Last Run Cycle (in minutes, can be reset)

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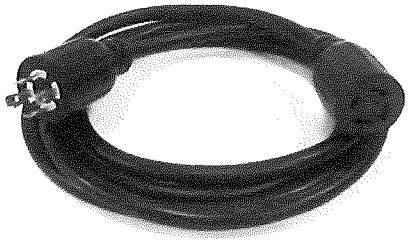
Emergency Generator Transfer Options.

The indoor pump units may be furnished with a receptacle for connection of emergency power supplies. The image to the right shows the connection receptacle on the right side of our Sentry panels. This connection may be connected by your electrician to a remote connection port outside of the home.

Wiring must be performed by a licensed electrician and conforming to NEC and local electrical codes.

The box (left) is shown in the face view (face up) and is intended to be mounted on the outside wall to permit connection of a portable generator to the receptacle on the bottom. Generator operation must always be in well ventilated areas outside of any living space.

The pump may be operated under emergency power provided the automatic transfer option is selected with the Sentry® panel. Normal pump run times are short and should not require the continuous connection of a generator. A single portable generator may be used to service several homes effectively.



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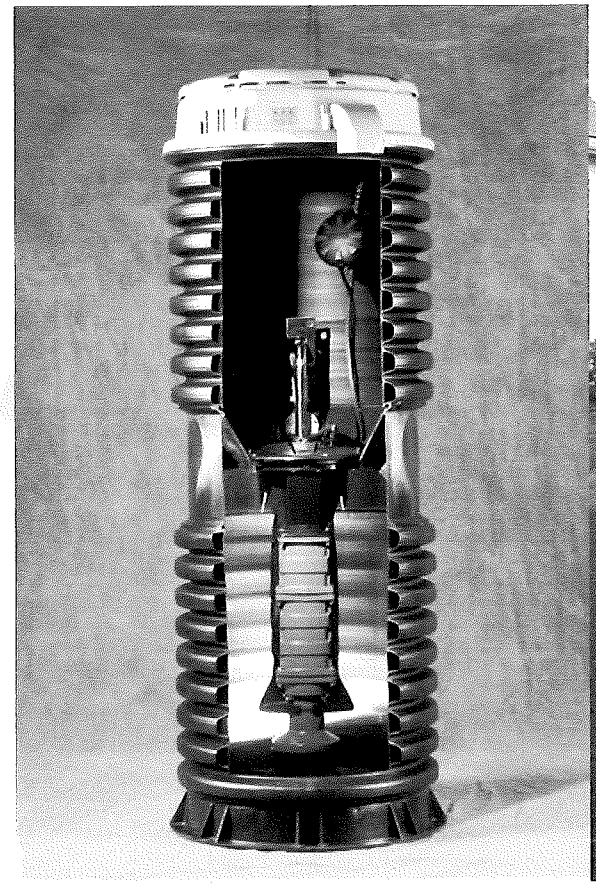
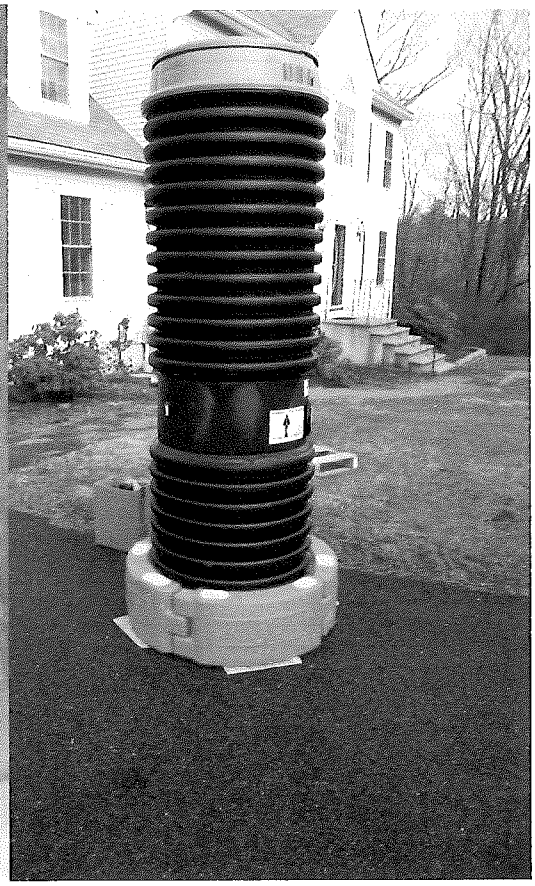
Pump models may be the DH071-93 (standard height) for outdoor use or the Model IH091 indoor unit. Both products are UL listed NSF and CSA certified.

Model DH071-93 Outdoor Pump With Bal-Last™

The outdoor model is complete - ready for installation and connection to exterior plumbing and power supply. This unit is fully tested for operation and factory leak tested. No assembly is required and there are no floats to adjust. The pump is furnished complete with the alarm panel and direct bury power supply cable. Standard cable length is 32 feet with 50, 75, and 100 and up to 150 foot cables available. (See Alarm Panel options above)





Other station configurations are available for higher flow requirements. Please contact us for more information. Additional information may be found at www.eone.com

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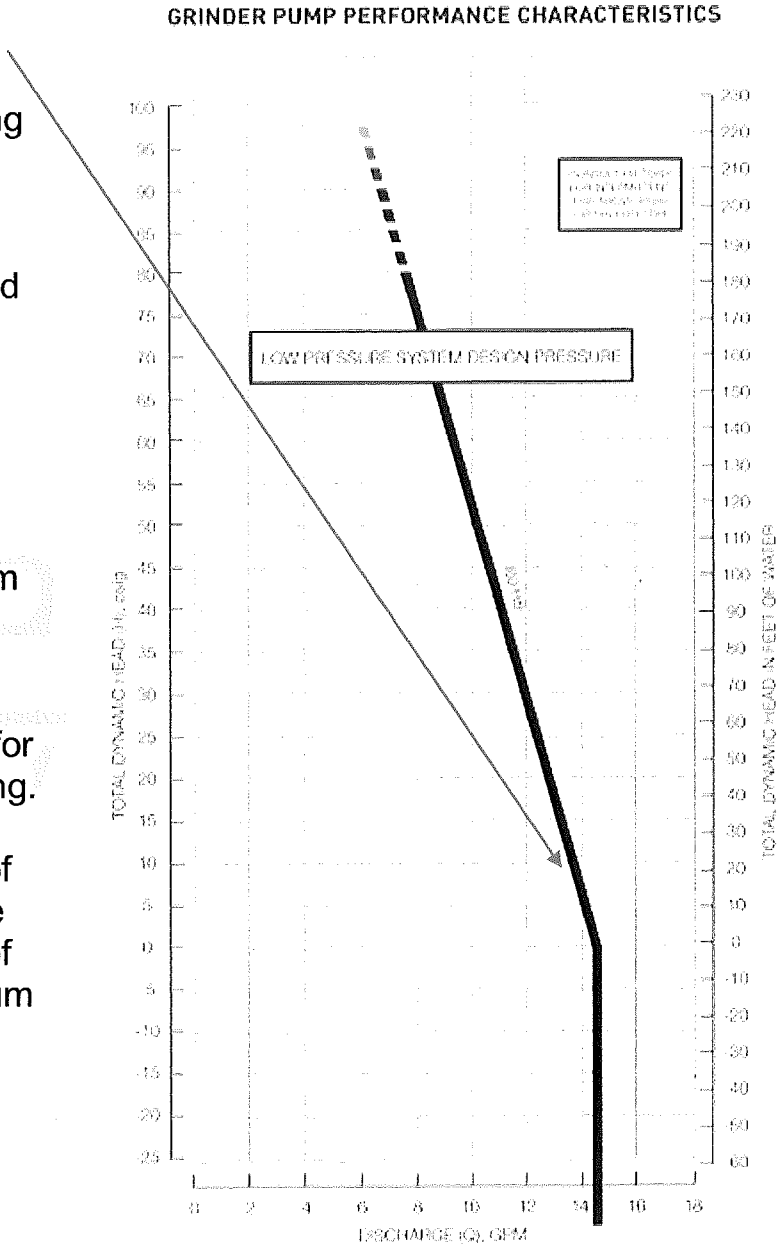
Operation Conditions

17.56 Feet is the highest TDH at simultaneous operating conditions with the expected number of pumps operating in each zone, or the head of an individual pump operating in a single zone condition.

Operating range of E/One pumps from 0-185 feet TDH and from 0 to -60 feet TDH.

Anti-siphon valves in E/One cores provide for negative head pumping. In common systems with negative heads of 25-30 feet or more we recommend the use of combination air/vacuum release valves as described below.



e one
SEWER SYSTEMS
Environment One Corporation

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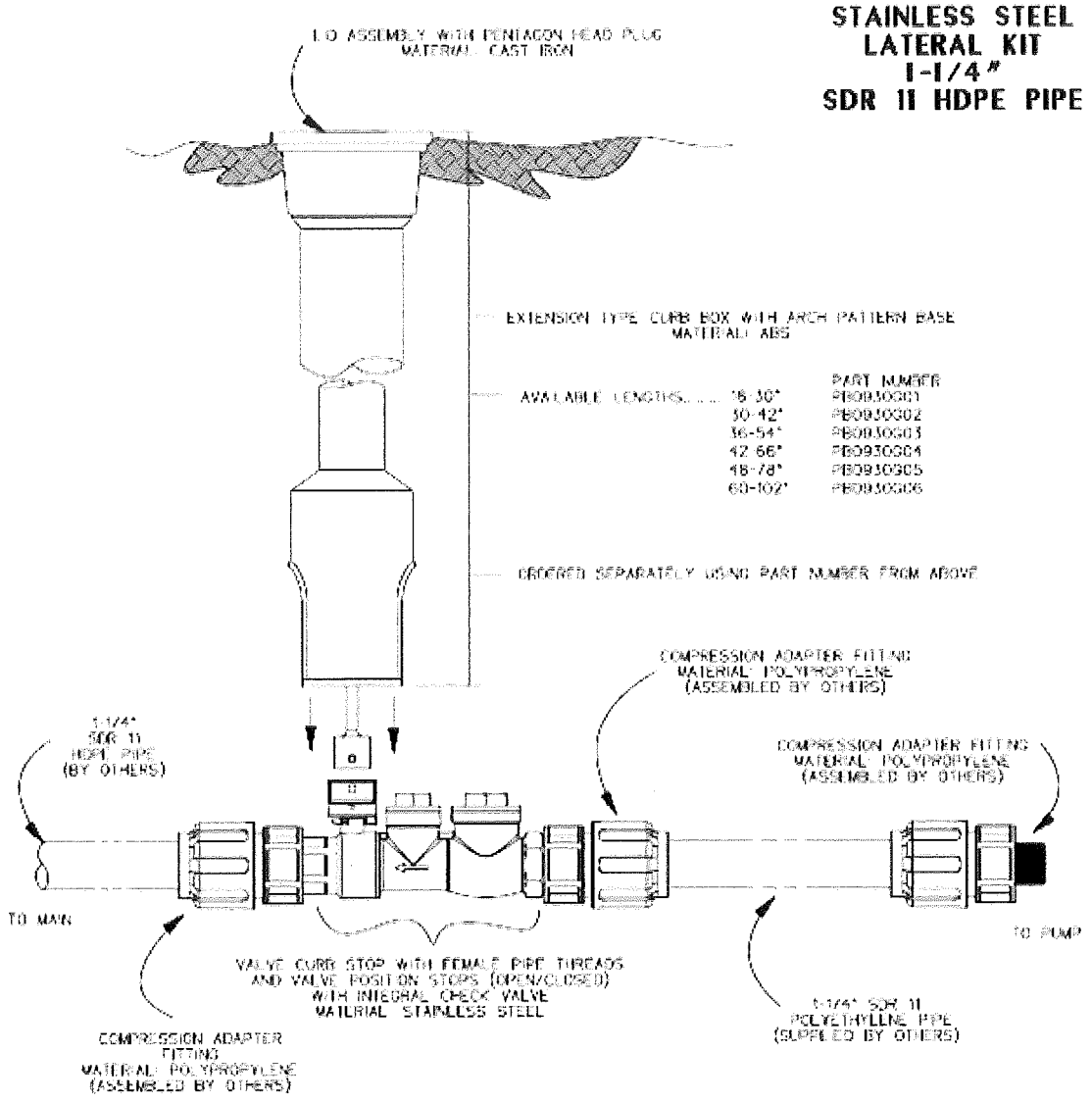
STAINLESS STEEL LATERAL KIT 1-1/4" SDR 11 HDPE PIPE



KIT PARTS ARE NOT ASSEMBLED

NOTES:

1. SS CURB STOP/CHECK VALVE AND FITTINGS ARE PROVIDED SEPARATELY, TO BE ASSEMBLED BY OTHERS
2. TO ASSEMBLE, APPLY A DOUBLE LAYER OF TEFLON TAPE, AND A LAYER OF PIPE DOPE (SUPPLIED BY OTHERS) TO THE THREADS ON THE PLASTIC FITTINGS AND INSTALL PER THE MANUFACTURER'S INSTRUCTIONS
3. ASSEMBLY IS TO BE PRESSURE TESTED (BY OTHERS)
4. ASSEMBLY IS TO BE USED WITH SDR11 HDPE PIPE
5. TO ORDER SS LATERAL KIT, USE PART NUMBER NC0193G01
6. CURB BOX IS TO BE ORDERED SEPARATELY, SEE ABOVE

SGS	ON	11/02/11	A	3/16
DR BY	CHK'D	DATE	ISSUE	SCALE

e/one SEWER SYSTEMS

STAINLESS STEEL LATERAL KIT
1-1/4" SDR 11 HDPE PIPE

NA0330P02

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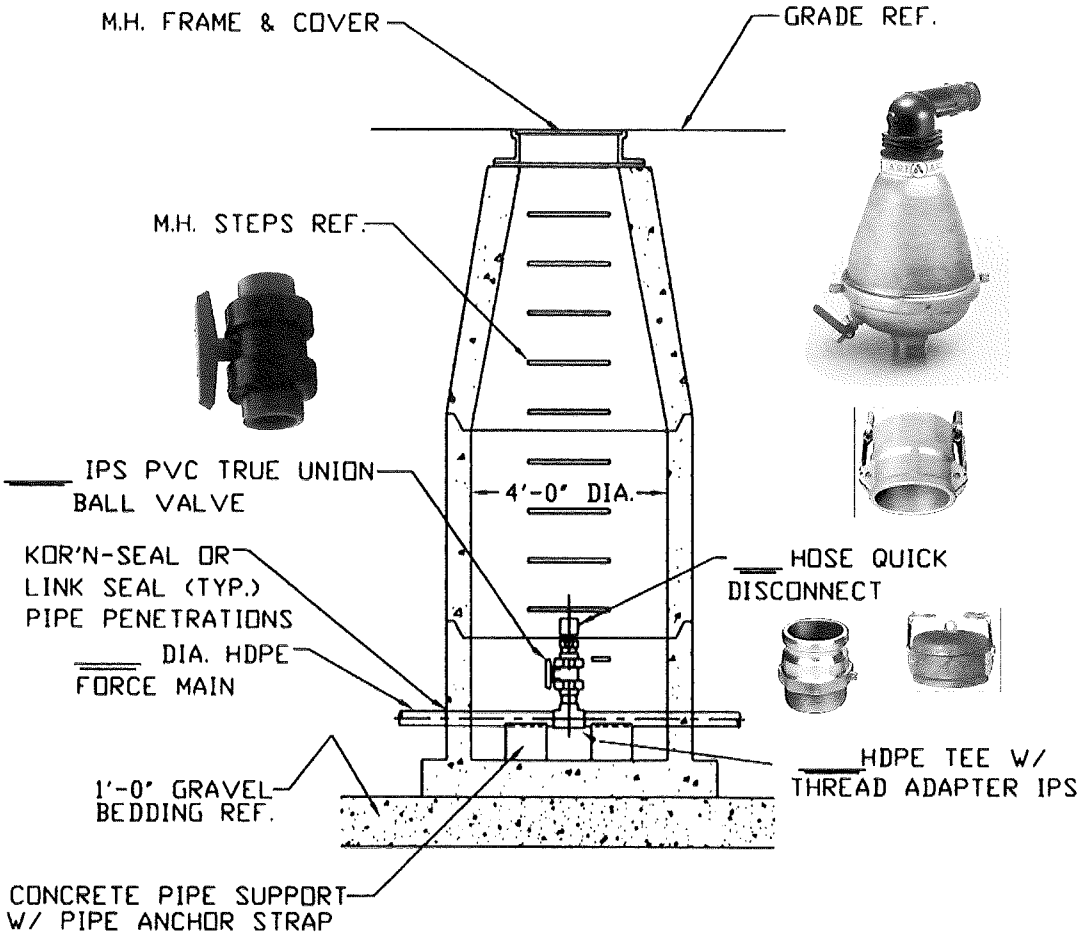
Typical Cleanout Detail
(Optional Air/Vacuum Valve shown –right)



TYPICAL ELEV. VIEW

Cleanout detail can be modified to match typical installation needs. Inline shut offs may be added to isolate flow direction. Image shown is flow through cleanout. These structures can be terminal end of line cleanouts, or junction cleanouts as may be required. Inline isolation valves are also recommended. Optional air and vacuum relief valves may be added when required.

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Pressure Sewer System Monitoring (Option)

We are pleased to introduce the **GRINDER PUMP GUARDIAN** system from High Tide Technologies, Inc. This remarkable system has the ability to track and monitor performance of pressure sewer system grinder pumps as well as that of main lift stations.

The **GRINDER PUMP GUARDIAN** is a cost effective solution to wirelessly monitor the health or status of individual grinder pumps. The **GPG** System consists of compact wireless modules for each grinder control panel. The system uses a neighborhood collector to transmit alarm data via satellite or cellular service to a central server and a web based application to view current status and historical information.

When any pump is in Alarm, the **GPG** System automatically notifies maintenance staff of the street address via voice or text message.

Utility personnel or service providers can view the status of every pump in their system from any Internet-connected computer, thus eliminating drive-by expenses and time.

We offer this on new projects and on septic tank replacement projects as a means to improve service reliability and to reduce service costs. This is a system that we think you may find useful for projects of this nature.

System Components

- HTT Model 1100 A/C Powered Collector available with cellular or satellite communications. Used to monitor lift stations and GPG Units.
- Collector can communicate with main lift station as well as up to 180 GPG remotes, depending on terrain.
- Guardian Remotes are A/C powered. They easily connect to alarm panel and are available in simplex and duplex models.
- Universal system works with all manufacturers' control boxes.
- Integrated system using mesh radio based remotes with wireless communication to collector.
- Collector can monitor up to 8 digital and 4 analog inputs at your lift station.

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- Web Based software www.gpgview.com.

System Benefits

- Monitors and reports alarms on high water and power failure.
- Alerts service personnel on excessive pump starts and stops and runtimes.
- Start/Stop and runtime alerts will provide advance notice of upcoming service needs.
- Manage labor force more efficiently.
- Reduces overtime labor by allowing for preemptive service
- Make timely maintenance repairs to reduce costly pump overhauls.
- Timely notification avoids tank overflows.
- Reduce gas & vehicle use.
- No more driving around looking for "red lights".

Reporting

- User defined 24 hour totals.
- Tailor reports and screens as desired.
- Download, print and modify reports as desired
    - Equipment run-times.
    - Equipment starts/stops.
    - Time-Stamped Alarm events to eliminate doubt when an alarm came in.
    - Store and view alarm history reports.
    - Store and view service history records.

Mapping Component

- Provides a map view of Guardian locations and unit status.
- Locate stations with GPS.
- See the status of all pumps at a glance.
- Provides a full overview of service area.

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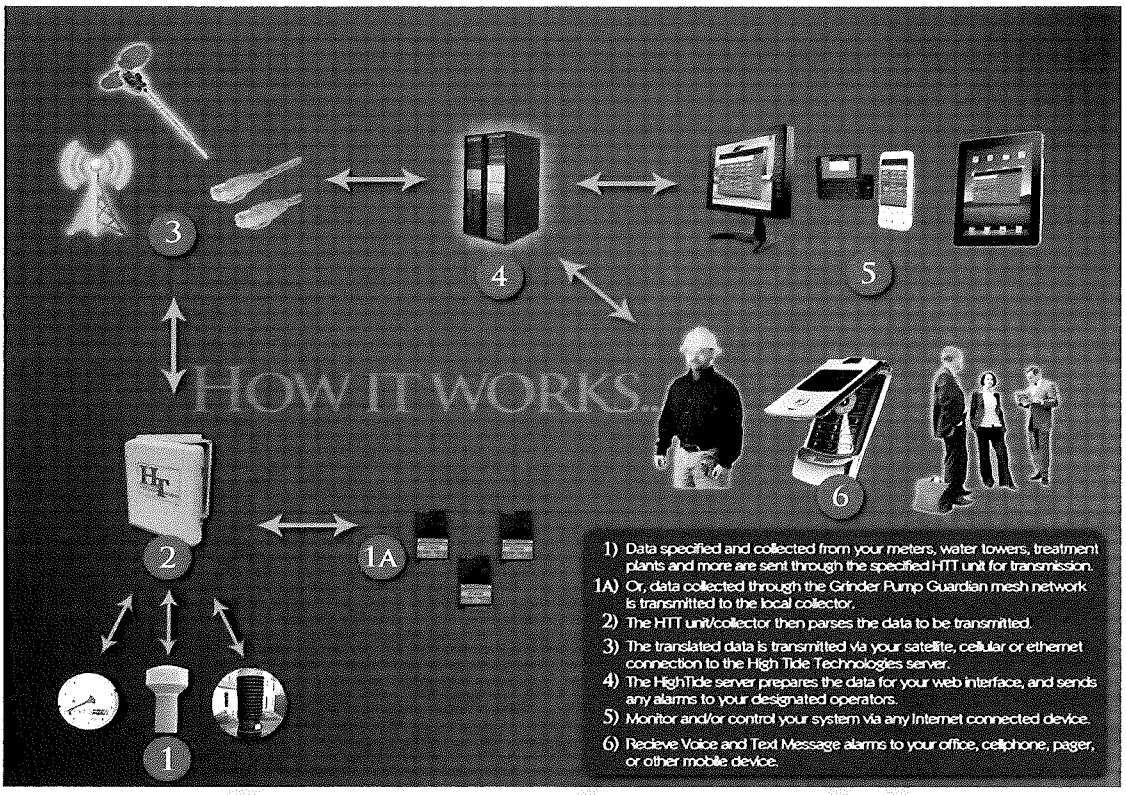

Grinder Pump GUARDIAN

The High Tide system comes with all of the necessary hardware and equipment and is ready to install and go live! No software licenses or radio licenses are needed. HTT updates software throughout the year. It works with any grinder pump system.

The Collector can be used to monitor lift station conditions. Monitor run times; start/stop cycles, wet well levels all from your office, laptop or smartphone. We have larger collectors to add other items to your lift station monitoring. Monitor chemical feed rates, or meters that provide an output signal.

Operating and ownership costs are the lowest in the industry and provide a wide range of functionality. System managers can monitor all of their grinder pumps for pennies each month.

The cost savings of just a few avoided overtime calls will pay for most systems.

1) Data collected from your meters, water towers, treatment plants, and more are sent through the HTT unit for transmission.

1A) Data collected through the Grinder Pump Guardian mesh network is transmitted to the local collector.

2) The HTT unit/collector then parses the data to be transmitted.

3) The translated data is transmitted via your satellite, cellular or ethernet connection to the High Tide Technologies server.

4) The High Tide server prepares the data for your web interface, and sends any alarms to your designated operators

5) Monitor and or control your system via any internet connected device.

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