

APPENDIX C

LOW PRESSURE SEWER DESIGN REPORT

Brower Woods

Low Pressure Sewer Design

**Water
ReSource
Technologies**



Brandon Shugart – Applications Engineer
Water Resource Technologies, LLC
Your Source for LPS Design and Supply

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Section 1 - Introduction

A. Project Description

Brower Woods is a residential subdivision that consists of 100 homes that are currently being serviced by septic tanks. The Mattituck Wastewater Department is evaluating the feasibility of upgrading the subdivision to city sewer that will connect to an off-site wastewater treatment facility.

B. Project Map

Brower Woods subdivision is in Mattituck, New York bounded by north property line of the residences on the north side of Woodcliff Drive to the north, Grand Avenue to the east, and Mattituck Creek to the west and south as shown in Figure 1.



Figure 1 - Project Area from Google Earth

C. Future Land Use

The site is zoned residential and appears to be almost fully developed.

Section 2 – Design Requirements

The main design requirements are to provide a low cost solution for a sewer collection system without the need for a master lift station and deep excavations. Other goals include keeping disruption and environmental impacts to a minimum and avoid inflow and infiltration by reducing stormwater impacts at the receiving wastewater treatment plant. The design should also incorporate prepackaged Environment One stations with SPD grinder pumps and wet well / dry well basins.

Section 3 – Design Constraints

A. Topography

Based on information found on Google Earth (Google Earth, 2013) the project area is relatively flat with moderate slopes suggesting that a trenching method of force main installation is practical.

B. Force main location

The force main will be located in the right-of-ways of the project area. The force main will be routed to avoid existing utilities and maintain the required separation of potable water mains. A profile view generated from Google Earth is shown below in Figure 2 .

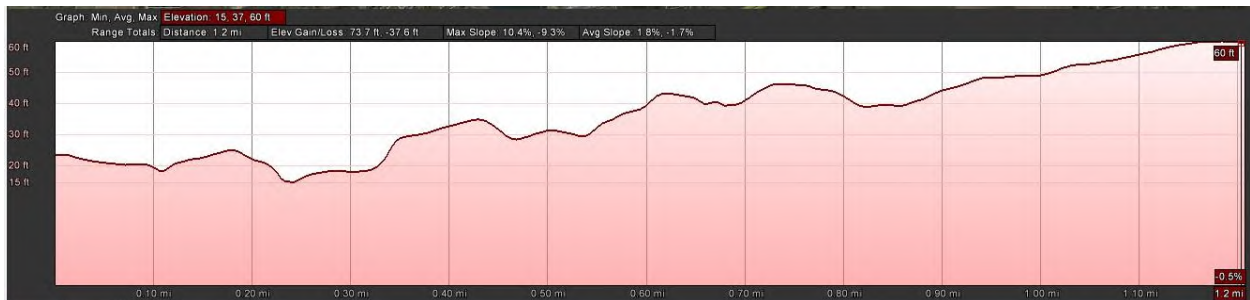


Figure 2 - Force Main profile from Google Earth (2013).

C. Discharge location

The discharge location is a proposed wastewater treatment facility at the corner of Reeve Road and East Mill Road.

D. Pipe sizing constraints

The force main throughout the project shall be sized to a minimum to ensure velocities greater than 2.0 feet per second (fps) to achieve pipe scouring and less than 4.0 fps to avoid water hammer effects. It is assumed that no other properties will be serviced with this project's force main so the pipe size should also be limited as to not allow the addition off site connections to the system.

Section 4 - Flow Calculations

This section outlines the procedure to estimating the average daily flow for a typical home within the project area and determines the flows that will impact the existing sewer system.

A. Average Daily Flow

Published guides for Suffolk County were used for estimating sewer. The following is a summary of the calculated flows that were used in the design:

Residential Single Family per dwelling unit:

3 bedrooms home = 300 GPD

$$\text{ADF} = (300 \text{ GPD}) / (24\text{hr} \times 60 \text{ min/hr}) = 0.21 \text{ gallons per minute (GPM)}$$

Flows at treatment facility:

(100 homes X 300 GPD) = 30,000 GPD

$$\text{ADF} = (30,000 \text{ GPD}) / (24\text{hr} \times 60 \text{ min/hr}) = 20.83 \text{ GPM}$$

(based on a 24 hour design day period)

Due to the individual storage capacity at each home, pump stations throughout the system run at different times. Therefore a more appropriate flow rate for the treatment plant should be based off the analysis in Section 5 of this report.

Maximum flow rate = 99 GPM in Zone 24.

Section 5 – Hydraulic Analysis

This section outlines the design of low pressure sewer system. It discussed the methodology used, additional design assumptions and constraints, and shows the calculations that were necessary to complete the design. A cost estimate breakdown is provided at the end of this section.

Methodology

The preliminary pressure sewer pipe sizing analysis was performed using the data collected. This was run through the Environment One Low Pressure Sewer Design Software that employs their Flow Velocity and Friction Head Loss vs. Pumps in Simultaneous Operation Spreadsheet (R. Paul Farrell, 2000) as shown in Figure 3.

Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15
345-377	16
378-410	17
411-443	18
444-476	19
477-509	20
510-542	21
543-575	22
576-608	23
609-641	24
642-674	25
675-707	26
708-740	27
741-773	28
774-806	29
807-839	30
840-872	31
873-905	32
906-938	33
939-971	34
972-1,004	35

Figure 3 - Maximum number of grinder pump cores operating daily.

Calculations

Figure 4 shows the results of the pipe sizing analysis. Computations are based on the Hazen-Williams formula for friction loss (Equation 1), using calculations of cross-sectional area and flow rate to determine pipe sizes that create “self-cleaning” velocities of approximately 2.0 fps or higher. A “C” factor of 150, SDR 11 High Density Polyethylene (HDPE 4710) pipe and daily flow per unit of 300 gallons per day are also used.

$$h_L = \frac{4.73L}{C^{1.85}D^{4.87}}Q^{1.85} \quad (\text{Equation 1})$$

Where:

L = the length of pipe in feet

C = Hazen-Williams roughness coefficient

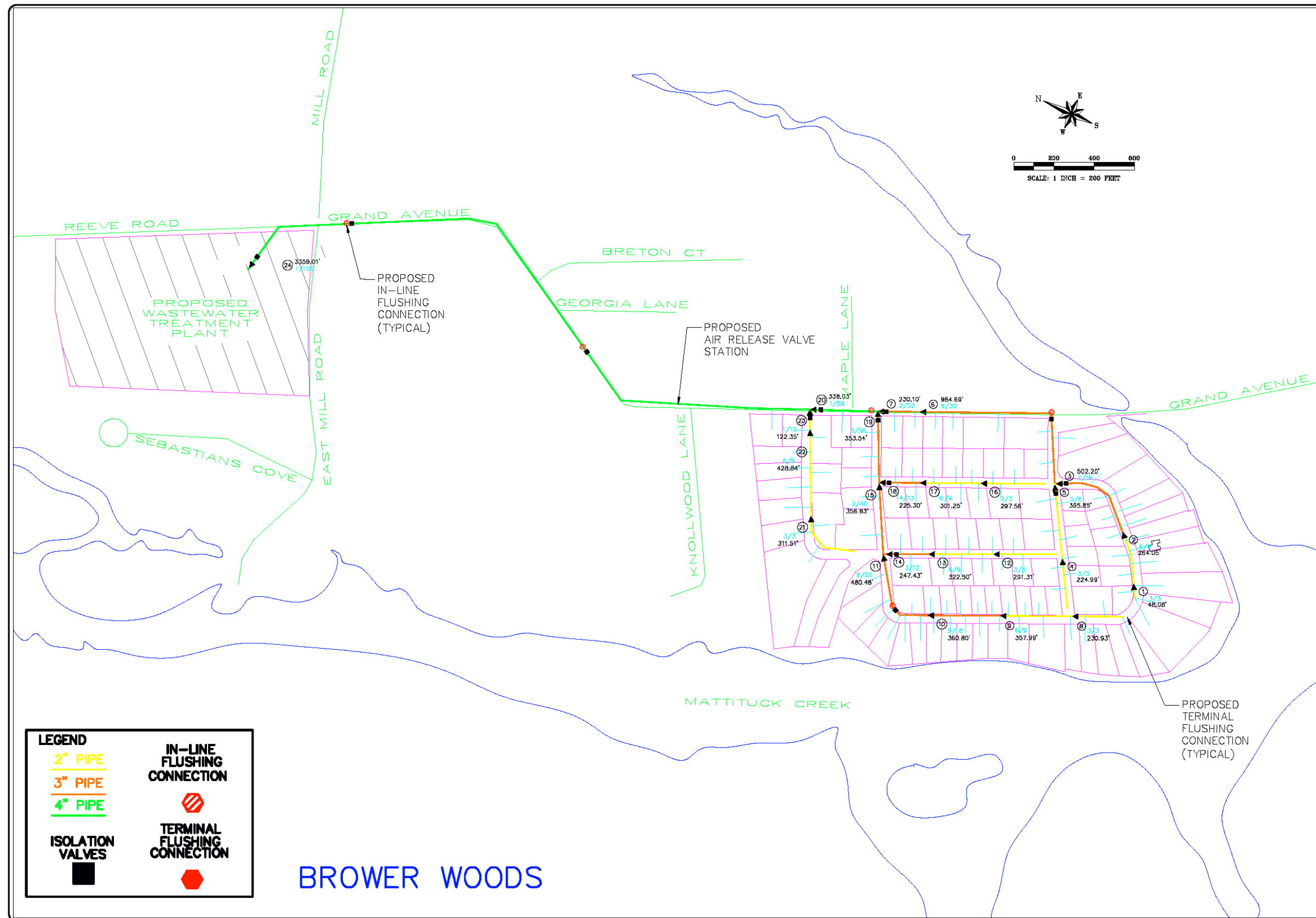
D = the pipe diameter in feet

Q = the flow rate ft^3/sec

There are 100 grinder pumps represented in the following hydraulic model of the proposed system. The model is composed of 24 “zones” illustrating the hydraulic character of each section of the system as shown in Figure 5 below. The highest Total Dynamic Head generated is approximately 116.85 feet. This is within the pump’s operating range of up to 185 feet. Flow velocity approximates or exceeds 2.0 feet per second throughout the system. These characteristics and low retention time indicate a reliable, low-maintenance system.

Zone Number	Destination Zone	Number Of Cores Connected This Zone	Accumulated Total Of Cores This Zone	Residential Connection EDUs	Accumulated Residential EDUs	Maximum Number Of Simultaneous Operations	Maximum Flow In GPM	Pipe Size (Inch)	Actual Pipe Inside Diameter	Maximum Velocity (FPS)	Length Of Main This Zone	Friction Loss Factor (FT/100 FT)	Friction Loss This Zone	Accumulated Friction Loss (Feet)	Maximum Main Elevation	Minimum Pump Elevation	Static Head (Feet)	Total Dynamic Head (Ft)	Gal Per 100 Lineal Feet	Capacity Of Zone	Average Daily Flow	Average Fluid Changes Per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
Pipe diameters used for (unless otherwise noted) :				SDR 11 PE Pipe (US)							Power: 240 Volt 60 Hz							Constant for inside roughness of "C" = 150						
1.00	2.00	3.00	3.00	3.00	3.00	2	21	2.00	1.92	2.36	48.08	1.19	0.57	59.99	60.00	15.00	45	104.99	14.99	7.21	900	124.85	0.19	4.02
2.00	3.00	6.00	9.00	6.00	9.00	3	33	2.00	1.92	3.61	264.05	2.62	6.91	59.41	60.00	20.00	40	99.41	14.99	39.59	2,700	68.20	0.35	3.82
3.00	6.00	7.00	16.00	7.00	16.00	4	44	3.00	2.83	2.27	502.20	0.71	3.55	52.51	60.00	20.00	40	92.51	32.58	163.63	4,800	29.34	0.82	3.47
4.00	5.00	3.00	3.00	3.00	3.00	2	21	2.00	1.92	2.38	224.99	1.21	2.72	62.37	60.00	20.00	40	102.37	14.99	33.73	900	26.68	0.90	4.15
5.00	6.00	5.00	8.00	5.00	8.00	3	33	2.00	1.92	3.68	395.85	2.70	10.69	59.65	60.00	25.00	35	94.65	14.99	59.35	2,400	40.44	0.59	3.25
6.00	7.00	6.00	30.00	6.00	30.00	5	55	3.00	2.83	2.83	984.69	1.06	10.41	48.96	60.00	15.00	45	93.96	32.58	320.83	9,000	28.05	0.86	2.65
7.00	20.00	2.00	32.00	2.00	32.00	6	71	3.00	2.83	3.64	230.10	1.69	3.89	38.55	60.00	25.00	35	73.55	32.58	74.97	9,600	128.05	0.19	1.80
8.00	9.00	3.00	3.00	3.00	3.00	2	20	2.00	1.92	2.26	230.93	1.09	2.52	66.85	60.00	10.00	50	116.85	14.99	34.62	900	25.99	0.92	4.41
9.00	10.00	6.00	9.00	6.00	9.00	3	31	2.00	1.92	3.42	357.99	2.36	8.44	64.33	60.00	10.00	50	114.33	14.99	53.67	2,700	50.31	0.48	3.49
10.00	11.00	9.00	18.00	9.00	18.00	4	43	3.00	2.83	2.20	360.80	0.67	2.41	55.89	60.00	15.00	45	100.89	32.58	117.55	5,400	45.94	0.52	3.01
11.00	15.00	8.00	26.00	8.00	26.00	5	54	3.00	2.83	2.78	480.48	1.03	4.93	53.48	60.00	15.00	45	98.48	32.58	156.55	7,800	49.82	0.48	2.49
12.00	13.00	3.00	3.00	3.00	3.00	2	22	2.00	1.92	2.42	291.31	1.25	3.64	62.76	60.00	25.00	35	97.76	14.99	43.67	900	20.61	1.16	4.14
13.00	14.00	6.00	9.00	6.00	9.00	3	33	2.00	1.92	3.68	322.50	2.71	8.74	59.12	60.00	25.00	35	94.12	14.99	48.35	2,700	55.84	0.43	2.97
14.00	15.00	3.00	12.00	3.00	12.00	4	46	3.00	2.83	2.33	247.43	0.74	1.83	50.38	60.00	25.00	35	85.38	32.58	80.62	3,600	44.66	0.54	2.55
15.00	19.00	2.00	40.00	2.00	40.00	6	69	3.00	2.83	3.52	356.83	1.59	5.66	48.55	60.00	25.00	35	83.55	32.58	116.26	12,000	103.22	0.23	2.01
16.00	17.00	3.00	3.00	3.00	3.00	2	22	2.00	1.92	2.47	297.56	1.30	3.86	56.97	60.00	25.00	35	91.97	14.99	44.61	900	20.17	1.19	3.82
17.00	18.00	6.00	9.00	6.00	9.00	3	34	2.00	1.92	3.76	301.25	2.82	8.49	53.11	60.00	25.00	35	88.11	14.99	45.16	2,700	59.78	0.40	2.63
18.00	19.00	4.00	13.00	4.00	13.00	4	46	3.00	2.83	2.38	225.30	0.77	1.73	44.62	60.00	25.00	35	79.62	32.58	73.41	3,900	53.13	0.45	2.23
19.00	20.00	3.00	56.00	3.00	56.00	7	85	3.00	2.83	4.33	353.54	2.33	8.23	42.89	60.00	35.00	25	67.89	32.58	115.19	16,800	145.85	0.16	1.78
20.00	24.00	1.00	89.00	1.00	89.00	8	99	4.00	3.63	3.07	338.03	0.92	3.12	34.66	60.00	35.00	25	59.66	53.85	182.02	26,700	146.69	0.16	1.61
21.00	22.00	3.00	3.00	3.00	3.00	2	22	2.00	1.92	2.42	311.51	1.24	3.87	53.64	60.00	15.00	45	98.64	14.99	46.70	900	19.27	1.25	3.41
22.00	23.00	6.00	9.00	6.00	9.00	3	33	2.00	1.92	3.67	428.84	2.70	11.57	49.78	60.00	15.00	45	94.78	14.99	64.29	2,700	41.99	0.57	2.17
23.00	24.00	1.00	10.00	1.00	10.00	4	48	2.00	1.92	5.37	122.35	5.44	6.66	38.20	60.00	30.00	30	68.20	14.99	18.34	3,000	163.55	0.15	1.59
24.00	0.00	1.00	100.00	1.00	100.00	8	100	4.00	3.63	3.10	3359.01	0.94	31.54	31.54	60.00	35.00	25	56.54	53.85	1808.72	30,000	16.59	1.45	1.45
Totals/Max		100.00									11,035.62		67		50		117							

Figure 4 -Hydraulic analysis based on use of Environment One SPD pumps.



REVISIONS

BROWER WOODS HYDRAULIC LAYOUT

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MATTITUCK (LONG ISLAND)

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1 of 1

Figure 5 - Low pressure force main layout per WRT.

Section 6 – Recommended Design

Recommended Design

This section outlines the system components recommended based on the assumptions in the design criteria section and the completed hydraulic analysis.

Station Selection

The size, efficiency and operating economy of the DH071 (shown in Figure 6) makes it the best choice for single dwellings, waterfront property, subdivision developments and marinas. The DH071 is ideally suited for both new and existing communities. The DH071 grinder pump station is a complete unit that includes: the grinder pump, check valve, HDPE (high density polyethylene) tank and controls. The DH071 is packaged into a single complete unit, ready for installation. All solids are ground into fine particles, allowing them to pass easily through the pump, check valve and small diameter pipelines. Even objects not normally found in sewage, such as plastic, rubber, fiber, wood, etc., are ground into fine particles. The 1 1/4-inch discharge connection is adaptable to any piping materials, thereby allowing us to meet your local code requirements. The tank is made of tough corrosion resistant HDPE. The optimum tank capacity of 70 gallons is based on computer studies of water usage patterns. A single DH071 is ideal for one, average single-family home and can also be used for up to two average single-family homes where codes allow and with consent of the factory. This model can accommodate flows of 700 GPD. The internal check valve assembly, located in the grinder pump, is custom-designed for non-clog, trouble-free operation. The grinder pump is automatically activated and runs infrequently for very short periods. The annual energy consumption is typically that of a 40-watt light bulb. Units are available for indoor and outdoor installations. Outdoor units are designed to accommodate a wide range of burial depths.

Station comes complete with simplex control panel. Many different panel configurations are available to meet contractor/homeowner preferences and specific local requirements. Enclosed in this report are the specifications and technical details for the package



Figure 6 - Environment One DH071 Grinder Pump Station.

Station Selection – Alternative

Suffolk County may require a duplex pump station for each home. In such an event Environment One's DH152 (shown in Figure 7) is rated for 3,000 GPD and has a greater storage capacity than the DH-071 model. The size, efficiency and operating economy of the DH152 make it an ideal choice for larger residential homes, multiple dwellings, waterfront property, subdivision developments and marinas. The DH152 is ideally suited for both new and existing communities. The DH152 grinder pump station is a complete unit that includes: two grinder pumps with check valves, HDPE (high density polyethylene) tank and controls. The DH152 is packaged into a single complete unit, ready for installation. All solids are ground into fine particles, allowing them to pass easily through the pump, check valve and small diameter pipelines. Even objects not normally found in sewage, such as plastic, rubber, fiber, wood, etc., are ground into fine particles. The 1-1/4-inch discharge connection is adaptable to any piping materials, thereby allowing it to meet local code requirements. The tough, corrosion-resistant tank is made of HDPE (high density polyethylene). The optimum tank capacity of 150 gallons is based on computer studies of water usage patterns. A single DH152 is ideal for small commercial use. The internal check valve assembly, located in each grinder pump, is custom-designed for non-clog, trouble-free operation. The grinder pump is automatically activated and runs infrequently for very short periods. The annual energy consumption is typically that of a 40-watt light bulb. Units are designed to accommodate a wide range of burial depths.

Station comes complete with alternating duplex panel. Many different panel configurations are available to meet contractor/homeowner preferences and specific local requirements. See Appendix B for additional product information and Appendix C for specifications.



Figure 7 - Environment One DH152-93 Grinder Pump Station.

Pipe, Valves, and Fittings

This section outlines all the various system components required for a well operating low pressure sewer design. Complete product information for everything mentioned in this section is enclosed with this report.

Force Main

It is recommended that a uniform cover be over the force main per local code or for frost protection. Trenchless methods, such as directional drilling, are recommended for infrastructure improvements to reduce any disruption in the project area. High Density Polyethylene (HDPE 4710) SDR 11 pipe is recommended for use with directional boring or open trench cuts. HDPE pipe is a superior product that is field welded to provide a seamless pipe network that has a 100 year life expectancy. By eliminating mechanical and glue joints it reduces overall construction cost and eliminates potential I & I problems that are inherent with all other pipe networks. No boring conflicts or dewatering activities are foreseen.

Lateral Kits

All Environment One grinder pumps have an integrated check valve on the pump, but as an added protection WRT Lateral Kits, which consist of one (1) 1-1/4" HDPE Check Valve and one (1) 1-1/4" HDPE Ball Valve, are recommended to be installed in the discharge line between the pump station and the discharge point to protect the pump stations from the high pressures of the force main and prevent any sanitary sewer overflows (SSO) in the event that a lateral line between a pump station and the force main connection is damaged. It is normally acceptable to have the lateral kit with the curb stop installed near other utility shut off valves for convenience of access. It is also acceptable in some cases to have it installed right at the pump station. A stainless steel Uni-lateral, which consists of a shut-off and a check valve integrated as one piece, is available as an alternative to the HDPE check valve mentioned above

Air Release Valve Stations

Air release valves (ARV) are an important tool for surge dampening and suppression. Accurate air valve specification, location and sizing are vitally essential for effective, efficient liquid flow and for sufficient pressure surge dampening and suppression. Since air bubbles tend to travel a short distance past a summit in the downstream direction, it is good practice to locate the ARV on a manifold about six feet long, located just past the summit on the downstream side. The following guidelines will avoid water hammer during massive air release if, as the last air leaves the line, a solid water column suddenly arrives at the vent opening. For manual valves, the vent opening should be less than one tenth the pipe diameter; for automatic valves, the opening should be either less than 1/10 or greater than 1/4 the pipe's diameter. The inherent ability to pump air/water mixtures is a strong point of semi-positive displacement pumps and a weakness of centrifugals. A centrifugal can become "airbound" from air in the casing or gas pockets in the pipeline. Especially troublesome are the so-called "running traps" created when a nominally flat line exhibits a series of shallow vertical undulations. These traps in series behave exactly as if the line were partially obstructed, creating a series of additive friction head losses. Since a centrifugal style pumps less at increased heads, the flow in an airbound line will decrease, the velocity will decrease correspondingly and the air bubble will grow larger. Ultimately, it is possible to drive the centrifugal back on its curve to "shutoff," at which point the system becomes inoperative. The inherent air pumping ability of an SPD pump, combined with its constant flow characteristic (even at abnormally high heads), means that it will not be rendered inoperative by these conditions that centrifugal pumps just can't handle.

Combination air release valves stations which consist of an HDPE basin (traffic bearing and non-traffic bearing models are available), a shut-off valve, and an isolation valve. General recommended valve placement is just beyond peaks of 25 feet or more on the down flow side of the peak and/or at intervals of 2,000 to 2,500 feet. One ARV is recommended for this system. It is recommended that it be installed on Grand Avenue just north of Knollwood Lane as shown in Figure 5. ARV's can also be equipped with a cam and groove fitting to double as an in-line flushing connection.

Flushing connections

Flushing connections, sometimes referred to as cleanout valves, are used only in the rarest of occasions to remove any blockages that may occur and to maintain the force main by cleaning them with large volumes of fresh water as prescribed by local municipalities. Flushing connections are vital to any low pressure sewer system that will be developed in phases. During construction the designed flow rates may not be achieved resulting in a velocity lower than the scouring velocity of 2.0 fps. In that case suspended solids have the potential to fall out during long periods of non-use and may contribute to a blockage over time. It is recommended that these be installed at 1,000 to 1,500 feet intervals and at branch ends and junctions.

Isolation Valves

Isolation valves are used to isolate (shut-off) a particular branch of the force main for maintenance activities such as flushing of the lines. They are also often used to isolate force mains that are not in use – especially when a development is constructed in phases. Isolation valves consist of an HDPE ball valve with a curb box for access. Curb boxes designs are available to accommodate on street (traffic rated) and off street locations. It is recommended that these be installed at all branch junctions. Isolation valves are integral parts to ARV's and Flushing connections stations.

Section 7 – Budget Information

Brower Woods – Mattituck, New York
Grinder Pump Pressure Sewer Collection System
System Cost
Prepared for Natural Systems Utilities

Qty	Item	Unit Cost	Extended Cost
9500 LF	1 1/4" HDPE SDR 9	\$1.05	\$9,975.00
3600 LF	2" HDPE SDR 11	\$2.05	\$7,380.00
3800 LF	3" HDPE SDR 11	\$3.10	\$11,780.00
3700 LF	4" HDPE SDR 11	\$4.75	<u>\$17,575.00</u>
	11,600 Feet of HDPE Force Main		\$46,710.00
100	1 1/4" SS lateral kit assemblies	\$300.00	\$30,000.00
6	2" HDPE Terminal Flushing Connections	\$1,500.00	\$9,000.00
5	2" HDPE In-line Flushing Connections	\$1,550.00	\$7,750.00
13	HDPE Isolation Ball Valves	\$800.00	<u>\$10,400.00</u>
	Valves & Cleanouts		\$57,150.00
100	DH071-93 Simplex Station with Panel	\$4,213.00	\$421,300.00
	Stations		\$421,300.00
		Total Cost:	\$525,160.00
		Total Cost per home:	\$5,251.60
If Duplex Stations are required			
100	DH152-93 Duplex Station with Panel	\$8,586.00	\$858,600.00
	Stations		\$858,600.00
		Total Cost:	\$962,460.00
		Total Cost per home:	\$9,624.60

***** SEE DISCLAIMERS BELOW *****

Disclaimers:

- Does not include labor or installation costs.
- Does not include applicable taxes.
- We can only include costs for what is foreseen as needed; unforeseen costs (i.e. dewatering, permitting, special use fees, etc) are difficult to predict.

These figures do not include engineering, permits, easements, asphalt (Directional boring should keep asphalt repair and replacement to a minimum.), etc.

Works Cited

Google Earth. (2013, March 28). Retrieved March 28, 2013, from Google: <http://www.googlemaps.com>

R. Paul Farrell, J. (2000). *Handbook of Grinder Pumps and Pressure Sewer Systems*. Niskayuna, NY: Environment One Corporation.

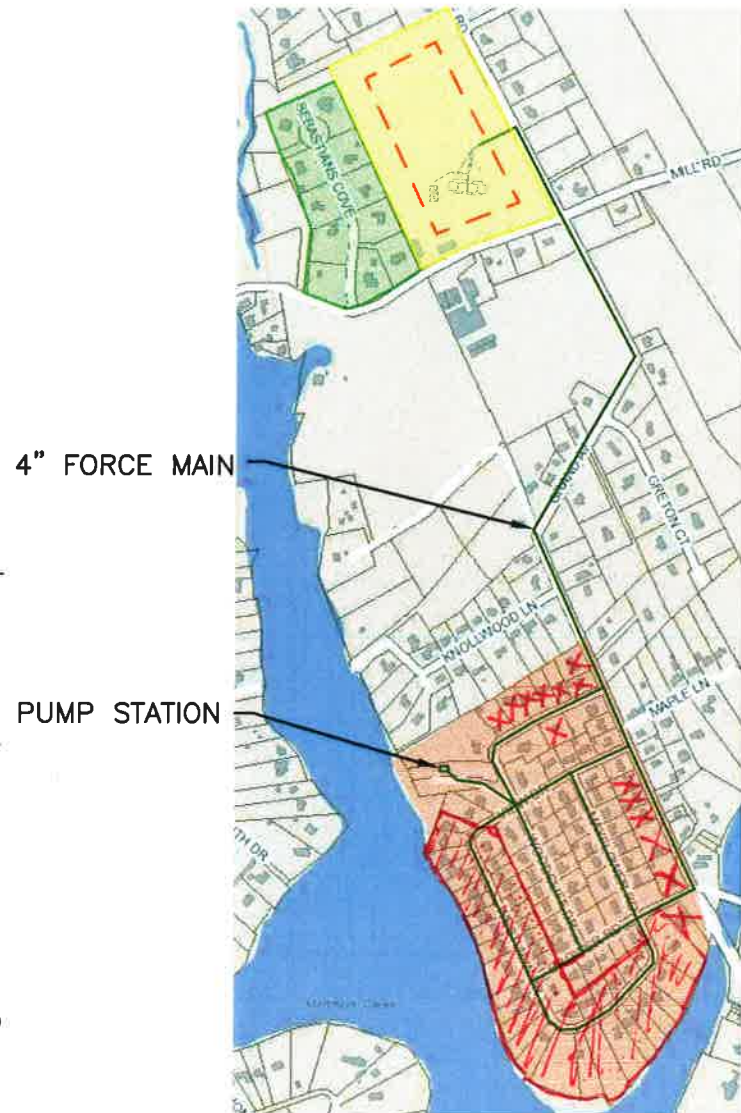
APPENDICES

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APPENDIX A: SITE LAYOUT & MAPS

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C:\Users\lshuler\Desktop\PGG\Mattituck\PGG_Site_Plan - Mattituck.dwg_6/28/2013 4:17:19 PM, DWG To PDF.pc3



BROWER WOODS SITE PLAN
COLLECTION SYSTEM
SCALE: 1" = 1000'

POTENTIAL ADDITION TO
SEWER SERVICE AREA

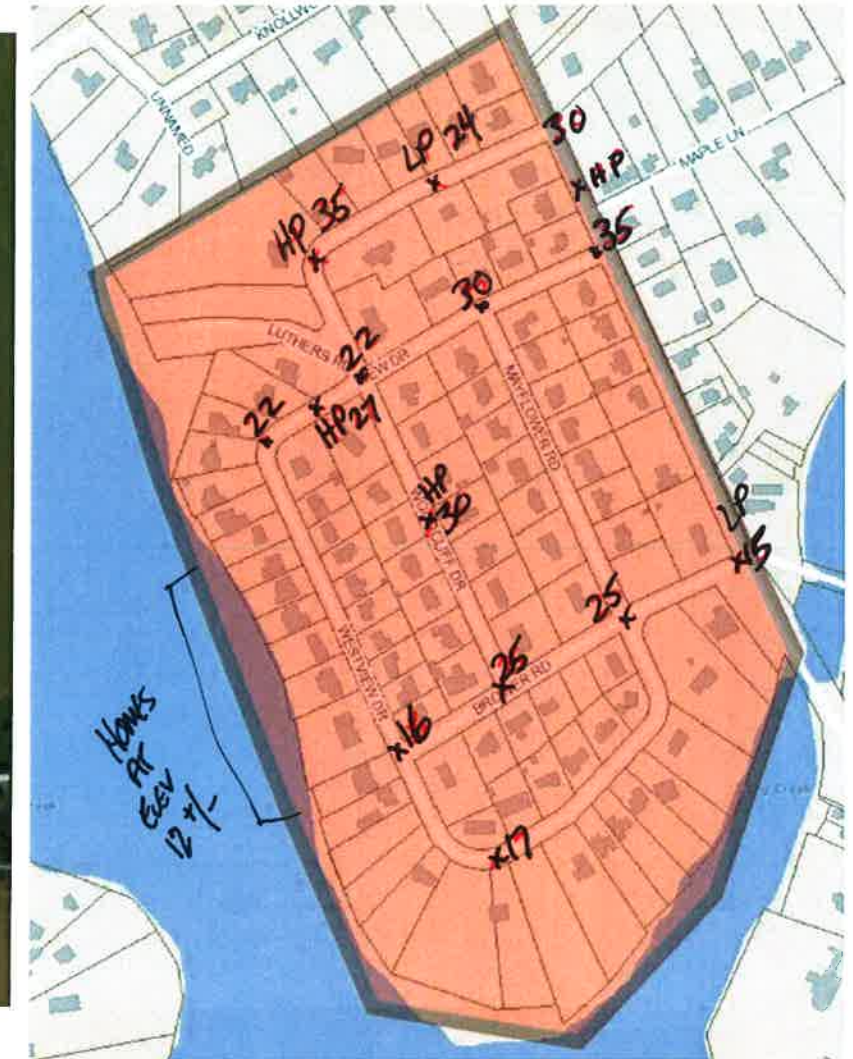
PROPOSED SEWER SERVICE AREA

PROPOSED WWTP LOCATION



ALTERNATIVE 1
NATURAL WASTEWATER TREATMENT PLANT
SCALE: NONE

14 HOMES REMOVED
43 ON LPS



SEWER SERVICE AREA
SCALE: NONE

REVISIONS	BROWER WOODS PROPOSED WWTP WASTEWATER SITE PLAN
	PECONIC GREEN GROWTH MATTITUCK, SUFFOLK, NY
	Edward A. Clerico P.E. LEED AP Disturbing Engineer NY License Number 023154 1
	2 CLERICO LANE, BUILDING 1 HILLSBOROUGH, NJ 08844
	DRAWN BY LMAS PROJECT ENG'R D. SMITH APPROVED
	DATE 6/18/2013 PROJECT ED1489AA
	USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES
	USE DIMENSIONS ONLY SCALE AS NOTED
	S1 - E01489AA

PERMITS

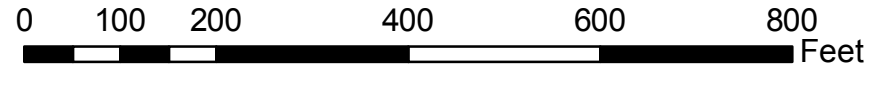
ED1489AA.S1



Date Saved: 6/27/2013



1 inch = 200 feet



NO.	DATE	REVISIONS

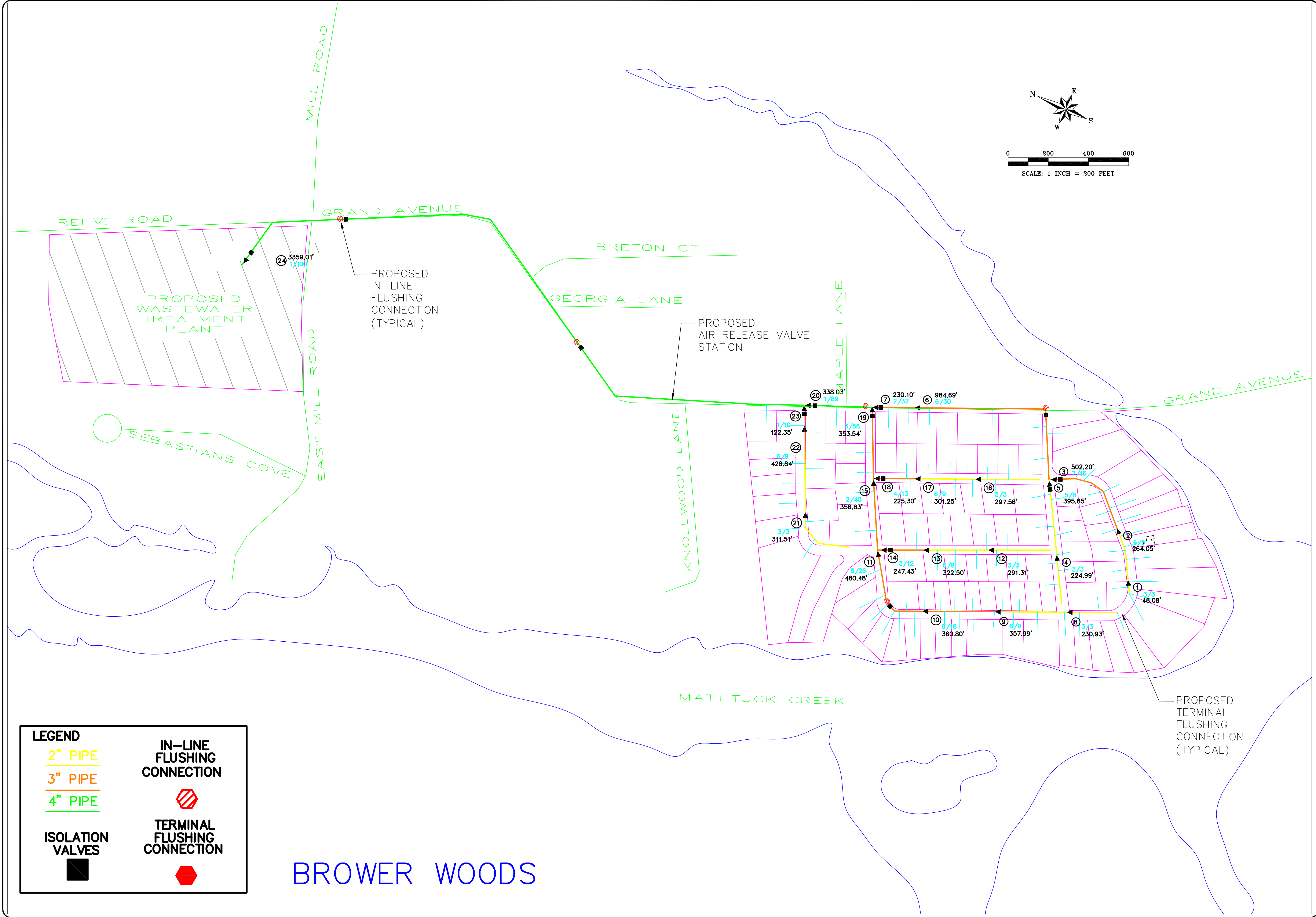
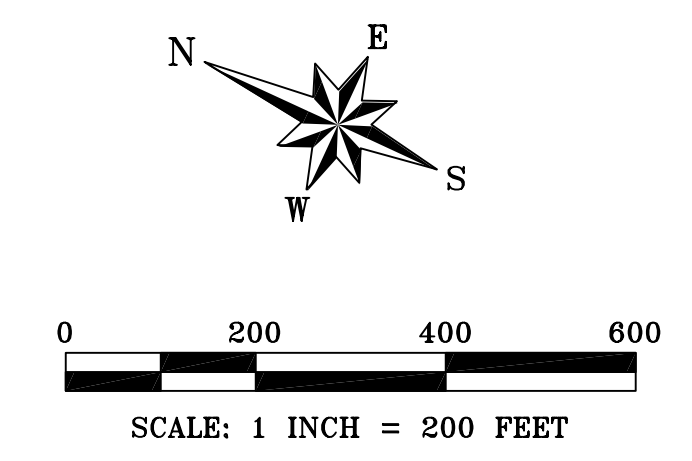
BROWER WOODS HYDRAULIC LAYOUT

Water ReSource Technologies, LLC.
 11221 St. Johns Industrial Pkwy North
 Jacksonville, FL 32246
 Office: (904) 928-0700
 Fax: (904) 928-0790
 WWW.WRTLCC.COM



SUFFOLK COUNTY, NEW YORK
 MATTITUCK (LONG ISLAND)

DRAWN BY: BJS
 DATE: 9/07/2013



LEGEND

2" PIPE	IN-LINE FLUSHING CONNECTION
3" PIPE	ISOLATION VALVES
4" PIPE	TERMINAL FLUSHING CONNECTION
ISOLATION VALVES	

BROWER WOODS

PROPOSED
 TERMINAL
 FLUSHING
 CONNECTION
 (TYPICAL)

PROPOSED
 IN-LINE
 FLUSHING
 CONNECTION
 (TYPICAL)

PROPOSED
 AIR RELEASE
 VALVE
 STATION

PROPOSED
 WASTEWATER
 TREATMENT
 PLANT

**Water Resource Technologies
Preliminary Pipe Sizing Analysis**

Your Name:

Brandon Shugart

Enter Project Header Line 1:

Brower Woods

Enter Project Header Line 2:

Natural Systems Utilities

Enter "C" Factor:

150

Select Pipe Type:

SDR 11 PE Pipe (US)

Enter GPD / Dwelling:

300

Select Power Requirements:

240 Volt 60 Hz



PRELIMINARY PRESSURE SEWER -- PIPE SIZING AND BRANCH ANALYSIS

Water Resource Technologies
 Connecticut - Florida - Georgia - New Jersey - New York
 877.978.4286



Zone Number	Destination Zone	Number Of Cores Connected This Zone	Accumulated Total Of Cores This Zone	Residential Connection EDUs	Accumulated Residential EDUs	Maximum Number Of Simultaneous Operations	Maximum Flow In GPM	Pipe Size (Inch)	Actual Pipe Inside Diameter	Maximum Velocity (FPS)	Length Of Main This Zone	Friction Loss Factor (FT/100 FT)	Friction Loss This Zone	Accumulated Friction Loss (Feet)	Maximum Main Elevation	Minimum Pump Elevation	Static Head (Feet)	Total Dynamic Head (Ft)	Gal Per 100 Lineal Feet	Capacity Of Zone	Average Daily Flow	Average Fluid Changes Per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)	
Pipe diameters used for (unless otherwise noted) :				SDR 11 PE Pipe (US)				Power: 240 Volt 60 Hz				Constant for inside roughness of "C" = 150													
1.00	2.00	3.00	3.00	3.00	3.00	2	21	2.00	1.92	2.36	48.08	1.19	0.57	59.99	60.00	15.00	45	104.99	14.99	7.21	900	124.85	0.19	4.02	
2.00	3.00	6.00	9.00	6.00	9.00	3	33	2.00	1.92	3.61	264.05	2.62	6.91	59.41	60.00	20.00	40	99.41	14.99	39.59	2,700	68.20	0.35	3.82	
3.00	6.00	7.00	16.00	7.00	16.00	4	44	3.00	2.83	2.27	502.20	0.71	3.55	52.51	60.00	20.00	40	92.51	32.58	163.63	4,800	29.34	0.82	3.47	
4.00	5.00	3.00	3.00	3.00	3.00	2	21	2.00	1.92	2.38	224.99	1.21	2.72	62.37	60.00	20.00	40	102.37	14.99	33.73	900	26.68	0.90	4.15	
5.00	6.00	5.00	8.00	5.00	8.00	3	33	2.00	1.92	3.68	395.85	2.70	10.69	59.65	60.00	25.00	35	94.65	14.99	59.35	2,400	40.44	0.59	3.25	
6.00	7.00	6.00	30.00	6.00	30.00	5	55	3.00	2.83	2.83	984.69	1.06	10.41	48.96	60.00	15.00	45	93.96	32.58	320.83	9,000	28.05	0.86	2.65	
7.00	20.00	2.00	32.00	2.00	32.00	6	71	3.00	2.83	3.64	230.10	1.69	3.89	38.55	60.00	25.00	35	73.55	32.58	74.97	9,600	128.05	0.19	1.80	
8.00	9.00	3.00	3.00	3.00	3.00	2	20	2.00	1.92	2.26	230.93	1.09	2.52	66.85	60.00	10.00	50	116.85	14.99	34.62	900	25.99	0.92	4.41	
9.00	10.00	6.00	9.00	6.00	9.00	3	31	2.00	1.92	3.42	357.99	2.36	8.44	64.33	60.00	10.00	50	114.33	14.99	53.67	2,700	50.31	0.48	3.49	
10.00	11.00	9.00	18.00	9.00	18.00	4	43	3.00	2.83	2.20	360.80	0.67	2.41	55.89	60.00	15.00	45	100.89	32.58	117.55	5,400	45.94	0.52	3.01	
11.00	15.00	8.00	26.00	8.00	26.00	5	54	3.00	2.83	2.78	480.48	1.03	4.93	53.48	60.00	15.00	45	98.48	32.58	156.55	7,800	49.82	0.48	2.49	
12.00	13.00	3.00	3.00	3.00	3.00	2	22	2.00	1.92	2.42	291.31	1.25	3.64	62.76	60.00	25.00	35	97.76	14.99	43.67	900	20.61	1.16	4.14	
13.00	14.00	6.00	9.00	6.00	9.00	3	33	2.00	1.92	3.68	322.50	2.71	8.74	59.12	60.00	25.00	35	94.12	14.99	48.35	2,700	55.84	0.43	2.97	
14.00	15.00	3.00	12.00	3.00	12.00	4	46	3.00	2.83	2.33	247.43	0.74	1.83	50.38	60.00	25.00	35	85.38	32.58	80.62	3,600	44.66	0.54	2.55	
15.00	19.00	2.00	40.00	2.00	40.00	6	69	3.00	2.83	3.52	356.83	1.59	5.66	48.55	60.00	25.00	35	83.55	32.58	116.26	12,000	103.22	0.23	2.01	
16.00	17.00	3.00	3.00	3.00	3.00	2	22	2.00	1.92	2.47	297.56	1.30	3.86	56.97	60.00	25.00	35	91.97	14.99	44.61	900	20.17	1.19	3.82	
17.00	18.00	6.00	9.00	6.00	9.00	3	34	2.00	1.92	3.76	301.25	2.82	8.49	53.11	60.00	25.00	35	88.11	14.99	45.16	2,700	59.78	0.40	2.63	
18.00	19.00	4.00	13.00	4.00	13.00	4	46	3.00	2.83	2.38	225.30	0.77	1.73	44.62	60.00	25.00	35	79.62	32.58	73.41	3,900	53.13	0.45	2.23	
19.00	20.00	3.00	56.00	3.00	56.00	7	85	3.00	2.83	4.33	353.54	2.33	8.23	42.89	60.00	35.00	25	67.89	32.58	115.19	16,800	145.85	0.16	1.78	
20.00	24.00	1.00	89.00	1.00	89.00	8	99	4.00	3.63	3.07	338.03	0.92	3.12	34.66	60.00	35.00	25	59.66	53.85	182.02	26,700	146.69	0.16	1.61	
21.00	22.00	3.00	3.00	3.00	3.00	2	22	2.00	1.92	2.42	311.51	1.24	3.87	53.64	60.00	15.00	45	98.64	14.99	46.70	900	19.27	1.25	3.41	
22.00	23.00	6.00	9.00	6.00	9.00	3	33	2.00	1.92	3.67	428.84	2.70	11.57	49.78	60.00	15.00	45	94.78	14.99	64.29	2,700	41.99	0.57	2.17	
23.00	24.00	1.00	10.00	1.00	10.00	4	48	2.00	1.92	5.37	122.35	5.44	6.66	38.20	60.00	30.00	30	68.20	14.99	18.34	3,000	163.55	0.15	1.59	
24.00	0.00	1.00	100.00	1.00	100.00	8	100	4.00	3.63	3.10	3359.01	0.94	31.54	31.54	60.00	35.00	25	56.54	53.85	1808.72	30,000	16.59	1.45	1.45	
Totals/Max		100.00								11,035.62				67		50		117						4	

Pipe Size	Feet
1.25"	5,000.00
1.5"	-
2"	3,597.21
3"	3,741.37
4"	3,697.04
6"	-

<- Pipe length shown here is based on 50' per home.
 Some lots will require more than others.

Simplex	Lift Stations
100.00	-

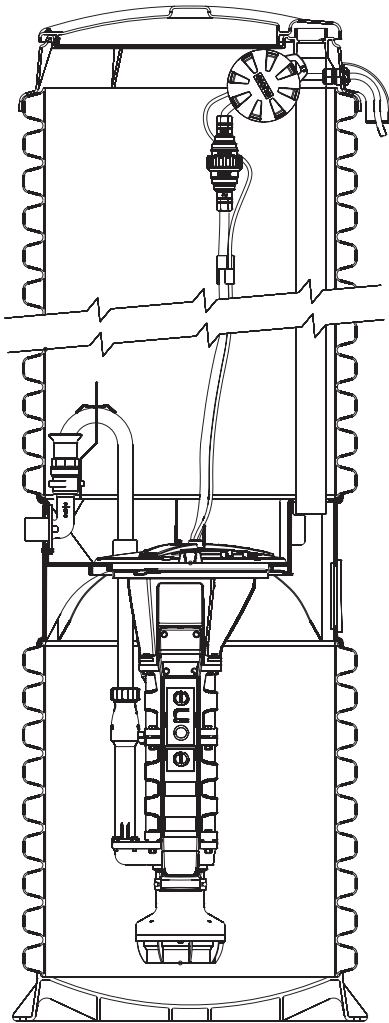
Terminal Flushing Connections
6.00

In-Line Flushing Connections
5

APPENDIX B: PRODUCT DETAILS

11221 St. Johns Industrial Pkwy North • Jacksonville • Florida • 32246
Phone: 904.928.0700 • Fax: 904.927.0790
www.WRTLLC.com

DH071



General Applications

The size, efficiency and operating economy of the DH071 make it your best choice for single dwellings, waterfront property, subdivision developments and marinas. The DH071 is ideally suited for both new and existing communities.

General Features

The DH071 grinder pump station is a complete unit that includes: the grinder pump, check valve, HDPE (high density polyethylene) tank and controls. The DH071 is packaged into a single complete unit, ready for installation.

All solids are ground into fine particles, allowing them to pass easily through the pump, check valve and small diameter pipelines. Even objects not normally found in sewage, such as plastic, rubber, fiber, wood, etc., are ground into fine particles.

The 1 1/4-inch discharge connection is adaptable to any piping materials, thereby allowing us to meet your local code requirements.

The tank is made of tough corrosion-resistant HDPE. The optimum tank capacity of 70 gallons is based on computer studies of water usage patterns. A single DH071 is ideal for one, average single-family home and can also be used for up to two average single-family homes where codes allow and with consent of the factory. This model can accommodate flows of 700 GPD.

The internal check valve assembly, located in the grinder pump, is custom-designed for non-clog, trouble-free operation.

The grinder pump is automatically activated and runs infrequently for very short periods. The annual energy consumption is typically that of a 40-watt light bulb.

Units are available for indoor and outdoor installations. Outdoor units are designed to accommodate a wide range of burial depths.

Operational Information

Motor

1 hp, 1,725 rpm, high torque, capacitor start, thermally protected, 120/240V, 60 Hz, 1 phase

Inlet Connections

4-inch inlet grommet standard for DWV pipe. Other inlet configurations available from the factory.

Discharge Connections

Pump discharge terminates in 1 1/4-inch NPT female thread. Can easily be adapted to 1 1/4-inch PVC pipe or any other material required by local codes.

*Discharge**

15 gpm at 0 psig

11 gpm at 40 psig

7.8 gpm at 80 psig

Overload Capacity

The maximum pressure that the pump can generate is limited by the motor characteristics. The motor generates a pressure well below the rating of the piping and appurtenances. The automatic reset feature does not require manual operation following overload.

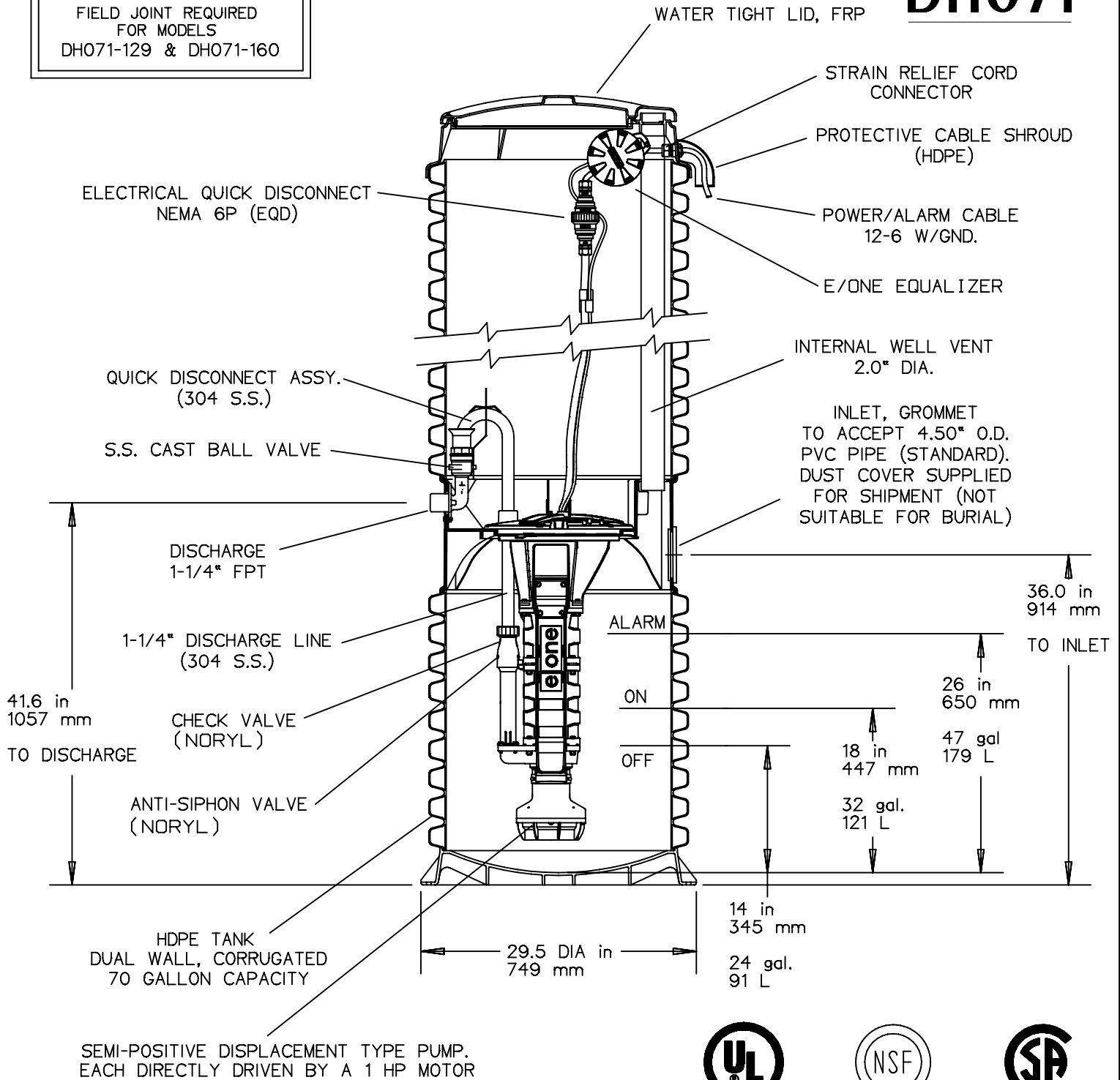
Patent Numbers: 5,752,315
5,562,254 5,439,180

* Discharge data includes loss through check valve, which is minimal.

NA0050P01

DH071

FIELD JOINT REQUIRED
FOR MODELS
DH071-129 & DH071-160



LNT	GAE	04/24/07	-	
DR BY	CHK'D	DATE	ISSUE	SCALE



MODEL DH071
DETAIL SHEET

NA0050P02

BALLAST REQUIREMENTS

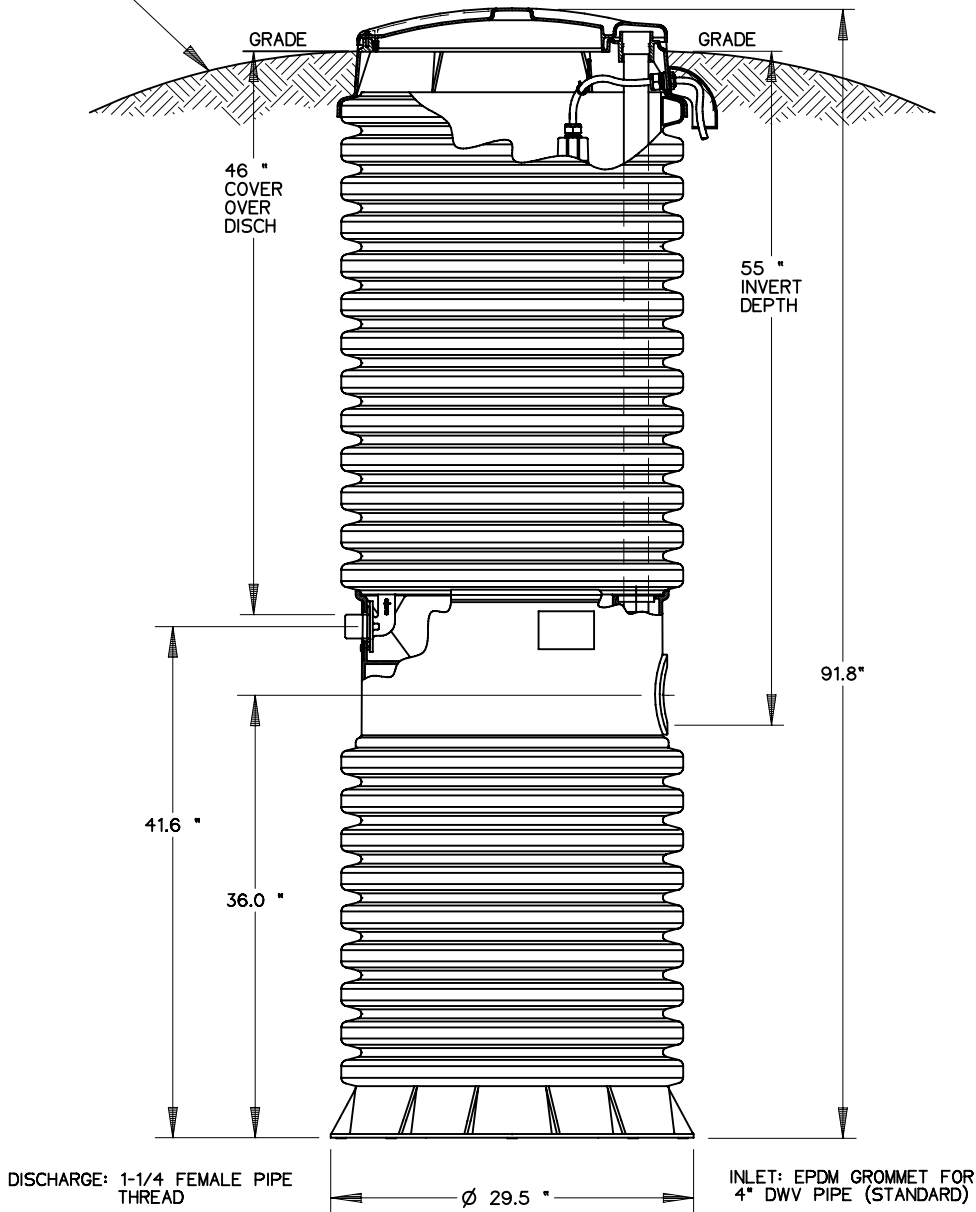
A CONCRETE ANCHOR IS REQUIRED
ON ALL OUTDOOR MODEL DH071 STATIONS

SPECIFIC CONCRETE DIMENSIONS ARE REQUIRED
TO ACHIEVE NECESSARY BALLAST EFFECT

SEE INSTALLATION INSTRUCTIONS FOR FURTHER DETAILS

DH071-93 (HARD WIRED LEVEL CONTROLS)
 DR071-93 (WIRELESS LEVEL CONTROLS)

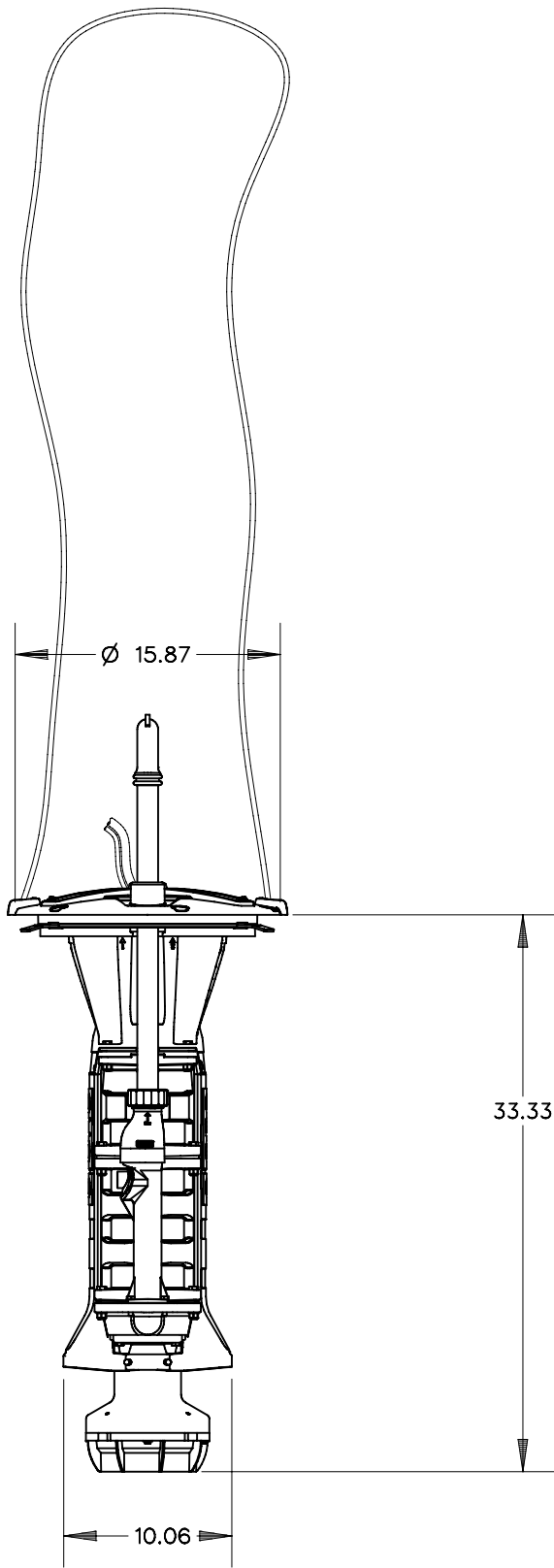
GRADE MUST SLOPE AWAY FROM STATION



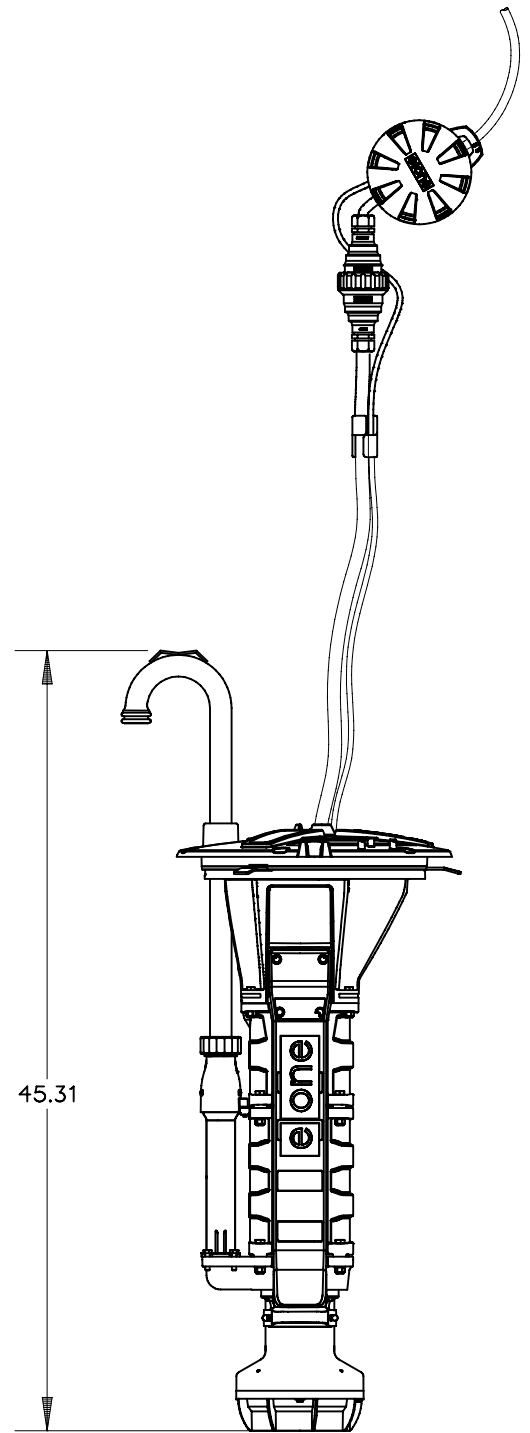
CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS



AD	CAH	07/12/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE
MODEL DH071-93 / DR071-93				
NA0050P06				



FRONT VIEW



SIDE VIEW

environment|one
CORPORATION

EXTREME D SERIES CORE

ESD 09-0079

E/One Sentry™

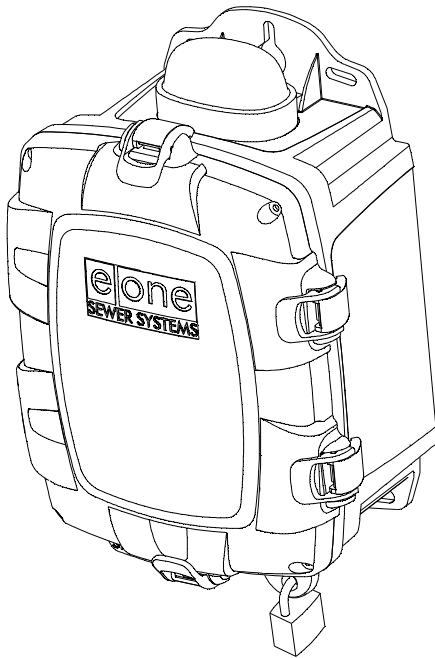
Alarm Panel — Basic Package

Description

The E/One Sentry panels are custom designed for use with Environment One grinder pump stations. They can be configured to meet the needs of your application, from basic alarm indication to advanced warning of pending service requirements.

E/One Sentry panels are supplied with audible and visual high level alarms. They are easily installed in accordance with relevant national and local codes. Standard panels are approved by UL, CSA, CE and NSF to ensure high quality and safety.

The panel features a corrosion-proof, NEMA 4X-rated, thermoplastic enclosure. A padlock is provided to prevent unauthorized entry (safety front).



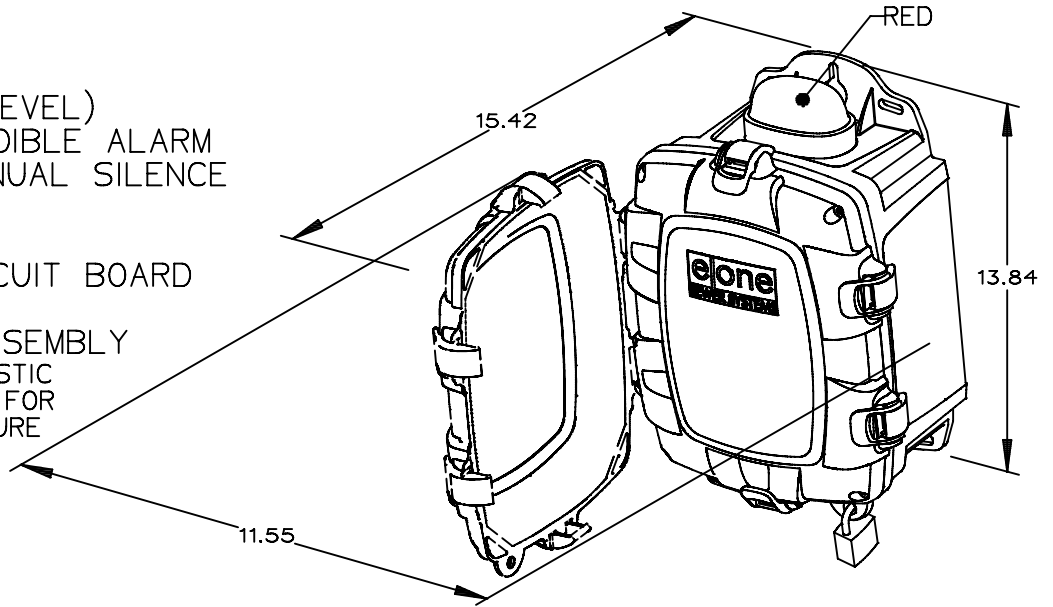
Features

- Circuit breakers, 240 or 120 VAC service
- Terminal blocks and ground lugs
- Audible alarm with manual silence
- Manual run feature and run indicator
- Redundant “Start” function with high level alarm
- Safety front — authorized personnel only when locked
- Conformal-coated alarm board (both sides)
- Alarm board overload protection

Please consult factory for special applications.

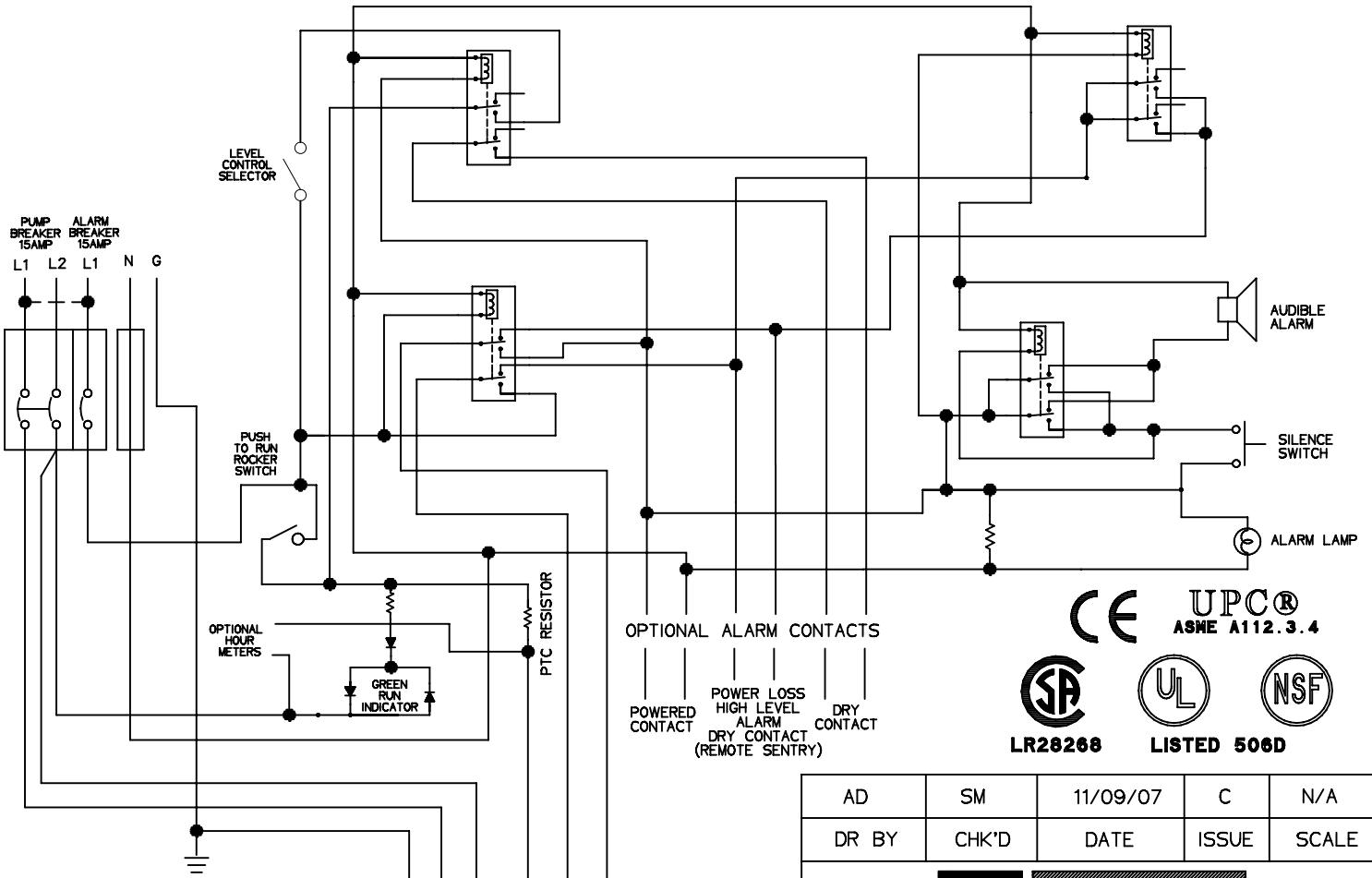
SIMPLEX SENTRY

REDUNDANT RUN (HIGH LEVEL)
 EXTERNAL VISUAL & AUDIBLE ALARM
 EXTERNAL LATCHING MANUAL SILENCE
 MANUAL RUN
 PUMP RUN INDICATOR
 CONFORMAL COATED CIRCUIT BOARD
 PADLOCK
 NEMA 4X ENCLOSURE ASSEMBLY
 CORROSION PROOF THERMOPLASTIC
 POLYESTER APPROVED BY UL FOR
 ELECTRICAL CONTROL ENCLOSURE



OPTIONS:

- ALARM CONTACTS
- HOUR METER



CE UPC® ASME A112.3.4
 SP UL NSF
 LR26268 LISTED 506D

PIN	FUNCTION	2000S	EXTREME
1	MANUAL RUN	RED	BROWN
2	L1	BLACK	RED
3	L2	WHITE	BLACK
4	GND	GREEN	GRN/YEL
5	ALARM FEED	ORANGE	YELLOW
6	ALARM RETURN	BLUE	BLUE

TO PUMP
 GND L1 L2
 PUMP POWER
 MANUAL RUN
 FEED
 RETURN
 ALARM

AD	SM	11/09/07	C	N/A
DR BY	CHK'D	DATE	ISSUE	SCALE

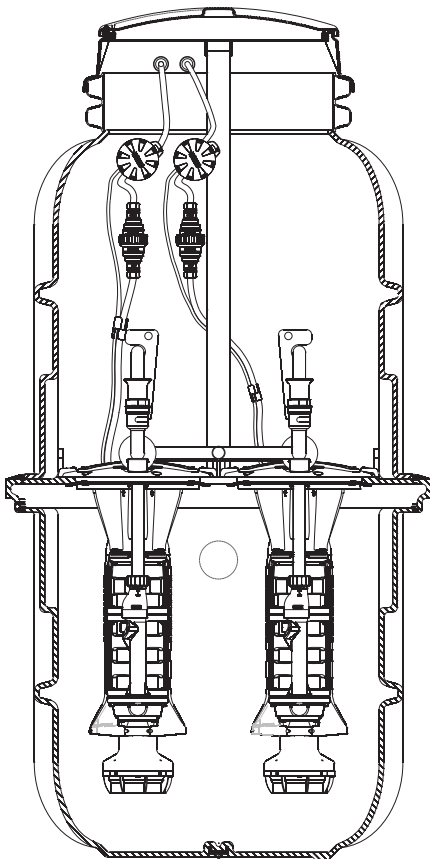


SIMPLEX SENTRY, 240V 60Hz.
 DOUBLE POLE POWER

LM000326

CONTROL CABLE:
 TYPE TC: DIRECT BURIAL, 12AWG,
 SIX CONDUCTOR

DH152/DR152



General Features

The DH152 or DR152 grinder pump station is a complete unit that includes: two grinder pumps with check valves, HDPE (high density polyethylene) tank and controls. The DH152 or DR152 is packaged into a single complete unit, ready for installation.

The DH152 is the “hardwired,” or “wired,” model where a cable connects the motor controls to the level controls through watertight penetrations.

The DR152 is the “radio frequency identification” (RFID), or “wireless,” model that uses wireless technology to communicate between the level controls and the motor controls.

All solids are ground into fine particles, allowing them to pass easily through the pump, check valve and small-diameter pipelines. Even objects that are not normally found in sewage, such as plastic, rubber, fiber, wood, etc., are ground into fine particles.

The 1 1/4-inch discharge connection is adaptable to any piping materials, thereby allowing it to meet local code requirements.

The tank is made of tough corrosion-resistant HDPE. The optimum tank capacity of 150 gallons is based on computer studies of water usage patterns. A single DH152 or DR152 is ideal for up to four average, single-family homes, and can also be used for up to 12 average, single-family homes with the consent of the factory. This model can accommodate flows of 3000 GPD.

The internal check valve assembly, located in each grinder pump, is custom-designed for non-clog, trouble-free operation.

The grinder pump is automatically activated and runs infrequently for very short periods. The annual energy consumption is typically that of a 40-watt light bulb.

Units are available for indoor and outdoor installations. Outdoor units are designed to accommodate a wide range of burial depths.

Operational Information

Motor

1 hp, 1,725 rpm, high torque, capacitor start, thermally protected, 120/240V, 60 Hz, 1 phase

Inlet Connections

4-inch inlet grommet standard for DWV pipe. Other inlet configurations available from the factory.

Discharge Connections

Pump discharge terminates in 1 1/4-inch NPT female thread. Can easily be adapted to 1 1/4-inch PVC pipe or any other material required by local codes.

*Discharge**

15 gpm at 0 psig (per pump)

11 gpm at 40 psig (per pump)

7.8 gpm at 80 psig (per pump)

Control Panel

This station is designed to use the Alternating Control Panel, MOD T260.

Overload Capacity

The maximum pressure that the pump can generate is limited by the motor characteristics. The motor generates a pressure well below the rating of the piping and appurtenances. The automatic reset feature does not require manual operation following overload.

Patent Numbers: 5,752,315
5,562,254 5,439,180

* Discharge data includes loss through check valve, which is minimal.

NA0052P01

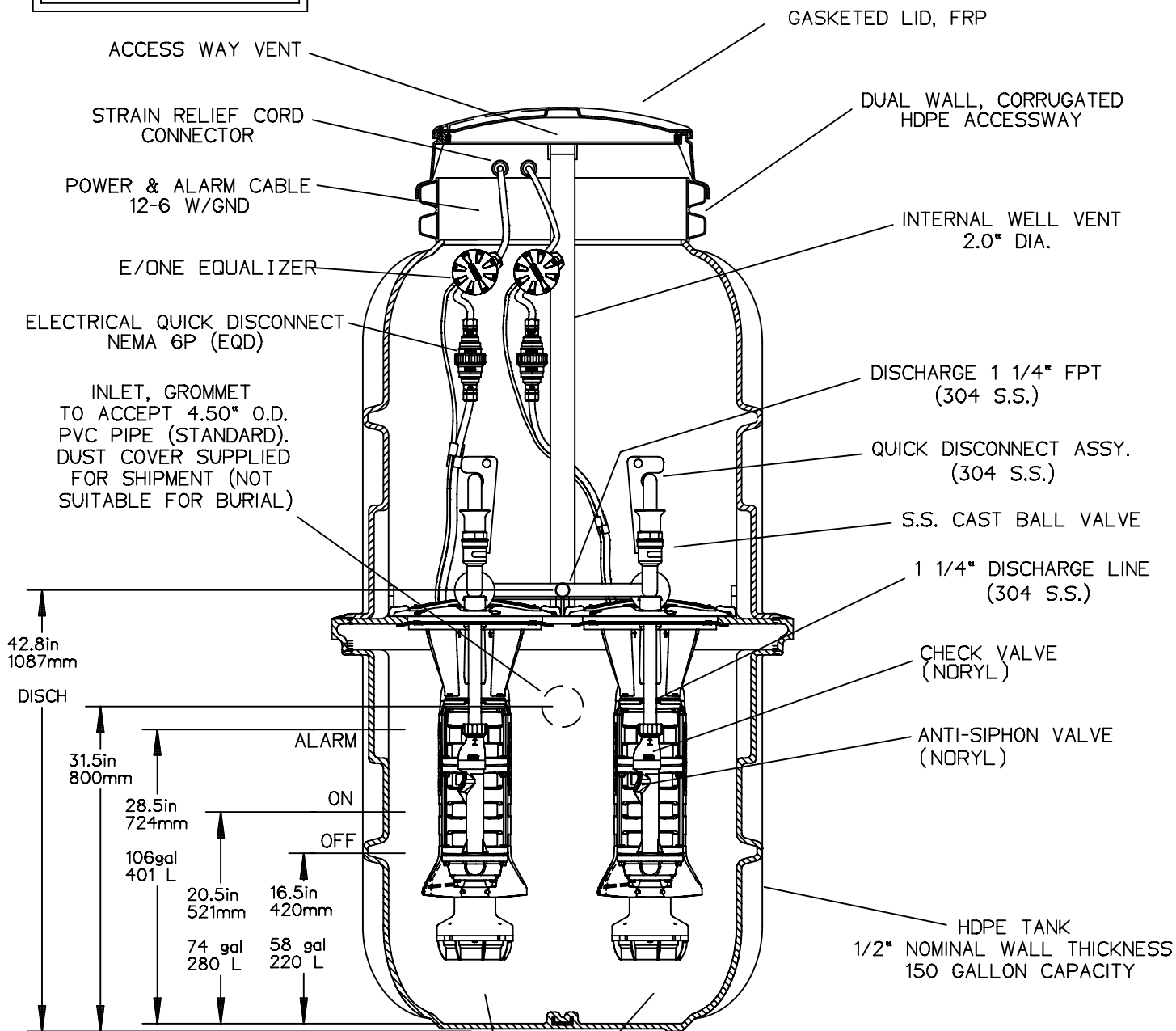
OPTIONS : **DH152**

(HARD WIRED
LEVEL CONTROLS)

DR152

(WIRELESS
LEVEL CONTROLS)

FIELD JOINT REQUIRED
FOR MODELS
DH152-129 / DR152-129
&
DH152-160 / DR152-160



SEMI-POSITIVE DISPLACEMENT TYPE PUMP
EACH DIRECTLY DRIVEN BY A 1 HP MOTOR

CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS



AD	CH	07/13/07	A	
DR BY	CHK'D	DATE	ISSUE	SCALE



MODEL DH152 / DR152
DETAIL SHEET

NA0052P02

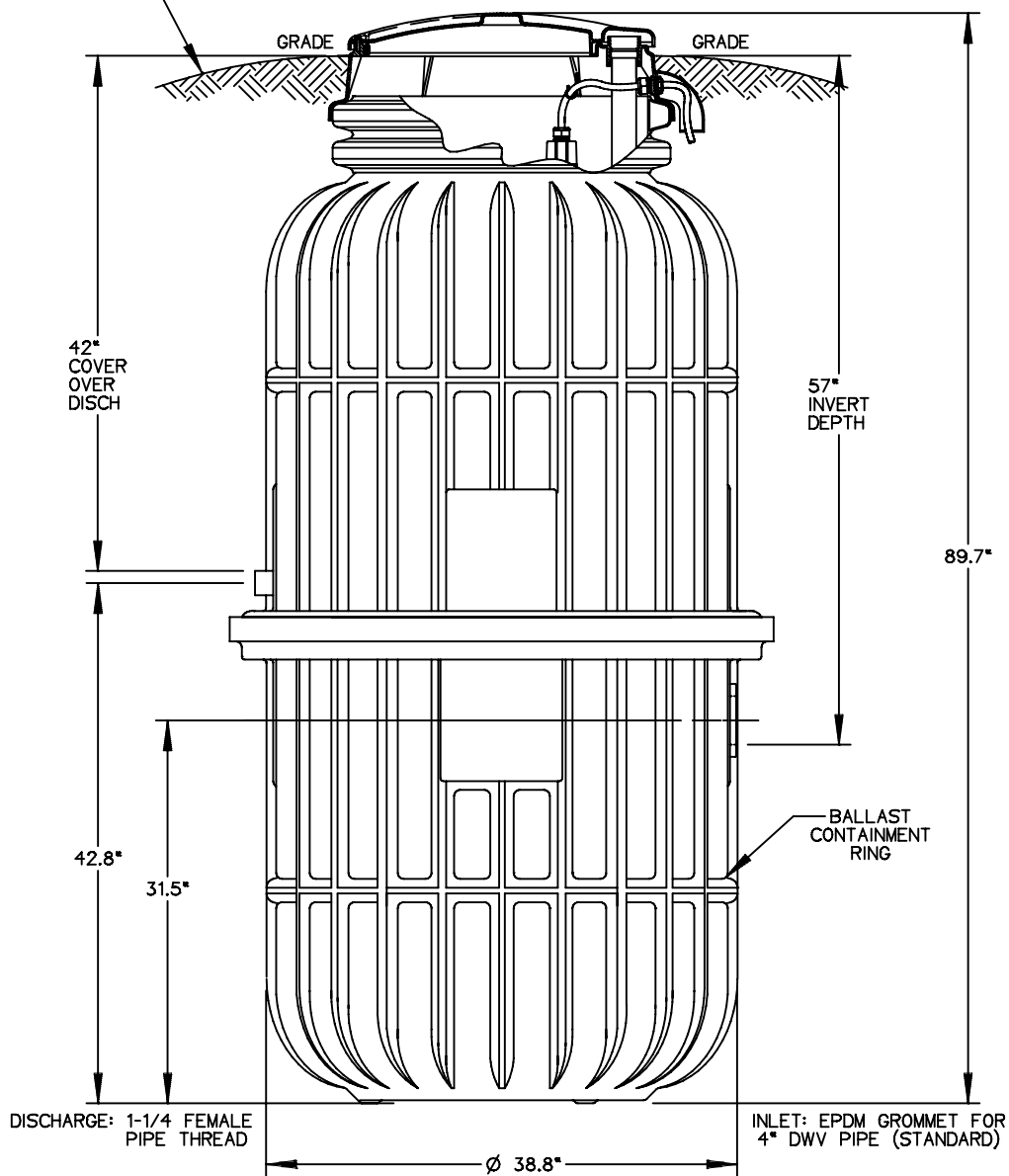
OPTIONS : **DH152 -93**

(HARD WIRED
LEVEL CONTROLS)

DR152 -93

(WIRELESS
LEVEL CONTROLS)

GRADE MUST
SLOPE AWAY FROM
STATION



CONCRETE BALLAST MAY BE REQUIRED
SEE INSTALLATION INSTRUCTIONS
FOR DETAILS

AD	CAH	7/13/07	A	1/16
DR BY	CHK'D	DATE	ISSUE	SCALE

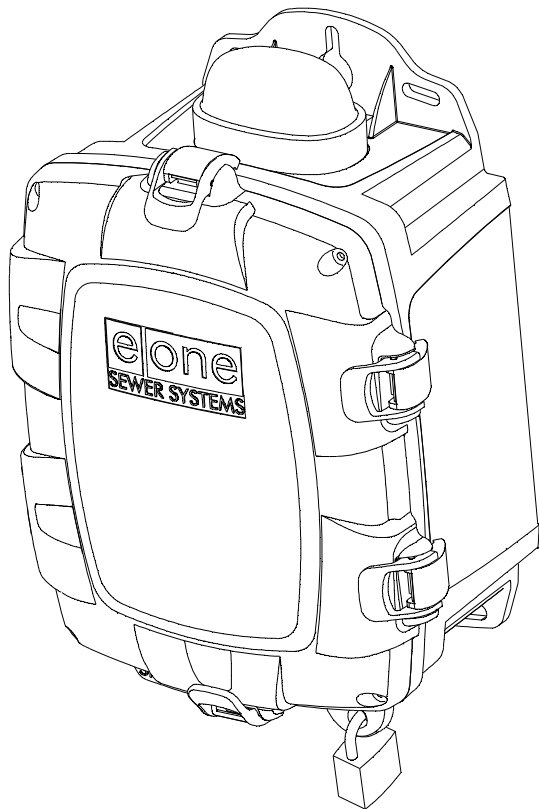


MODEL DH152-93 / DR152-93

NA0052P04

E/One T260

Duplex Alternating Alarm Panel



Description

The T260 Duplex Alternating Alarm panel is custom designed for use with Environment One duplex grinder pump stations.

Duplex grinder pump stations, a station with two grinder pumps, require the pumping load to be shared equally between the two pumps. Under normal conditions, one pump removes the accumulated sewage from the grinder pump basin. After 24 hours, the T260 Alternating Panel toggles the electrical supply power to the pump that was idle. If the sewage level reaches the alarm level, the two grinder pumps will operate simultaneously for 3 to 4 minutes. If, after that time, the sewage is not below the alarm level, the alarm circuit is engaged.

The T260 Alternating Panel is supplied with audible and visual high water level alarms. The panel is easily installed in accordance with relevant national and local codes.

The T260 Panel is listed by Underwriters Laboratories, CSA, CE and NSF to ensure high quality and safety.

Standard Features

- UL-approved, corrosion-proof polyester enclosure
- NEMA 4X-rated enclosure with hinged access panel
- Lockable latch with keyed-alike padlock included
- Circuit breakers
- Terminal blocks & ground lugs
- Dry contacts
- Lead/lag, run and alarm indicator lights
- Manual push-to-run

Optional Features

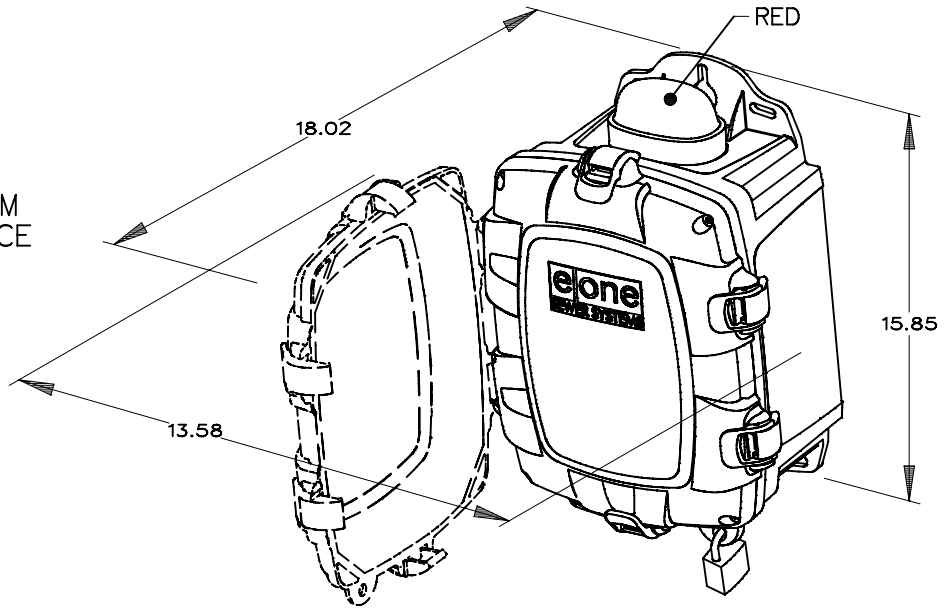
- Hour meters (with larger enclosure)
- E/One Remote Sentry ready (with power loss capability)
- Dead front
- Generator receptacle with auto transfer
- GFCI receptacle
- Auto dialer

** Consult factory for special applications

DUPLEX ALTERNATING PANEL T-260

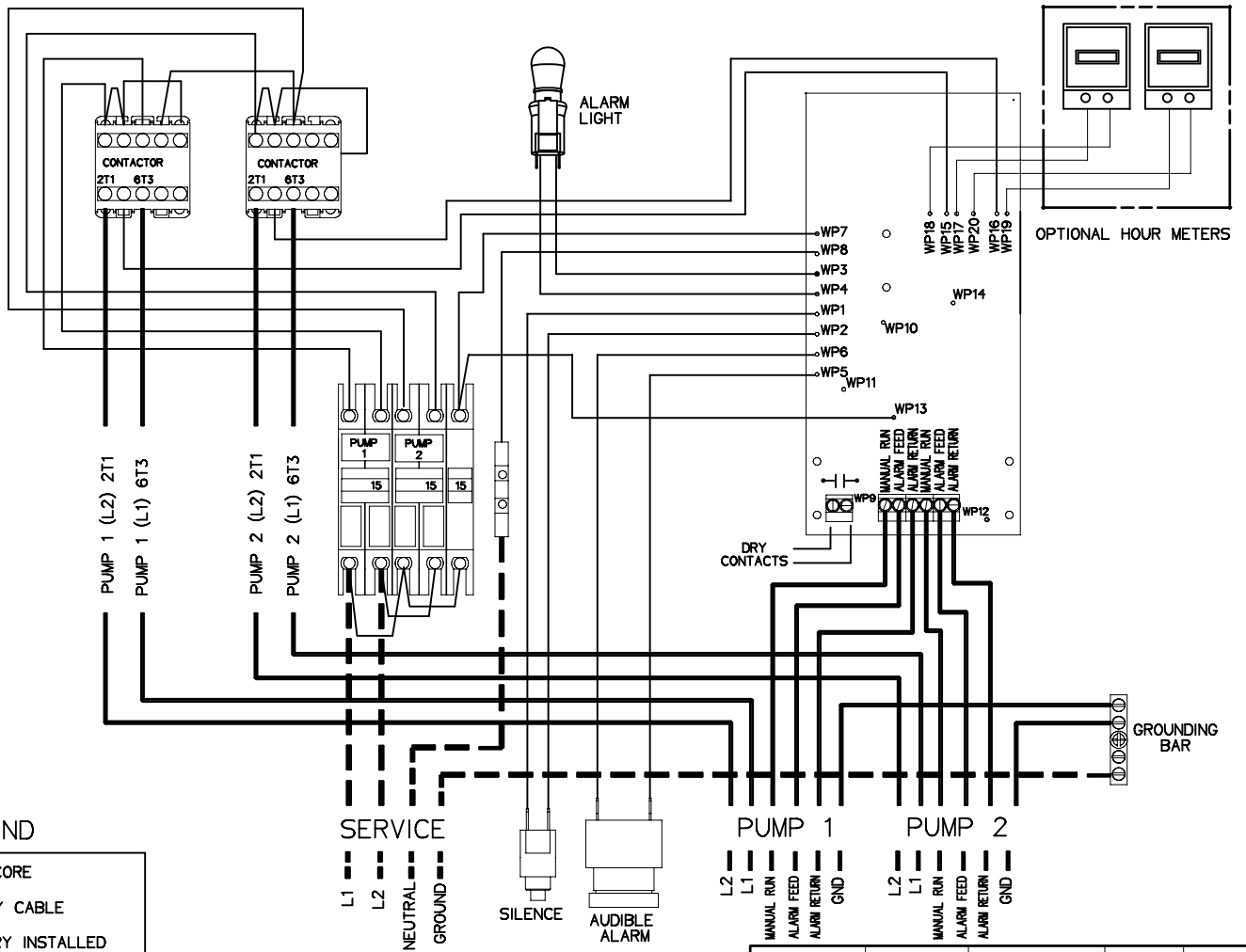
EXTERNAL VISUAL & AUDIBLE ALARM
EXTERNAL LATCHING MANUAL SILENCE
MANUAL RUN
PUMP RUN INDICATORS
CONFORMAL COATED CIRCUIT BOARD
PADLOCK
ALARM DRY CONTACT
NEMA 4X ENCLOSURE ASSEMBLY

CORROSION PROOF THERMOPLASTIC
POLYESTER APPROVED BY UL FOR
ELECTRICAL CONTROL ENCLOSURE

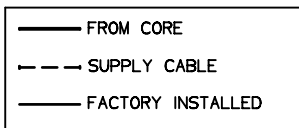


OPTIONS:

HOUR
METER



LEGEND



PIN	FUNCTION	2000S	EXTREME
1	MANUAL RUN	RED	BROWN
2	L1	BLACK	RED
3	L2	WHITE	BLACK
4	GND	GREEN	GRN/YEL
5	ALARM FEED	ORANGE	YELLOW
6	ALARM RETURN	BLUE	BLUE

CONTROL CABLE:

TYPE TC: DIRECT BURIAL, 12AWG,
SIX CONDUCTOR



AD	SM	09-24-07	C	N/A
DR BY	CHK'D	DATE	ISSUE	SCALE

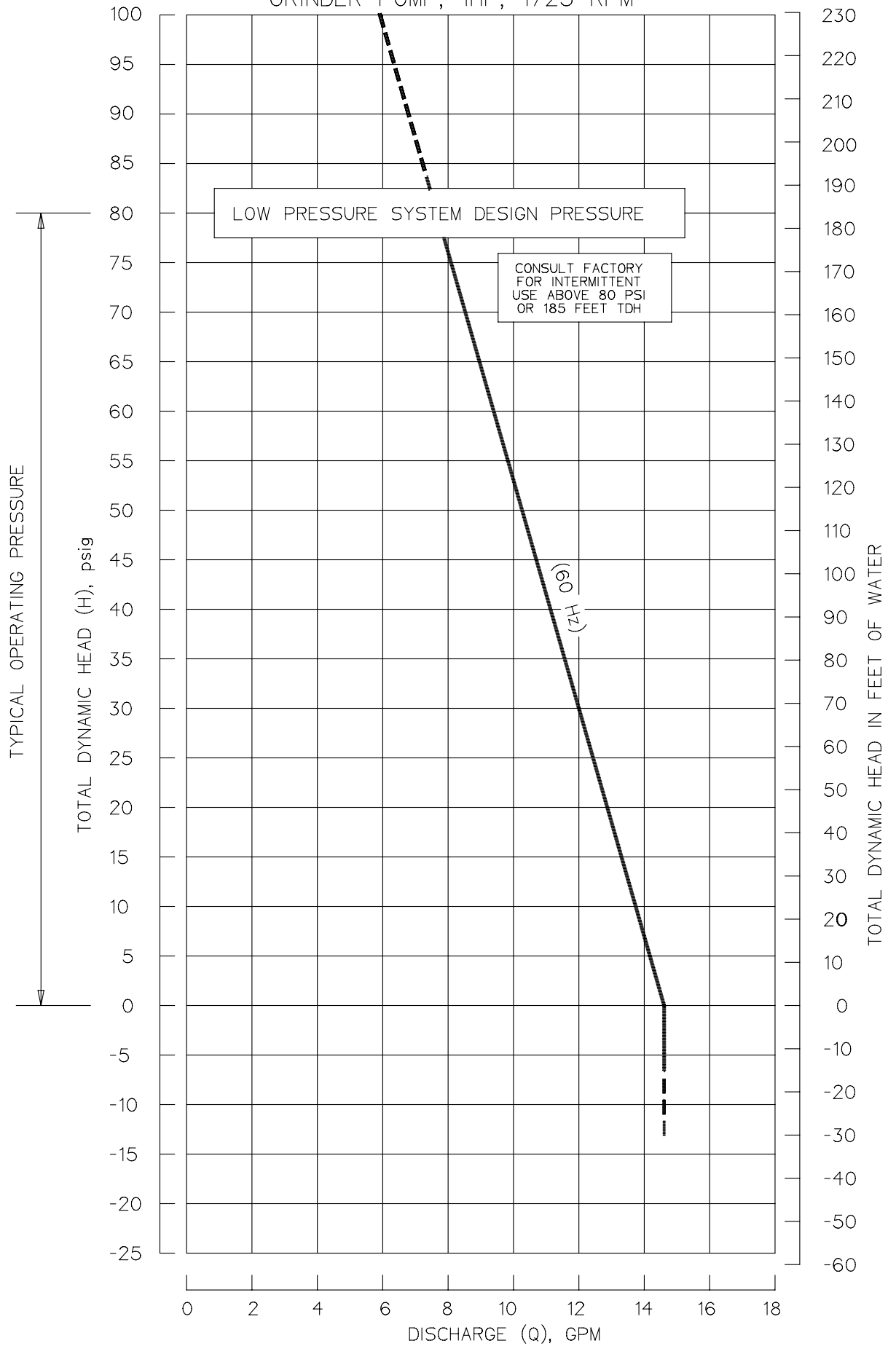


DUPLEX T-260 ALTERNATING PANEL,
240V 60Hz DOUBLE POLE POWER
WIRED LEVEL CONTROL

LM000329 P1

E|ONE SPD PUMP PERFORMANCE CURVE

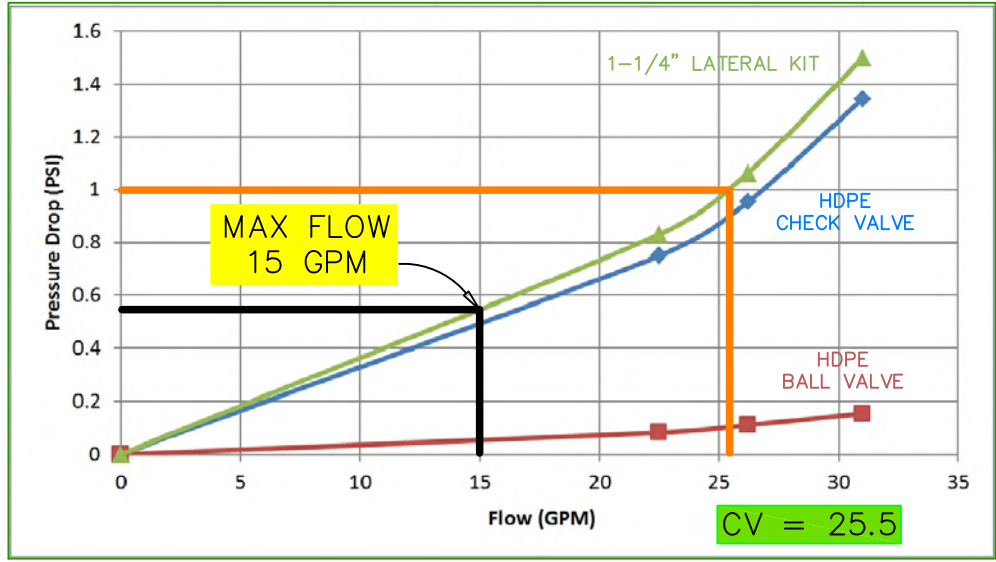
GRINDER PUMP, 1HP, 1725 RPM



CAST IRON LID
PAINTED GREEN
CAST "SEWER" MARKING

STANDARD WATERWORKS
PENTAGON BOLT

HIGH DENSITY
POLYETHYLENE
SHUTOFF EXTENSION
GREEN OPERATOR NUT



ΔP @ MAX OPERATING POINT 0.56 PSI

***ACTUAL LAYOUT MAY VARY -
DIFFERENT VALVE ACCESS BOXES ARE
AVAILABLE***

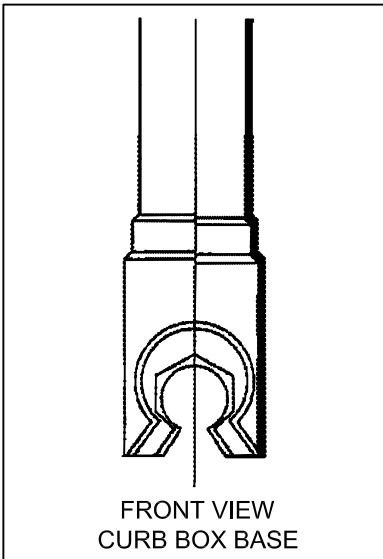
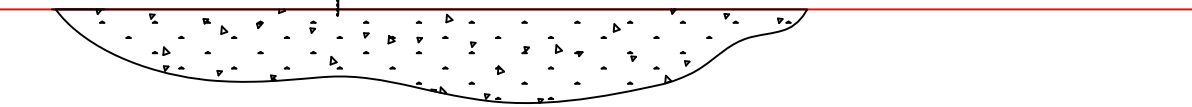
316 STAINLESS
STEEL COTTER PIN

1-1/4" SDR9
HDPE PIPE
TO BUTT FUSE
OR ELECTROFUSE

1-1/4" HIGH DENSITY
POLYETHYLENE
BALL VALVE

1-1/4" HIGH DENSITY
POLYETHYLENE
CHECK VALVE

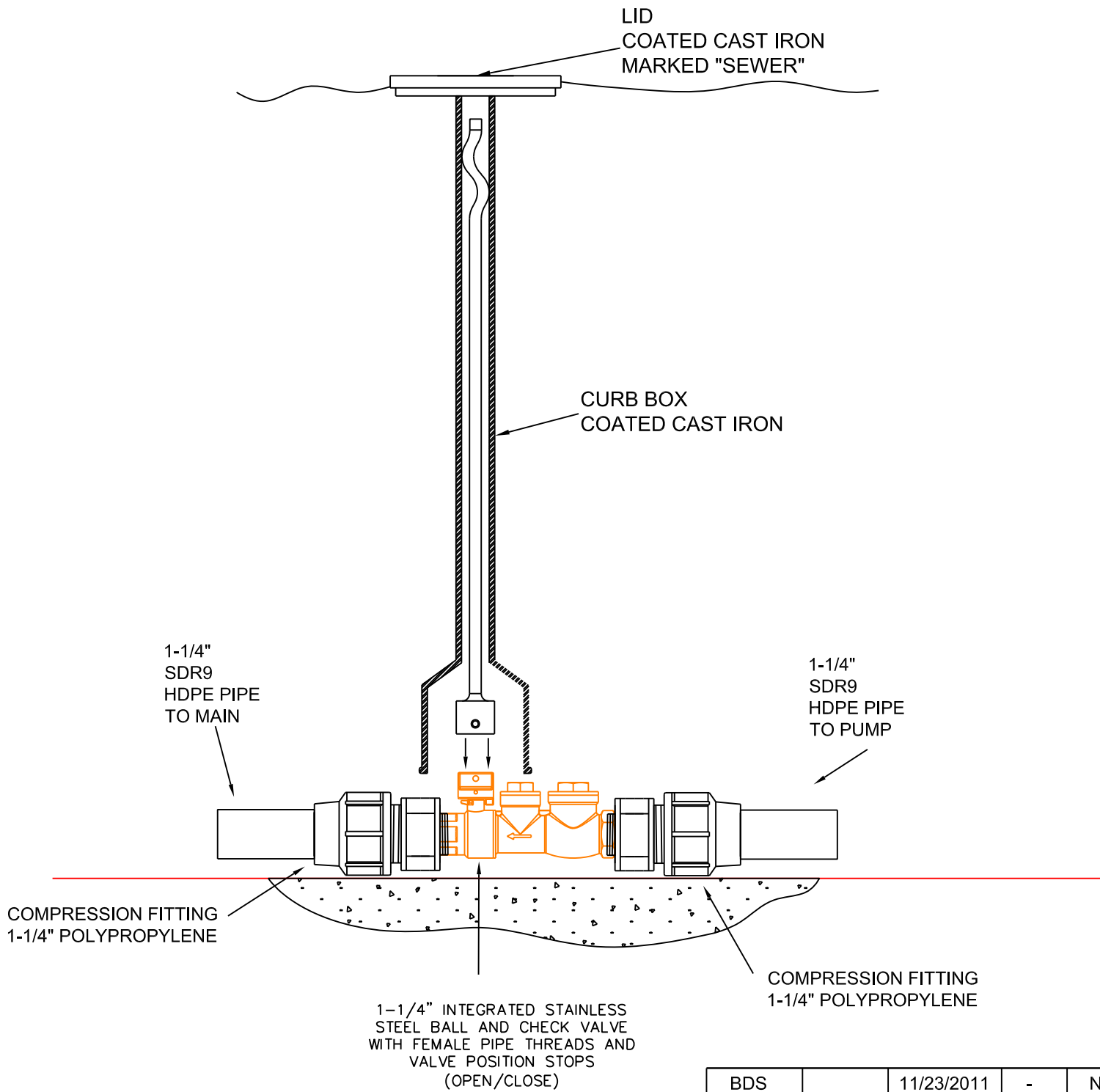
1-1/4" HDPE CAP
TO GRINDER
PUMP STATION



BDS		02/28/2013	-	N/A
DR BY	CHK'D	DATE	REV.	SCALE



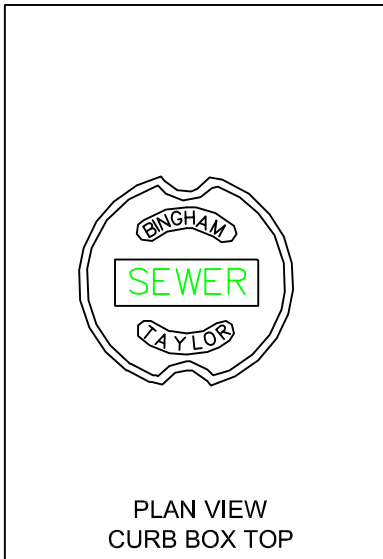
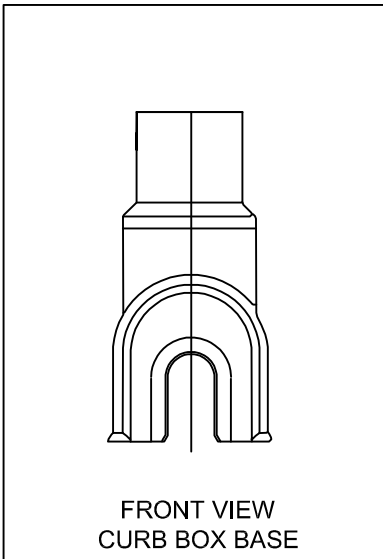
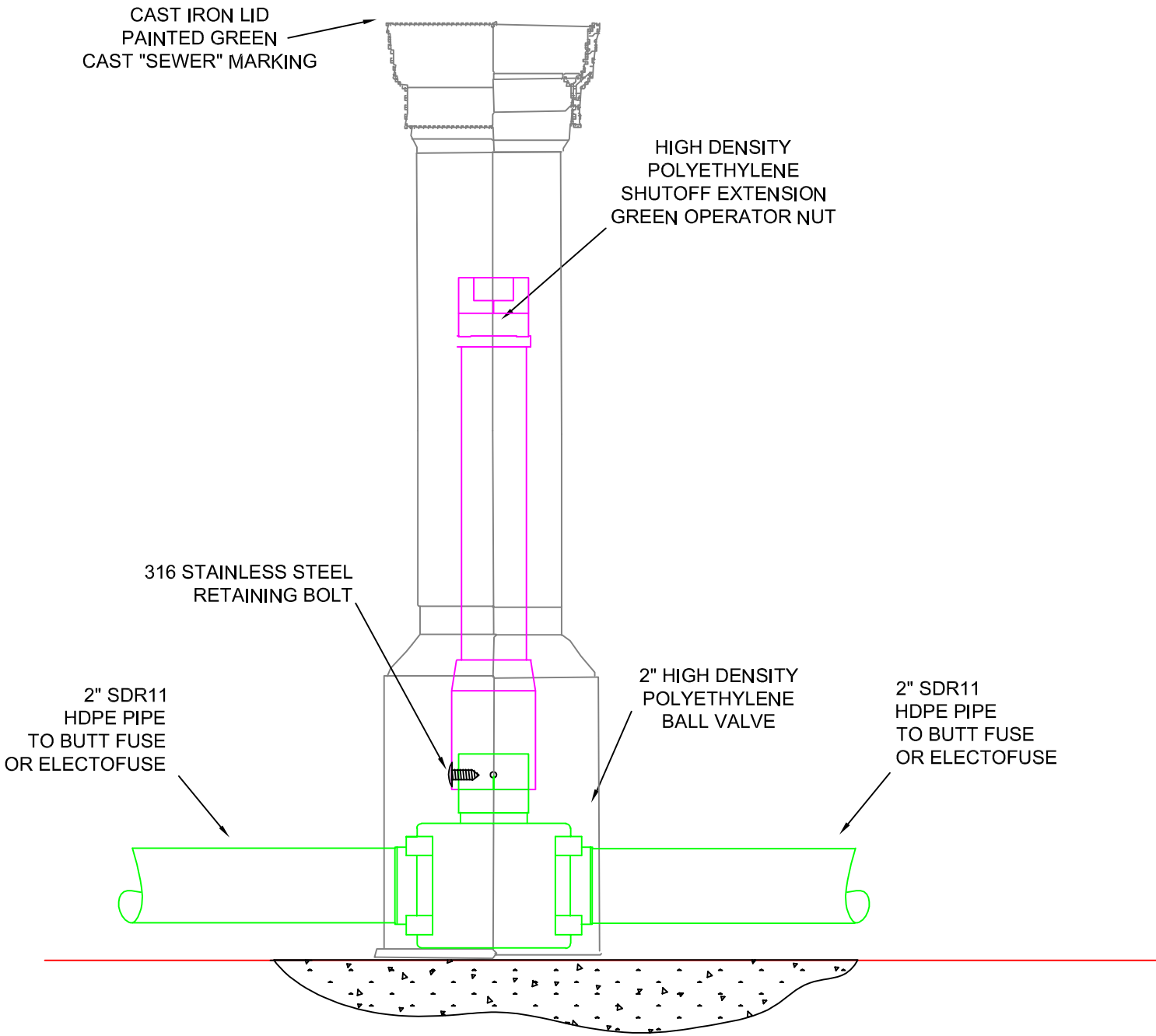
1-1/4 LATERAL
ASSEMBLY
WRT-LK125



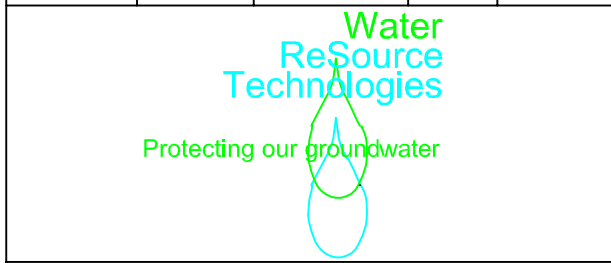
BDS		11/23/2011	-	N/A
DR BY	CHK'D	DATE	REV.	SCALE



1-1/4" LATERAL ASSEMBLY				
WRT-LK-SS-125				



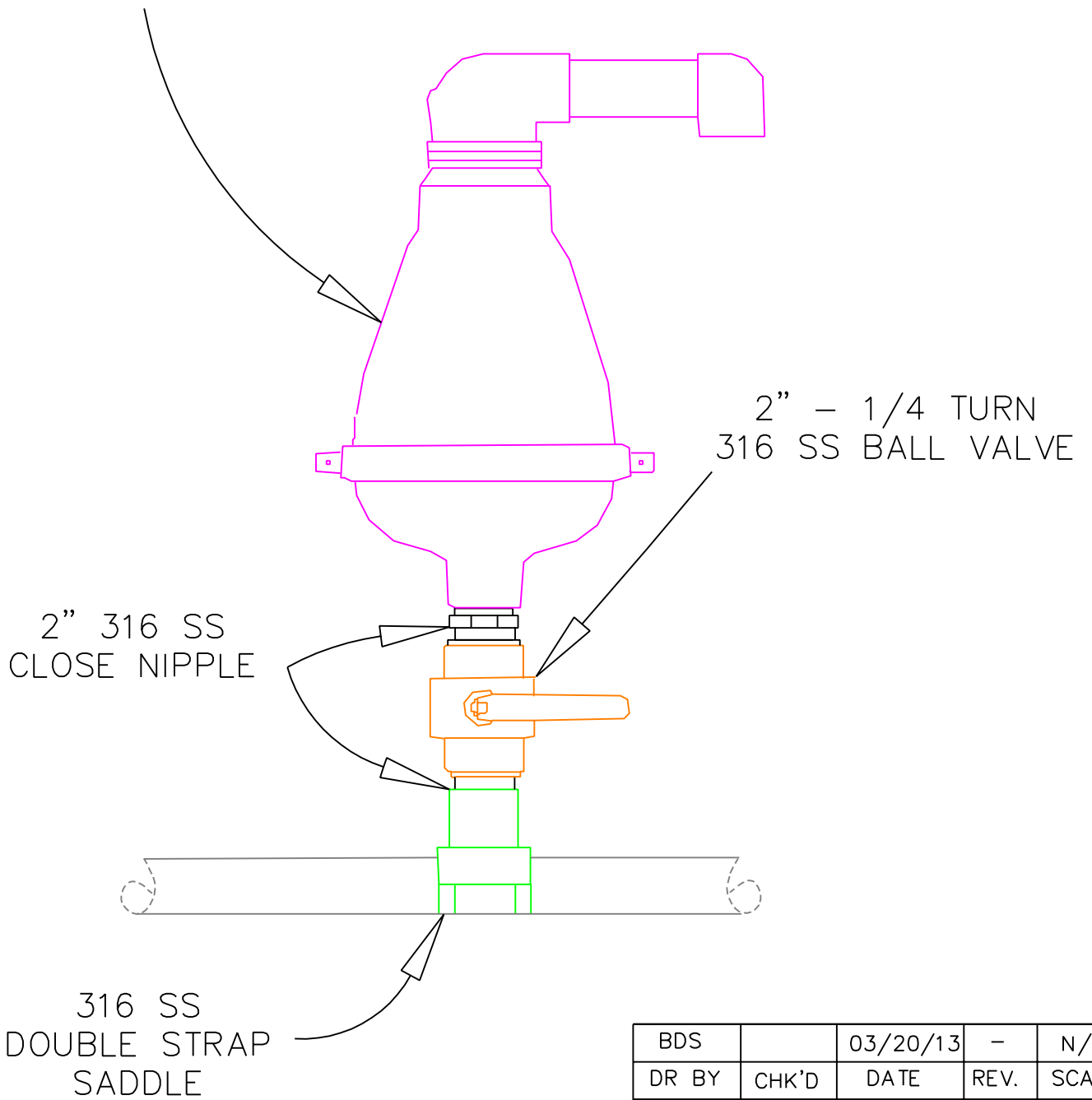
BDS		03/04/2013	-	N/A
DR BY	CHK'D	DATE	REV.	SCALE



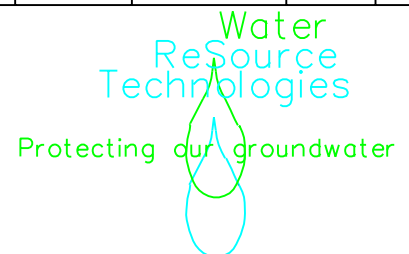
2" ISOLATION
VALVE

WRT-ISO-200

AIR RELEASE VALVE
ARI-D-025SST02

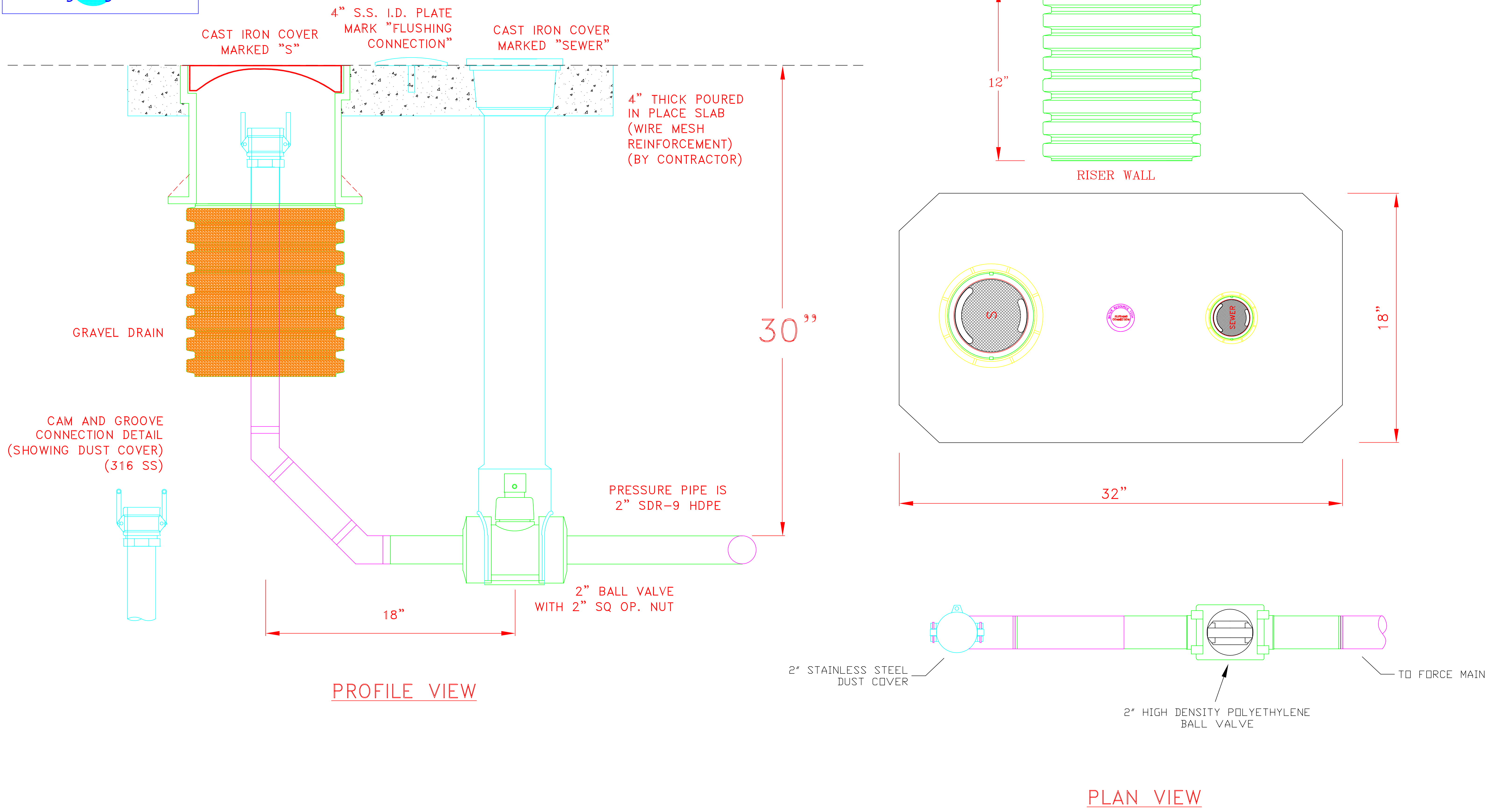


BDS		03/20/13	-	N/A
DR BY	CHK'D	DATE	REV.	SCALE



2" AIR RELEASE VALVE
ASSEMBLY

WRT-ARV-D025



No.	Revisions	By

