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Sewer Hydraulic Report

The Reserve

City of Gig Harbor, WA

1/16/23

Prepared for:

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January 16, 2023

SEWER HYDRAULIC REPORT

FOR

THE RESERVE

CITY OF GIG HARBOR, WA

TABLE OF CONTENTS

SECTION 1 – INTRODUCTION AND SUMMARY

This Sewer Hydraulic Report (SHR) is provided to describe the existing site conditions and proposed sewer improvements associated with the development of *The Reserve*. The project proposes to subdivide and develop approximately 4.09 acres into 14 single-family residential parcels, access roadway, and frontage improvements within the city of Gig Harbor. This SHR is provided to summarize the applicable sewer utility standards and the analysis and design provisions for the anticipated residential sewer demand in general accordance with the City of Gig Harbor 2018 Public Works Standards (PWS).

SECTION 2 – PROPOSED DEVELOPMENT

The Reserve project site is located at 10017 Peacock Hill Avenue (Pierce County tax parcel no. 0222323134 and 0222323135). More generally, it is located in Section 32 of Township 22 North, Range 2 East, W.M., in Pierce County, Washington (see Figure 1, Vicinity Map below). The area was annexed into the City of Gig Harbor in 2006.

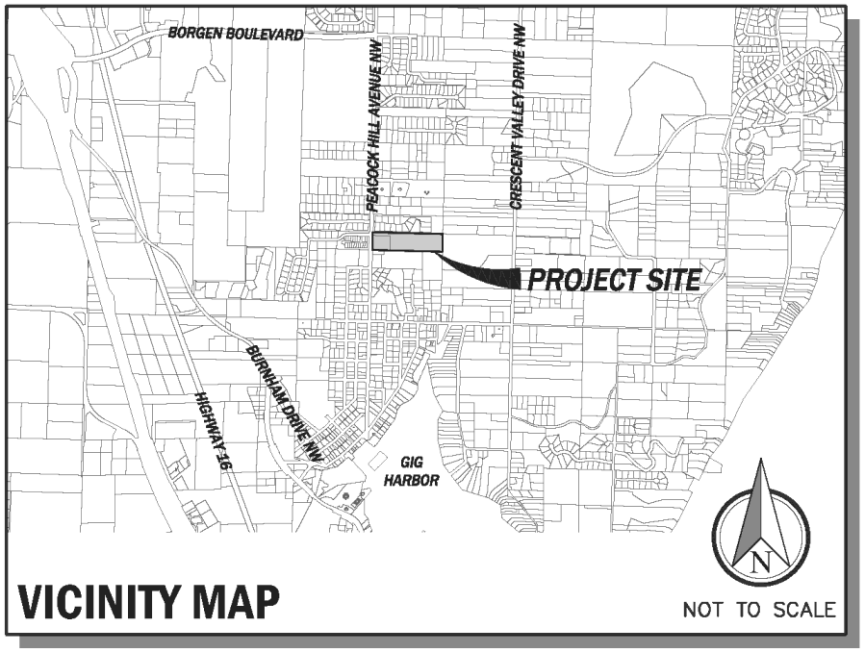

Figure 1 – Vicinity Map

The Reserve site is comprised of two real parcels totaling approximately 9.88 acres. The proposal includes subdividing the two parcels into 14 single-family lots and three tracts. The tracts will consist of Tract A consisting of private roads and utility access, Tract SD100 for stormwater and recreational use and Tract OS1 for open spaces and critical areas. Both existing parcels are vacant, and no structures currently occupy the project site. A number of trees of varying type, age, and health condition exist on the site. The majority of the mature trees along the perimeter of the area to be developed will be retained as part of the required screening buffer. Figure 2 represents the proposed overall sewer site plan.

The proposed final subdivision will create a total of 14 single-family residential lots over 4.09-acre of the parcels. It will also include half street improvements at Peacock Hill Avenue with pavement widening to accommodate the addition of curb, gutter, and sidewalk. Extension of the existing sewer system along the Peacock Hill Road frontage is also proposed by the project. All project improvements are proposed in general accordance with City of Gig Harbor 2018 Public Works Standards (PWS).

The site is zoned R-1 which limits the development density to 4 dwelling units per acre (GHMC 17.16.060, *Single Family Residential – Development Standards*). The sewer hydraulic analysis performed for this report considers the maximum proposed density of 14 single family residential lots. Site grading, storm drainage, roadway, and utility infrastructure improvements are proposed to be constructed by the developer prior to completing the final subdivision recording. The infrastructure improvements will include the installation of the sewer main and service stubs. The home builder(s) purchasing these finished lots will install individual grinder pumps and service line extensions for each individual lot.

SECTION 3 – EXISTING CONDITIONS

The site lies within existing wastewater basin 2 according to the City of Gig Harbor 2018 Wastewater Comprehensive Plan (WWCP). The current wastewater system has been extended to approximately the south boundary of the project site on Peacock Hill Avenue. The sewer in this area flows via gravity south along Peacock Hill Avenue to lift station 2A where it is then discharged to wastewater basin 3. The gravity sewer main in Peacock Hill Avenue will be extended north within the roadway along the west frontage of the site. The majority of the adjacent properties are also zoned R-1 single family residential while a few properties are zoned R-2 medium density residential. The majority of the properties on the east side Peacock Hill Avenue are outside of city limits in Pierce County.

According to record drawings by N.L Olson & Associates, Inc. as prepared for Grindstone Management, LLC dated May 31, 2011, an 8-inch stub is located at the north end of the sewer main near the southwest corner of The Reserve site. The exact elevation could not be determined in the survey. The approximate invert elevation of this terminus was calculated to be 270.61 feet based on as-built records of the invert elevation of the existing downstream manhole located approximately sixty-five (65) feet south of the clean out and the pipe slope. The existing pipe material is 8-inch PVC. In order to connect to the existing gravity main, 4 feet of 8-inch PVC sewer main will be removed and replaced to begin the main extension at an invert elevation of 270.59.

SECTION 4 – PROPOSED DESIGN

The project proposes to extend gravity sanitary sewer main along the Peacock Hill Avenue frontage. Manholes will be added to the existing gravity main 4 feet south of the existing cleanout, at the intersection of Peacock Hill Avenue and proposed Road A, and at a terminus opposite the northwest corner of the site for future connection. The existing and proposed grade of the site slopes easterly and steeply away from Peacock Hill Avenue. A maximum road grade of 15% is proposed to accommodate access to the proposed subdivision lots. This roadway will be private, and all utilities will be located within a 36-foot wide tract, minimum. These utilities will include a proposed 2-inch low pressure sanitary sewer (LPSS) collection main and a small section of gravity for the transition from pressure to gravity systems right before the ROW of Peacock Hill Avenue.

The LPSS system has been designed based on a hydraulic model prepared using the proprietary Pressure Sewer Preliminary Cost and Design Analysis software program by Environmental One Sewer Systems, Inc (E-One). Per the Washington Department of Ecology – *Criteria for Sewage Works Design*, August 2008, a design flow rate of 100 gpd per person along with an estimated 4 persons per residence for each of the future 14 single family lots. This results in a design flow rate of 400 gpd per lot and 5,600 gpd for the project. Other parameters used in the analysis consist of the total length of 2" main of 437 feet and an elevation difference of 41.12' from the low point at the pig launch of 237.00' to the connection to the private sewer manhole located just outside Peacock Hill Ave ROW at 278.12'. The maximum design demand established for each individual pump was 12 gpm. The design demand also anticipates that a maximum of 4 pumps will be operating at any given time in accordance with the E-One manufacturer recommendations. Appendix A provides the supporting calculations and referenced hydraulic model output.

The proposed 2-inch diameter HDPE sewer pipe provides the necessary 2 feet per second (fps) minimum velocity in the LPSS collection main. The project proposes to install this main along with individual 1 ¼-inch sewer service laterals to each of the lots. The individual grinder pump systems and extension of these laterals, including the necessary one-way swing check valve and aeration equipment, will be installed in the future by the home builder(s).

The gravity sewer main in Peacock Hill Avenue is sized to be 8-inch PVC to be consistent with the City's 2018 WWCP. Connection of the force main to the gravity main will be accomplished at the manhole at the Road A intersection with Peacock Hill Avenue. This receiving manhole will be coated with an approved coating as per City of Gig Harbor which will be resistant to sulfuric acid.

The proposed pressure system will be completed located within Private Access and Utility tracts within the proposed property. This system will transition from pressure to gravity directly before the ROW of Peacock Hill Avenue. The pressure system and gravity portion tying into the existing manhole in Peacock Hill Avenue, will be owned, operated, and maintained by The Reserve Homeowner's Association (HOA). The gravity system located within Peacock Hill Ave and the City of Gig Harbor Right-of-Way will be owned, operated, and maintained by the City of Gig Harbor.

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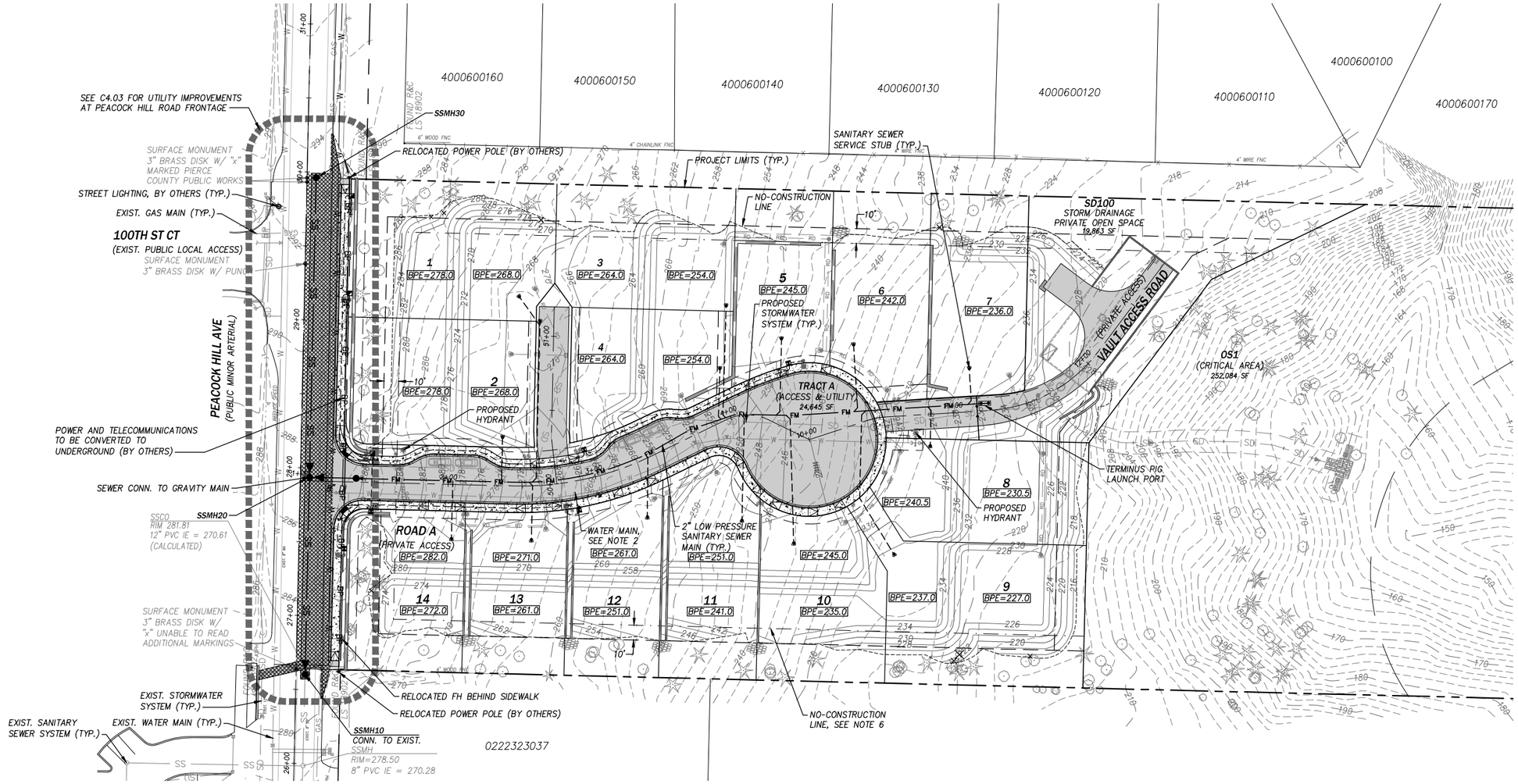
FIGURES

PTN. SEC. 32, TWP 22 N, R2E W.M.



LEGEND

- SD — STORM DRAIN
- SD CATCH BASIN
- FM — SANITARY SEWER FORCED MAIN
- SS — SANITARY SEWER MAIN
- STANDARD PRECAST MANHOLE
- SIDE SEWER SERVICE
- SIDE SEWER CLEANOUT
- W — WATER MAIN
- WATER SERVICE
- PUBLIC UTILITY ESMT.
- WATER METER
- FIRE HYDRANT

NOTES:

1. THE LOW PRESSURE SANITARY SEWER (LPSS) COLLECTION MAIN SHALL BE HDPE SDR-11 OR APPROVED EQUAL INSTALLED IN GENERAL ACCORDANCE WITH COGH PUBLIC WORKS STANDARDS.
2. WATER IMPROVEMENTS SHOWN ARE FOR REFERENCE ONLY. FINAL DESIGN AND CONSTRUCTION TO BE COMPLETED BY WASHINGTON WATER SERVICE COMPANY (WWSC). CONTRACTOR SHALL COORDINATE INSTALLATION WITH WWSC.
3. THE MANHOLE AT THE TERMINUS OF THE LOW PRESSURE MAIN AND THE FIRST MANHOLE DOWNSTREAM OF THIS TERMINUS SHALL BE COATED WITH SPECTRA-SHIELD LINING SYSTEM OR APPROVED EQUAL.
4. THE LOW PRESSURE SANITARY SEWER (LPSS) COLLECTION MAIN AND PRIVATE SEWER SERVICE LATERAL DESIGN PROPOSED WITH THIS PROJECT ARE BASED ON MANUFACTURER RECOMMENDATIONS FOR A REPRESENTATIVE E|ONE MODEL DH07 GRINDER PUMP SYSTEM (OAE). THIS PROJECT PROPOSES TO INSTALL THE LPSS COLLECTION MAIN AND PRIVATE SEWER LATERALS FOR EACH LOT AS SHOWN IN THESE PLANS. EXTENSION OF THE SERVICE LATERALS, INCLUDING A SWING CHECK VALVE AND OTHER NECESSARY APPURTENANCES, SHALL BE INSTALLED BY INDIVIDUAL HOME BUILDERS IN THE FUTURE AND IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDED MEANS AND METHODS.
5. DUE TO INADEQUATE FIRE FLOW AVAILABILITY, RESIDENTIAL SPRINKLER SYSTEMS IN ACCORDANCE WITH IFC CH. B105.1 AND NFPA 13D (INCLUDING GARAGES) MUST BE INSTALLED AND MAINTAINED IN PERPETUITY IN ALL BUILDINGS AND STRUCTURES HENCEFORTH UNDER A SEPARATE BUILDING PERMIT FROM THE CITY OF GIG HARBOR.
6. THE CLEARING AND GRADING SHOWN AND ANY IMPROVEMENTS WITHIN THE 10-FOOT NO CONSTRUCTION ZONE SHALL BE ALLOWED ONLY UPON INSPECTION AND CERTIFICATION BY THE PROJECT ARBORIST THAT SUCH WORK WILL NOT ADVERSELY AFFECT THE LONG-TERM VIABILITY OF THE TREES WITHIN THE DESIGNATED LANDSCAPE OR BUFFER AREA.

FIGURE 2 - OVERALL SEWER PLAN

0 40 80
PLAN IN FEET

811 Know what's below. Call before you dig.

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NO.	DATE	REVISION	BY	CK.
1	9/28/22	PRELIMINARY PLAT SUBMITTAL (PLPRLAT22-00001)	MDS	DRG

DARRON RIELY-GIBBONS
STATE OF WASHINGTON
54944
REGISTERED PROFESSIONAL ENGINEER
12/21/2022

THE RESERVE

ROADWAY, GRADING AND DRAINAGE IMPROVEMENTS

FIGURE 2 - OVERALL SEWER PLAN

CITY OF GIG HARBOR PIERCE COUNTY, WASHINGTON

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PROJECT NO.
0228-21-001

DRAWING
C4.00

SHEET 2 OF 2

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APPENDIX A

HYDRAULIC CALCULATIONS

Site Planning
Civil Engineering
Project Management
Land Development Consulting

Environment One Corporation

Pressure Sewer Preliminary Cost and Design Analysis For The Reserve

Prepared For:
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Kirkland WA 98034 USA
Tel: 4254840949
Fax:
Prepared By: Darton Riely-Gibbons
July 11, 2022

PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By: The Reserve

Darton Riely-Gibbons July 11, 2022

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Fric Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR21PVC											Friction loss calculations were based on a Constant for inside roughness "C" of: 150						
1.00	1.00	14	14	400	12.00	4	48.00	2.00	4.25	437.00	3.09	13.50	13.50	278.12	237.00	41.12	54.62

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One.

P:\project\0228_Prospect Development\21001_The Reserve\Design\Utilities\EONE Analysis\The Reserve Sewer.EOne

PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)

Prepared By:
Darton Riely-Gibbons

The Reserve

July 11, 2022

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR21PVC								Gals per Day per Dwelling		200
1.00	1.00	14	2.00	18.84	437.00	82.34	5,600	68.01	0.35	0.35

Note: This analysis is valid only with the use of progressive cavity type grinder pumps as manufactured by Environment One

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APPENDIX A

EONE BROCHURE

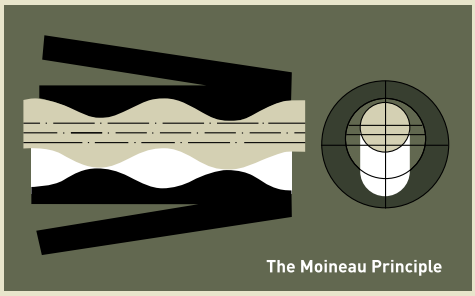

ENGINEERED
TO DO ONE JOB
PERFECTLY
E/ONE
EXTREME
SERIES
PRESSURE
SEWER
SYSTEMS

ENGINEERED TO DO ONE JOB PERFECTLY

At the heart of the E/One Sewer System is the toughest, hardest working pump in the industry. The new standard in excellence, durability, and longevity, the E/One Extreme Series Grinder Pump. Its evolution reflects everything we've learned in 40 years as the originator and leader in the category of low pressure sewer systems.

The pump stations incorporate the grinder pump, motor controls and level sensing device integrated into a compact unit, easily removable for servicing when necessary.

And, the geometry of the pump not only produces a near-vertical pump curve, but allows passage of ground solids without clogging. Because of the low rpm and highest quality components, we experience the lowest service call rate in the industry. An average mean time of 10 years between service calls is typical.



The Moineau Principle

The progressing cavity pump itself is based on the Moineau principle. A rotor turns within a stator, creating a sequence of sealed chambers. The precision-cast and polished stainless steel rotor moves wastewater through these chambers at a nearly constant flow, over a wide range of conditions – from negative to abnormally high heads. Turning at just 1,725 rpm, the one-horsepower motor can pump fluid through more than two miles of small-diameter piping or elevation changes of over 185 feet.

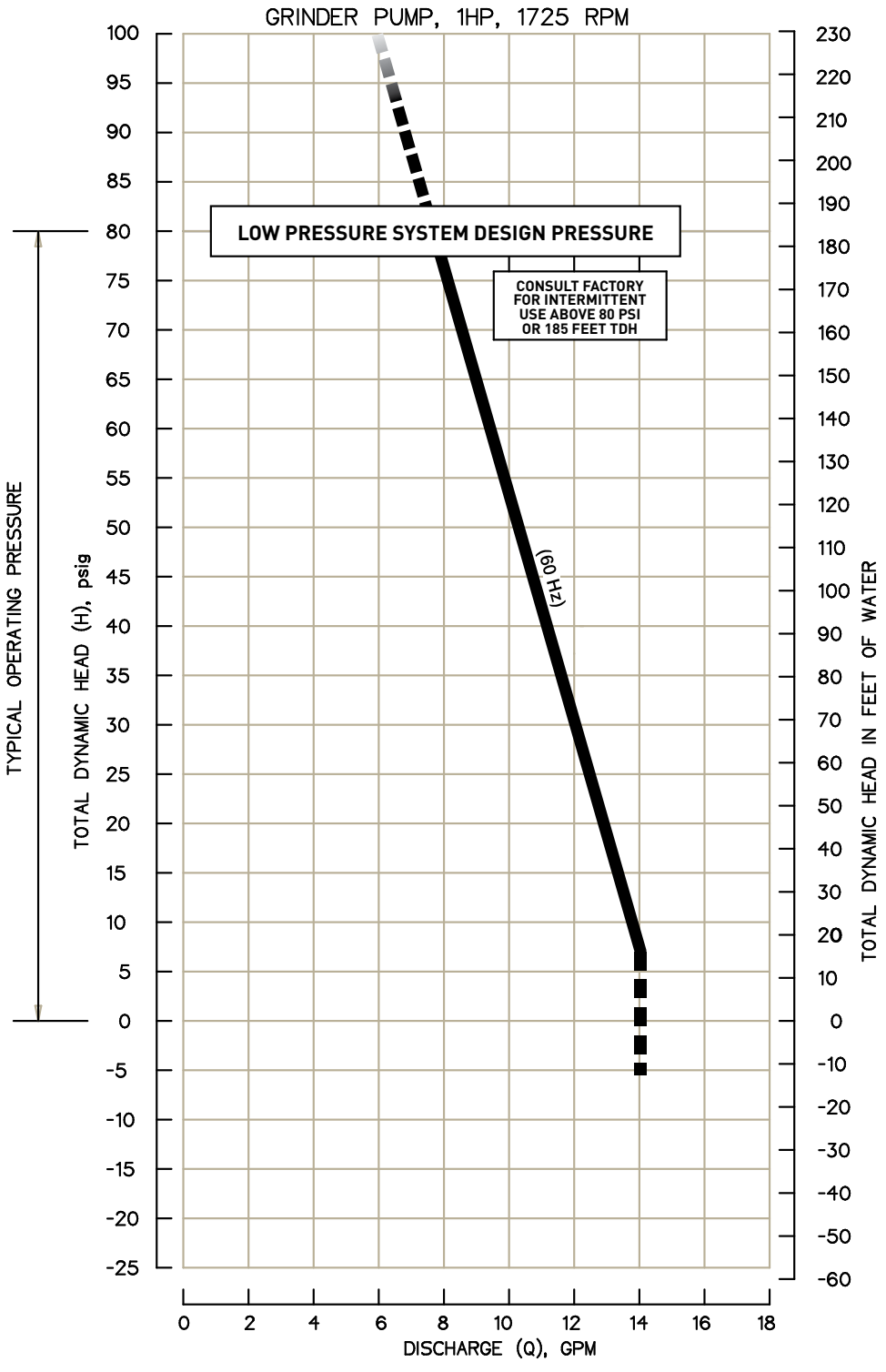
SOME KEY ADVANTAGES:

- **HIGH HEADS/NEGATIVE HEADS.** Reliable operation from negative head to 185 feet of total head for continuous duty reduces the number of lift stations and pipe sizes. This cuts costs – both initially and in long-term operation and maintenance.
- **CONSTANT FLOW.** The system pressures to be overcome by any given grinder pump in a low pressure system vary dramatically over the course of a day. E/One's progressing cavity pump readily accommodates these pressure variations while maintaining a nearly constant flow without ever operating at "near shut off" – thus avoiding the wear and motor burn-out suffered by other pump types.
- **HIGH GRINDING TORQUE.** Our unique pump system, driven by a one-horsepower motor turning at 1725 rpm, produces grinding torque greater than a two-horsepower pump turning at twice the speed.
- **ENERGY EFFICIENT.** The pump is activated automatically and runs for short periods. Typical annual energy consumption is comparable to a 40-watt light bulb.
- **LOW MAINTENANCE SUBMERSIBLE MOTOR.** Low maintenance and long life are the hallmarks of our air-filled motor. Permanently lubricated ball bearings and Class F insulation eliminate the need for periodic oil changes and oil disposal costs required by oil-filled submersible motors.
- **LARGE-DIAMETER GRINDER ASSEMBLY.** Almost twice the diameter of most other types of grinder pumps, contributing to a dramatic reduction of inflow velocity for less wear and no blinding, clogging or jamming.
- **NO PREVENTIVE MAINTENANCE.** Non-fouling static level sensors require no preventive maintenance. Because of our unique, near constant discharge rate, no main line flushing is required in a properly designed system.
- **CORROSION RESISTANCE.** E/One's stainless steel ball-type discharge valve and piping won't corrode like copper or galvanized, and hold up years longer. No corrosion, no maintenance.
- **DEPENDABILITY.** E/One pumps typically run ten years between service calls with 40 years of in-ground experience.
- **PROVIDES FOR ENVIRONMENTALLY SOUND WASTEWATER MANAGEMENT.** The E/One Extreme Series grinds waste material into small particles. This enables the use of inexpensive, small-diameter pressure pipes, buried at shallow depths, to transport wastewater to a suitable processing site. Result: Ground water contamination from failing septic tanks can be eliminated.
- **SERVICEABILITY.** Our unique core design eliminates the need for in-field troubleshooting and pump servicing. This means lower maintenance costs and minimum homeowner inconvenience.

GRAVITY SEWERS ARE NO LONGER THE RULE FOR SOLVING WASTEWATER PROBLEMS.

At the heart of the system is the E/One progressing cavity grinder pump – with high heads that can eliminate costly lift stations, and a robust, powerful design that translates into the industry's highest levels of reliability, availability and maintainability.

E/ONE SPD PUMP PERFORMANCE CURVE



ENGINEERED LOW PRESSURE SYSTEMS

REPEALING THE LAW OF GRAVITY

NOBODY CAN TOUCH OUR CURVE.

In a low pressure system, constant, predictable pump output is the foundation for proper hydraulic design. It enables the engineer to minimize retention time, pump wear, and keep scouring action at effective levels.

Environment One's semi-positive displacement, progressing cavity pump has a nearly vertical H-Q curve. It is by far the most "forgiving" pump design – providing predictable flow over the full range of typical system pressures; strengths critical in a large-scale, low pressure sewer.

E/One's superior high head capability allows a system with few, if any, lift stations. And, it easily accommodates additional future connections without compromising system performance.

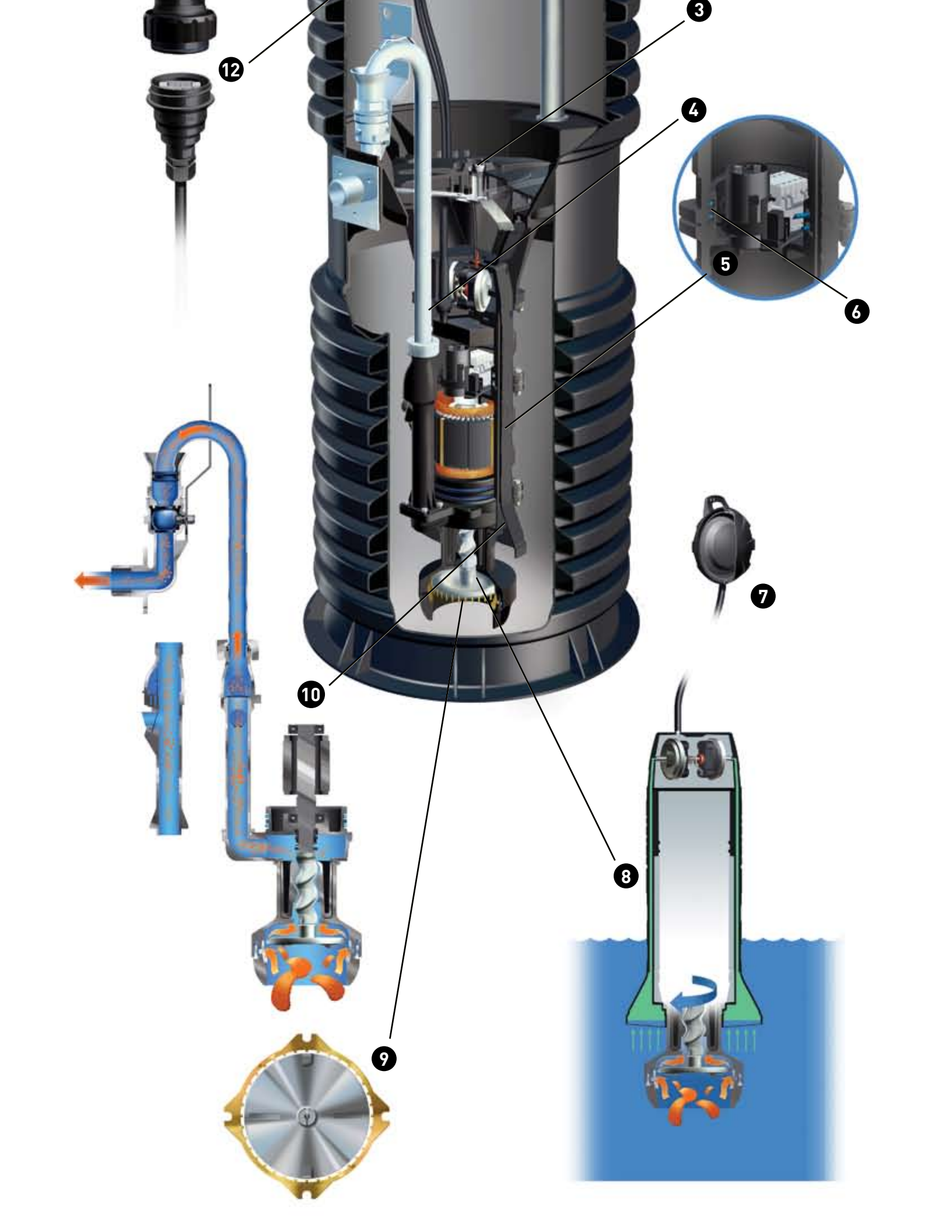
These E/One pump characteristics translate into:

- predictable hydraulic design
- lower collection system capital costs
- less maintenance
- lower operating costs

ANATOMY OF A LEADER:

THE INSIDE STORY ON THE E/ONE GRINDER PUMP STATION.

1. **LOW-PROFILE COVER:** Aesthetically pleasing. Provides easy access for service while blending with surroundings.
2. **HIGH-DENSITY POLYETHYLENE TANK:** Double-wall construction of high-density thermoplastic for rugged reliability. Factory pressure tested for infiltration and exfiltration free installation.
3. **QUICK-RELEASE CORE LATCH:** All stainless mechanism secures core in place and can be easily released from ground level.
4. **STAINLESS STEEL PIPING & HARDWARE:** E/One's SS discharge piping and ball valve won't corrode. No corrosion, no maintenance, no tools required.
5. **UNIQUE CORE DESIGN:** Eliminates the need for in-field troubleshooting and service. Modular controls simplify service.
6. **DOUBLE O-RING SEALS:** Make assemblies waterproof and novel joint geometry minimizes the effects of crevice corrosion.
7. **E/ONE EQUALIZER:** Compensates for fluctuations in atmospheric pressure to enable accurate level sensing while assuring the level sensing system is watertight.
8. **PROGRESSING CAVITY PUMP:** A deceptively simple design produces a nearly constant flow under a wide range of continuously varying conditions.
9. **GRINDER WHEEL AND SHREDDER RING:** Hardened corrosion-resistant cutter bars and teeth process sewage, grinding wastewater solids, as well as wood, plastic and cloth. Will not jam or clog!
10. **PRESSURE SWITCH LEVEL CONTROL:** Self-cleaning level sensors require no preventive maintenance.
11. **DIRECT-BURY CABLE:** For simple and inexpensive installation.
12. **ELECTRICAL QUICK DISCONNECT:** For safe and easy service. UL-listed, compatible with OSHA regulations for confined space entry.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LEADING THE INDUSTRY WE INVENTED.

Environment One not only pioneered the low pressure sewer system, but consistently leads the industry both in system deployment and innovation. The company is dedicated to Total Quality, Continuous Improvement, and Customer Satisfaction, as evidenced by the E/One Extreme Series. Today, there are nearly a million end users worldwide.

SEWER ANYWHERE

Driven by the remarkable E/One Extreme grinder pump, E/One Sewers give engineers, developers, municipal sanitarians, and land planners unprecedented new freedom in land usage and septic tank replacement.

With a smaller footprint and a softer touch on the land, they're so much easier to install. Front-end costs can be reduced by as much as 80%. Total installed costs by half. And O&M costs by up to 75%.

The E/One Extreme grinder pump reduces all forms of sanitary waste to a non-clogging slurry and pumps it through a network of small-diameter pipes. Since gravity is replaced by the power of the pump, sewer systems need not run downhill nor require large-diameter pipes, deep trenches, multiple booster stations – or their associated costs.

A system powered by the E/One Extreme grinder pump converts formerly cost-prohibitive building sites into cost-effective reality. "Problem areas," with high ground water, elevation changes or impenetrable bedrock, are transformed into valuable, developable real estate.

Of course, E/One's low upfront cost advances apply to conventional building sites as well.

In addition, E/One units are easy to install and virtually maintenance-free – refined through 40 years of experience with the largest installed base in the industry.

SAVE THOUSANDS, VIRTUALLY SERVICE-FREE.

Contact your local distributor:

e|one
SEWER SYSTEMS

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LM000364 Rev B