INTERLOCKING BAL-LAST SYSTEM™

Make your next E/One® installation an easy one with Bal-Last™ Interlocking Ballast Systems

• tel. 978.808.4986
www.interlockingballast.com

August 8, 2023

Ballast for Environment One® stations - The evolution of ballast practices.

Over the past 40 years of installation of Environment One grinder pump stations there have been several methods used to provide ballast containment. Environment One Corporation used to use a very conservative approach that called for a full ballast concrete capable of holding the station and ballast in place without consideration of the soil backfill. All pump chamber installations require ballast consideration.

Typical installation instructions used to call for 2/3 of a yard of concrete for the standard 2010-93 Station. This would be the same for the current model designation under the **EXTREME Series DH071-93** station.

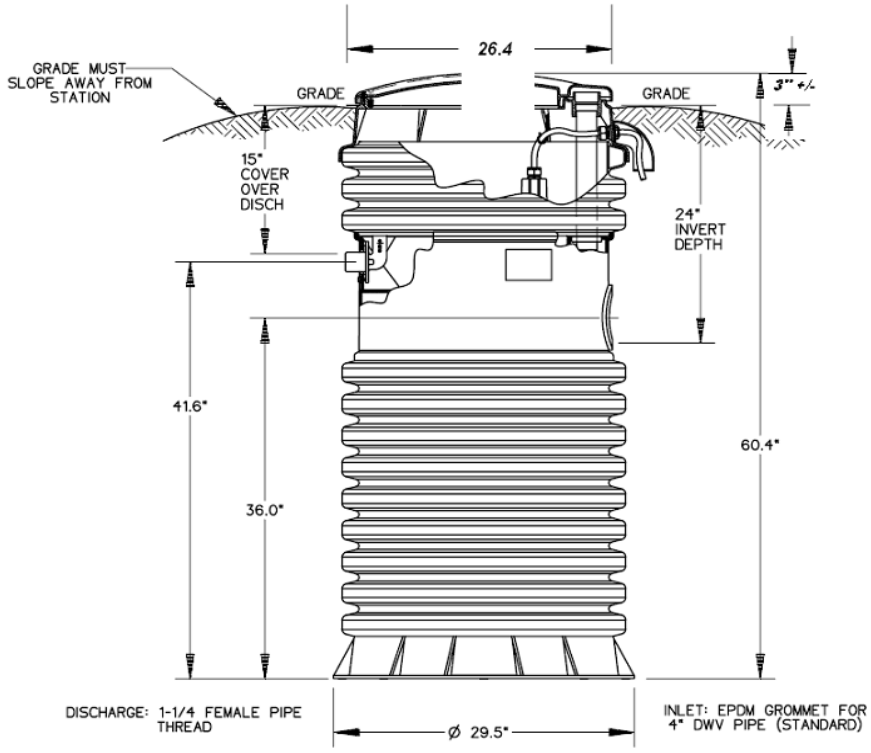
Constants:	**Concrete Density in air**		**150.00**	**lb/cu. Ft.**	
	Density of Water		**62.40**	**lb/cu. Ft.**	
	Density of Concrete in water		**87.60**	**lb/cu. Ft.**	
	Density of dry Compacted Soil		**110.00**	**lb/cu. Ft.**	
	Density of saturated backfill		**70.00**	**lb/cu. Ft.**	
Example:	**DH071-93 station**				
	Station weight		**270.00**	**lbs.**	
	Diameter		**26.40**	**inches**	
			2.20	Feet	
	A= π(D)²/4		3.80	Sq. Ft.	
	Height of station		**91.80**	**inches**	
			7.65	Feet	
	Buried depth		88.80	inches	
			7.40	Feet	
	Volume Displaced = Area times Height		28.13	Cu. Ft.	
	Uplift force	**62.40**	**28.13**	**1755.305**	**lbs.**
	Less weight of station			-270.00	
	Weight to hold station in standing water			1485.30	lbs.
	Volume of concrete needed to hold station in water				
	Uplift force/density of concrete in water			16.96	cu. Ft.
	Volume in cubic feet/ 27 cu. Ft. per yard			**0.63**	**yds.**

Several years ago, Environment One modified the ballast calculations to include the weight of backfill soil to meet actual conditions. This approach has greatly reduced the amount of concrete ballast required. The following table of uplift forces (Ballast Worksheet DH071) provides ballast and uplift forces for each station. The compensating ballast weights shows that the standard ballast ring of 408 pounds and the weight of saturated soil backfill meet the ballast needs for these stations. The table lists the uplift forces for a station in fully saturated soil conditions and for a variety of station heights and associated bury depths.

Example: DH071-61

The soil backfill height is less than the full height of the station allowing for the 10-inch ballast ring at the bottom and the exposed access cover height of 3+/- inches.

DH071-61



The soil area above the concrete ballast ring (anti-floatation collar) is calculated by determining the total area of soil less the area of the grinder pump and multiplying this by the height of soil to

determine the cubic feet of soil. Knowing the specific weight of saturated soil, we can calculate the weight or ballast value of the saturated soil backfill.

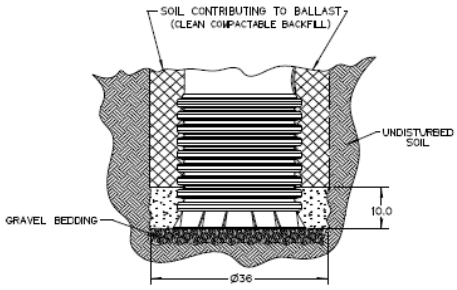
Looking at the Manufacturer's Ballast Worksheet we have shaded the uplift forces in red and the ballast weights in green. The "Final Condition" is the weight of the station and ballast more than the uplift forces of a submerged station.

BALLAST WORKSHEET DH071

Model	Pump Volume (ft^3) *	Pump Height (ft)	Pump Dia. (ft)	Submerged Volume (ft^3)	Buoyant Force (lbs.)	Pump Weight (lbs.) *	Net Buoyant Force (lbs.)	Ballast Height (in.)	Ballast Diameter (in)	Area of Ballast (ft^2)	Volume of Ballast (ft^3)	Volume of Ballast (yd^3)	Weight (in water)of Concrete (lb)	Weight (in air)of Concrete (lb)	Volume of Saturated Soil (ft^3)	Weight of Saturated Soil (lb)	Volume of Dry Soil (ft^3)	Weight of Dry Soil (lb)	Total Ballast Weight (lb)	Final Condition Weight (lb)
DH071-61	19.1	5.03	2.20	19.10	1192	238	954	10	36	3.27	2.7	0.1	238.5	408	12.8	896.9	0.0	0.0	1135.4	181.6
DH071-74	22.8	6.08	2.20	22.80	1423	254	1169	10	36	3.27	2.7	0.1	238.5	408	16.2	1137.1	0.0	0.0	1375.6	206.9
DH071-93	28.6	7.65	2.20	28.60	1785	270	1515	10	36	3.27	2.7	0.1	238.5	408	21.4	1496.1	0.0	0.0	1734.6	220.0
DH071-124	38.6	10.30	2.20	38.60	2409	280	2129	10	36	3.27	2.7	0.1	238.5	408	30.0	2102.2	0.0	0.0	2340.7	212.1
DH071-129	40.0	10.70	2.20	40.00	2496	300	2196	10	36	3.27	2.7	0.1	238.5	408	31.3	2193.7	0.0	0.0	2432.2	236.2
DH071-158	49.5	13.20	2.20	49.50	3089	325	2764	10	36	3.27	2.7	0.1	238.5	408	39.5	2765.5	0.0	0.0	3004.0	240.2
DH071-160	49.9	13.30	2.20	49.90	3114	329	2785	10	36	3.27	2.7	0.1	238.5	408	39.8	2788.3	0.0	0.0	3026.8	242.1

*Heights above 160" will have special ballast requirements

0.0



As you can see the volume of 2.7 cubic feet with saturated soil backfill will provide a positive "Final Condition" for all the heights of stations shown in this table. This modified ballast method does depend greatly on a uniform structural bond of concrete to the tank basin. By reducing the amount of concrete required and relying on the weight of the soil on the concrete, installers can save the cost of the conservative concrete used in previous installation methods. **However, it is critical that this smaller concrete ballast be securely attached to the pump chamber.** Pre-casting prior to installation to allow the concrete to reach full strength is highly recommended. If concrete is poured in place, then care must be taken to secure the pump chamber and to allow the concrete to properly cure. These methods may

require bracing the pump and dewatering the soil until the concrete can properly bond to the tank.

Curing is one of the most important steps in concrete construction.

- Proper curing increases the strength and durability of concrete.
- Proper water content and temperature are essential for good curing.
- The more water that is added to the mix the weaker it becomes; adding one extra quart of water per 80 lb bag can reduce the strength of the concrete by up to 40%.
- In near freezing temperatures, the hydration process slows considerably.
- When the weather is too hot, dry or windy, water is lost by evaporation from the concrete and hydration stops, resulting in finishing difficulties and cracks.
- The ideal circumstances for curing are ample moisture and moderate temperature and wind conditions.

Bal-Last™ Interlocking Ballast System

Recently we have developed a ballast containment method that utilizes the smaller volumes of concrete required by the manufacturer with the added benefits of ease of handling and the ability to immediately backfill the pump station. The Bal-Last™ Interlocking Ballast System shown below is a series of 4 interlocking ballast blocks that are pre-cast with concrete and are locked to the pump chamber for a positive structural bond that may be used immediately. These blocks are formed to specifically fit the tank ribs and support the tank and backfill ballast soil. Each block is provided with lifting inserts and lifting rings to allow for easy handling of the pump and ballast as one assembly. The Bal-Last™ system works in all kinds of soil conditions and provides structural support and full ballast strength for immediate backfilling of the pump chamber. This system prevents the station from shifting upwards under high groundwater conditions.

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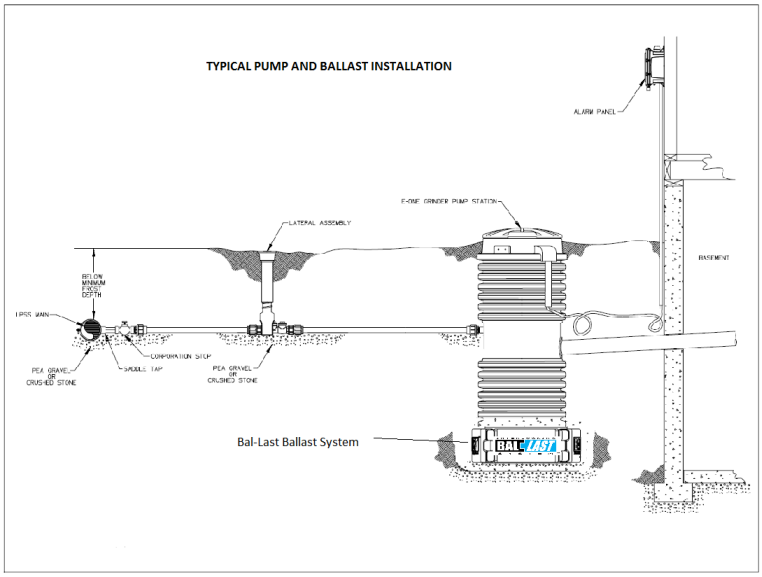
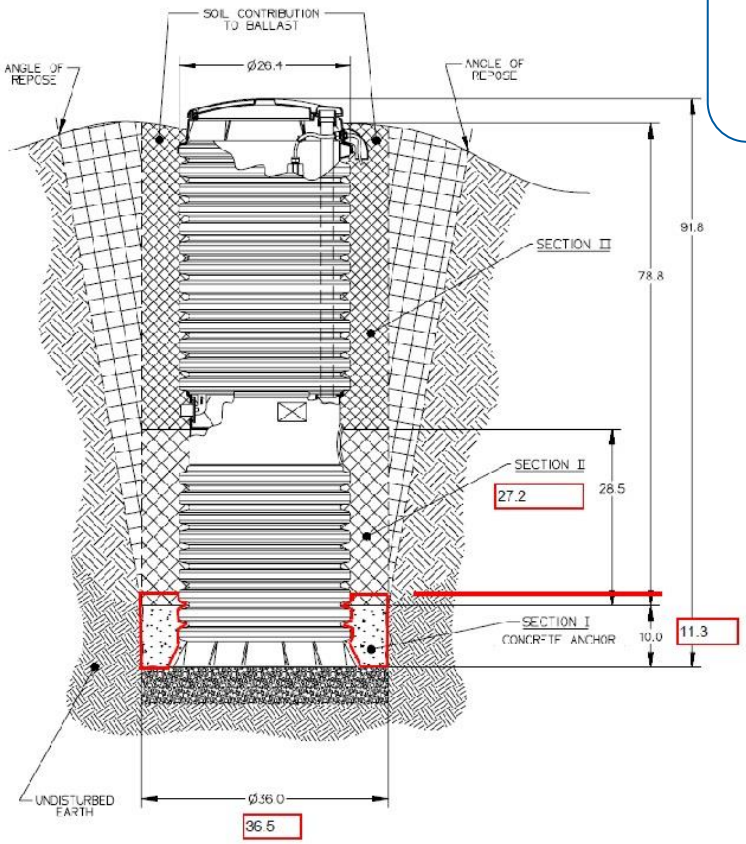


The blocks interlock with the tank ribs and to each other to form a continuous structural ring and each block is secured with locking pins to prevent separation. The high strength concrete material used in these systems is molded to a precise fit with the tank wall; thereby providing proper bond and strength to be used as ballast. This allows the use of backfilled soil to complete the ballast requirement.

The "TYPICAL PUMP AND BALLAST INSTALLATION" detail shown here depicts how the system works with the grinder pump installation.



The image (left) is a modified drawing which is taken from the manufacturer's installation manual that shows the comparison of the Bal-Last™ Interlocking Ballast Block System compared to the manufacturer's required form and pouring method. As you can see this system fully exceeds the required dimensions and captures the added support of the backfill soil for a complete ballast system.

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Available with the Bal-Last™ Interlocking ballast system is a (4) four-point lifting harness designed to connect to the lifting hooks provided and properly center and secure the balanced lifting and placement of the grinder pump.

The lifting harness and carry bag are available for purchase, rent or loan through authorized distributors. The harness assembly is rated at 3,000 pounds of working load capacity, providing a considerable safety margin to lift the pump and ballast ring.

Best of all we have found the Bal-Last™ system can save between and 20 and 40% over the cost to pre-cast or pour in place typical concrete ballast rings. So, save some valuable time and reduce your cost to install ballast.

Your Bal-Last™ Dealer has proudly represented Environment One ® Corporation for many years. They would be pleased to help you with your Pressure Sewer needs. Please visit our website. www.interlockingballast.com Check the Distributor page for a dealer near you.

Best regards,

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