N-12® Pipe

The high-performance future of engineered drainage

ADS®

The new standard in drainage pipe

Every day for more than 30 years, Advanced Drainage Systems corrugated high density polyethylene (HDPE) pipe has been building its reputation for economy, durability, and superior performance in gravity-flow drainage applications. During the 1970's and 1980's, ADS single wall pipe became the preferred product for agricultural, mining, turf/recreation, and residential drainage markets.

N-12® Pipe (4" - 60")(100-1500mm)

The hydraulic capabilities of the product were significantly improved in 1987 when ADS introduced the first HDPE drainage pipe to combine an annular corrugated exterior for strength with a smooth interior wall for maximum flow capacity. Named for its excellent Manning's "n" rating of 0.012, N-12 pipe was designed specifically for storm sewers, highways, airports, and other engineered construction. Through extensive field and university testing, ADS engineers were able to refine the corrugated wall design for larger diameters without compromising the pipe's excellent strength-to-weight ratio. Its performance and economy have led to rapid acceptance by contractors and engineers, and official approval by state and municipal agencies.

Revolutionary joining technology

Years of research and testing have produced soil-tight and water-tight systems providing unsurpassed joint integrity, with built-in bell joints and fast push-together installation.

Soil-tight joint. N-12 ST IB pipe, delivered with an integral bell and spigot joint, meets the most stringent soil-tight requirements. The bell design resists distortion, chipping or cracking, and spans three corrugations, exceeding AASHTO M294 recommendations. The in-line bell design eliminates the need to dig bell holes in the trench. Joints are sealed by a factory-installed rubber gasket that meets all requirements of ASTM F477.

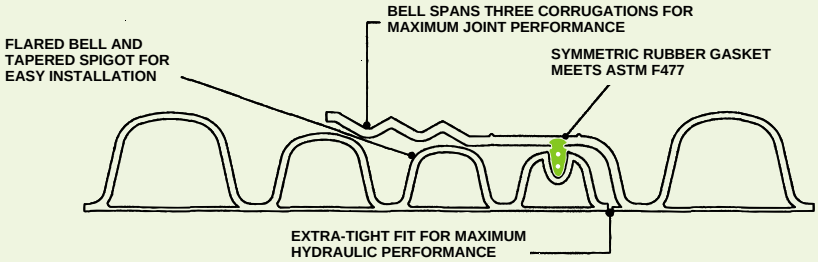
Water-tight joint. Incorporating patented technology developed in the aerospace industry, N-12 WT IB pipe adds two important features to the N-12 soil-tight pipe design. The sealing area of the bell is reinforced with a proprietary 2" (50mm) ceramic/polymer composite collar which improves the joint's integrity and dimensioinal control. Secondly, a proprietary gasket designed to maximize sealing reference and meeting ASTM F477, is factory installed into the spigot. The result is a design that meets or exceeds ASTM D3212 lab test and ASTM F1417 water-tight field test requirements, and fills an essential role in complying with the stricter demands of new EPA water quality guidelines.

Applications

N-12 pipe meets the requirements for Type S pipe under AASHTO M 252 and M 294. This product can be specified for culverts, cross drains, storm sewers, landfills, and other public and private construction.

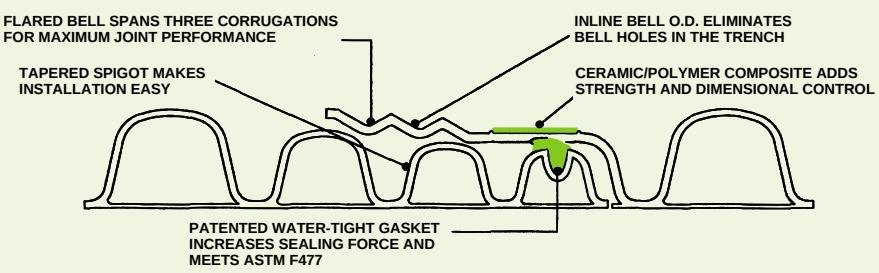
N-12® Pipe, (plain end, 4" – 60") (100-1500mm)

The first corrugated High Density Polyethylene drainage pipe with a smooth inner wall for superior hydraulics and maximum flow capacity.



N-12 ST IB Soil-tight Pipe, (4" – 60") (100-1500mm)

Integral gasketed bell-and-spigot joint for long-term soil-tight performance. (4"-10" sizes incorporate integral bell and non-tapered gasketed spigot.)



N-12 WT IB Water-tight Pipe, (4" – 60") (100-1500mm)

Reinforcing collar and proprietary sealing gasket provide a durable water-tight connection. (4"-10" sizes incorporate integral bell and non-tapered gasketed spigot.)

Technology creates a superior pipe material

Gone are the days when plastic pipe was specified only for cost reasons. Advances in polymer science and structural design have created a product that has ***actually outperformed and outlasted concrete and metal pipe while maintaining its cost advantage.*** By any measure, ADS N-12 pipe compares favorably to conventional materials.

Structural Strength

As a flexible conduit, HDPE pipe withstands vertical pressure by transferring most of the load to the surrounding soil. N-12 pipe will support H-25 live loads with 12" minimum cover* and E-80 loads under 24" cover. Maximum cover will vary with design conditions, but can usually be specified up to 60 feet. In controlled tests, N-12 has performed well at fill heights of more than 100 feet.

* 60" pipe requires 2' cover for H-25 loads.

Durability

High density polyethylene is an extremely tough material that can easily withstand the normal impacts involved in shipping and installation. It is highly resistant to chemical attack and is unaffected by soils or effluents with pH ranges from 1.5 to 14.

HDPE's ductility and molecular structure result in excellent resistance to abrasion. Polyethylene pipe shows less than 20% of the material loss of concrete pipe in abrasive environments, and is often specified for harsh mine slurries and as a slip liner for deteriorated culverts.

Hydraulic efficiency

The smooth interior of N-12 pipe provides superior flow characteristics. Tests on various sizes of N-12 pipe show Manning's "n" values ranging from 0.010 to 0.013. (It should be noted that "n" values tend to increase with slower velocities and larger pipe sizes.) The chart below indicates that the values for N-12 pipe are basically the same as those yielded on previous tests of reinforced concrete pipe. On the other hand, the "n" ratings for corrugated metal pipe are considerably higher, and are predicated on the pipe running full to develop the spiral flow.

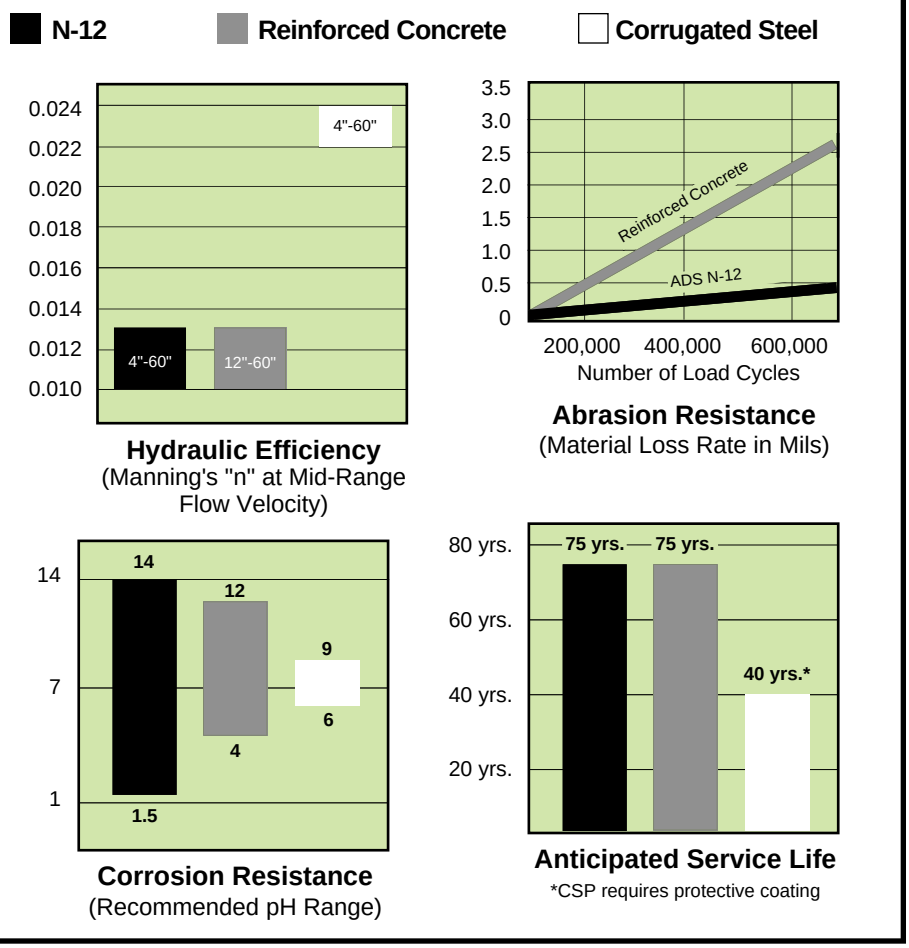
Light weight

HDPE pipe is up to 30 times lighter than concrete pipe, making it far easier to transport and handle. On-site labor and equipment requirements are reduced, with a corresponding reduction in the potential risk of injury.

Fast installation

Long 6m (19' 8") lengths mean fewer joints. (N-12 pipe is also available in 13 ft. lengths for smaller trench boxes.) Soil-tight or water-tight connections are quick and easy with integral gasketed bell and spigot joints. The pipe cuts easily and does not need to be beveled for joining. In typical trench depths of 6 to 10 feet, contractors report installation rates ranging from 1,200 feet per day of 15"-24" pipe to more than 400 feet per day of 60" pipe.

How HDPE stacks up against the competition:



The lowest installed cost of any drainage pipe

The material cost of HDPE is extremely competitive with concrete and corrugated metal. When installation costs are factored in, the savings start to multiply.

- Polyethylene's light weight cuts shipping charges. More lengths of pipe per truck means fewer delivery loads.
- Fewer people are needed for on-site unloading and handling.
- Heavy equipment requirements are reduced.
- Long lengths are easy to handle and require fewer joints.

A recent survey of state Departments of Transportation revealed that reductions in installed cost for HDPE pipe were 12 to 38 percent compared to concrete, and 5 to 28 percent vs. corrugated steel.

A choice of joining systems

1. ***Integral bell-and-spigot joints.*** N-12 ST IB and N-12 WT IB pipe (see page 2) are engineered for fast installation of long straight sewer lines that require soil-tight or water-tight joint performance.
2. ***Hinged split couplers and fabricated fittings*** provide cost effective connections for normal drainage installations. ADS can fabricate virtually any fitting as long as it meets engineering standards.
3. ***Injection molded HDPE couplers*** are available on fittings and repair couplers to meet specific joint performance requirements and provide installation savings. Just align the pipe or fitting sections, lubricate the bell and spigot, and push together.
4. ***Small diameter injection molded fittings.*** A complete line of fittings including tees, wyes, elbows, couplers and reducers are available in 4"-12" (100-300mm) diameters for both soil tight and water tight applications.
5. ***Series 35® thermo-molded PVC sanitary fittings*** meet the 10.8 psi pressure testing requirements of ASTM D 3212. Selection includes couplers, tees, wyes, elbows, caps and adaptors, each fitted with a rubber gasket. The fittings connect not only corrugated HDPE pipe, but also PVC, concrete and other materials.

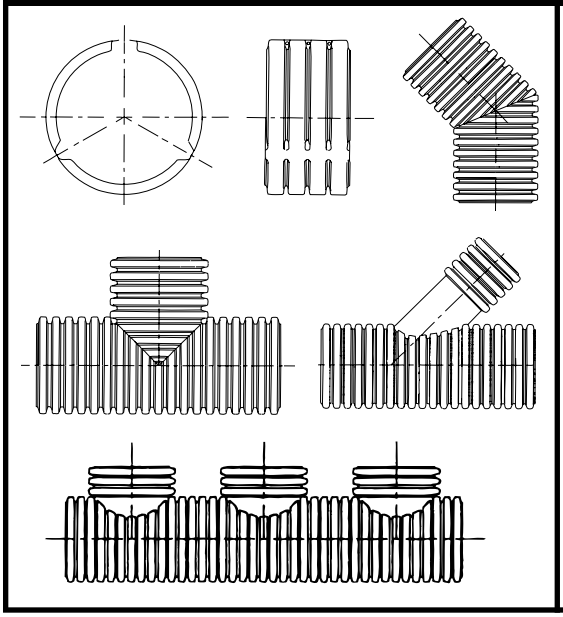
Installation recommendations

Proper installation is perhaps the major determinent of long-term performance of any drainage pipe, and the basic procedures and precautions for corrugated polyethylene pipe are in fact quite similar to those for concrete and metal pipe.

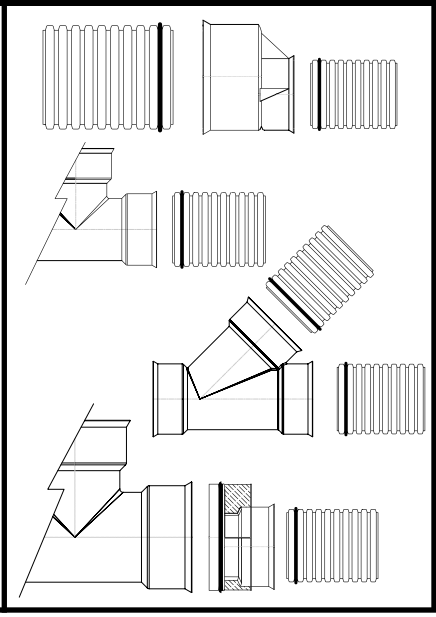
N-12 pipe is a flexible conduit which transfers live and dead loads to the surrounding soil. Particular care is therefore required in bedding, backfilling and compaction, and in the selection of backfill material.Class I, II, or III soils may be used for backfill, and should be compacted to at least 90% Standard Proctor Density.

Instructions for underground installation of plastic drainage pipe are contained in ASTM D 2321. AASHTO Section 30 is recommended for highway applications. Specific instructions for N-12 pipe are detailed in ADS Product Note 3.115, "Installing N-12® Storm, Sanitary Sewer and Culvert Pipe".

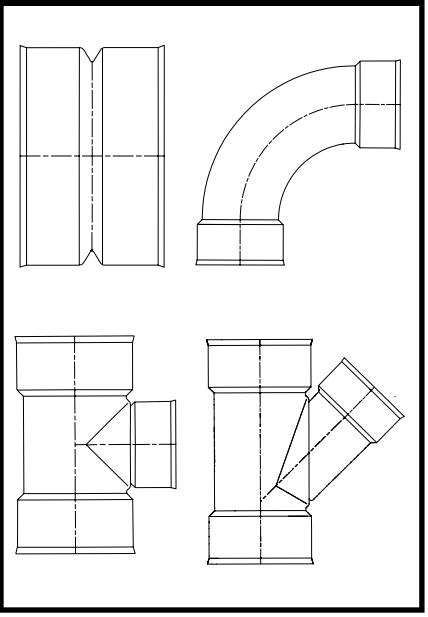
Standard & Fabricated Drainage Fittings



Injection Molded Fittings

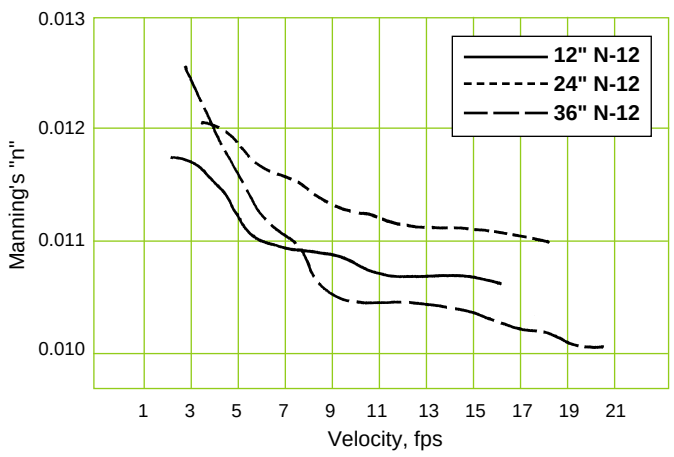


Series 35® Sanitary Fittings



Specifications

Manning's "n" vs. Velocity



Source: Tests at Utah State University

Recommended Manning's "n" for Design

Pipe Dia. (in)	(mm)		Reinforced Concrete[1]	Corrugated Steel[1,2]
4"– 10"	100-250	.010	N/A	.024
12"—15"	300-380	.012	.012	.024
18"—36"	450-900	.012	.012	.024
42" – 60"	1060-1500	.013	.013	.024

[1] *Source: "Hydraulic Design of Highway Culverts" Federal Highway Administration, HDS No. 5*

[2] *2 2/3 x 1/2 corrugation pattern*

Height of Cover

Minimum Cover:
H-25 loads: 12" **(300mm) E-80 loads: 24" (600mm)

Maximum Cover: Typically 50-60 (15-18m) feet but will vary depending on application and engineering design.

Notes:
1. Cover heights are measured from the top of the pipe.
2. Calculations based on load factor design per AASHTO procedures.
3. Assume soil density of 120 lbs./cu. ft.
4. Backfill compacted to minimum 90% density per AASHTO T-99.
5. If a hydro-hammer is used for compaction, at least 48" (1.2m) of cover must be provided.

** 60" pipe requires 2 'cover for H-25 loads.

Pipe Stiffness

Pipe Diameter (in")	(mm)	Minimum Pipe Stiffness (psi)
4"-12"	100-300	50
15"	380	42
18"	450	40
24"	600	34
30"	760	28
36"	900	22
42"	1060	19
48"	1200	17
60"	1500	14

Weight Comparison

Pipe Dia. (in")	(mm)	Pounds per Foot N-12	Concrete [1]	Corrugated Steel [2]
4"	100	.45	N/A	N/A
6"	150	.85	N/A	6
8"	200	1.5	N/A	7
10"	250	2.0	50	9
12"	300	3.2	79	11
15"	380	4.6	103	13
18"	450	6.4	131	16
24"	600	11.5	264	19
30"	760	15.4	384	24
36"	900	18.1	524	29
42"	1060	25.3	686	34
48"	1200	31.3	867	38
60"	1500	46.3	1295	60

[1] *Class B pipe* [2] *16 gauge steel*

Applicable Standards

AASHTO M 252, Standard Specification for Corrugated Polyethylene Pipe, 75mm to 250mm Diameter (3"-10")

AASHTO M 294, Standard Specification for Corrugated Polyethylene Pipe, 300mm to 1200mm Diameter (12"-60")

AASHTO Section 30, Construction Standard, Thermoplastic Pipe

ASTM D 2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

ASTM D 3212, Standard Specification for Joints for Drain and Sewer Plastic Pipe Using Flexible Elastomeric Joints

ASTM F 1417, Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-pressure Air

ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe

ASTM F 667, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings

CAN/CSA B182.8, Storm Sewer and Drainage Pipe and Fittings Polyethylene

Solving drainage problems across the nation

PennDOT Deep Burial Study

In 1987, the Pennsylvania Department of Transportation initiated what is believed to be the most ambitious research project ever attempted by the plastic pipe industry. A total of 576 ft. (175m) of 24" (600mm) corrugated HDPE pipe (both standard single wall and N-12 pipe) were buried at depths exceeding 100 feet (30m) in an embankment under Interstate 279 near Pittsburgh. Researchers from the University of Massachusetts administered the test, which sought to determine the performance limits of HDPE pipe under extreme loads.

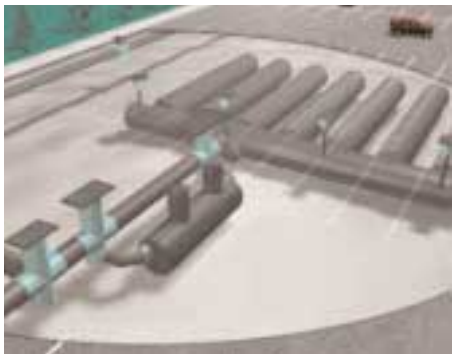
Electronic and hydraulic systems have been monitoring many aspects of pipe performance, including wall strain, deflection, soil pressure and soil strain. The results to date are impressive. Despite the tremendous soil load, the total of pipe deflection and circumferential shortening is just 4.3%, and has remained constant since the second year of the test. In 2002, 15 years after the initial installation, a full inspection was conducted. The pipe was unchanged from the last inspection completed in 1997. PennDOT has provided the full report to the Federal Highway Administration for their distribution and use.

PennDOT officials view the pipe's performance under these severe soil pressures as very positive, particularly since a sample of concrete pipe failed rather quickly under 65 feet in the same embankment. The study results have led PennDOT and other state transportation agencies to conclude that existing maximum fill height requirements for HDPE pipe are conservative and may be increased under certain project design conditions.

Underground Retention/Detention Systems

As real estate costs continue to escalate, developers and design engineers strive to maximize the potential of available land. Add to this the ever-increasing variables of government regulations, environmental impact and safety, one quickly recognizes the challenges that come with commercial and residential site development.

For nearly 20 years ADS has been assisting landowners increase the value of their investments by designing underground stormwater management systems as an economic alternative to retention ponds. No longer are designers limited to high-maintenance ponds along with their inherent aesthetic and safety issues. By creating subsurface retention or detention systems, previously unusable land can now be used for other applications such as parking lots, playing fields and green spaces. With minimal maintenance costs and productive use of the land, this investment pays significant dividends over its lifetime.



N-12 pipe plays a critical role in the design of a complete stormwater system. By connecting to surface drainage structures like our Nyloplast® drain basins, collected storm water feeds into a complete retention or detention system using N-12 pipe for distribution and storage. By taking advantage of N-12 pipe's superior abrasion and corrosion resistance, integral soil tight or watertight joints, and it's design flexibility for water quality structures, it is no wonder engineers and architects readily choose N-12 pipe for all their stormwater management needs.

Neighborhood storm sewer project installs easily

After 25 years of persistent flooding, the residents of the Lakeview subdivision of Madison Township, Ohio, applied for state public improvement funds to install a modern storm drainage system. Of all the materials bid, only the HDPE system fell within the funding limit.

The installation included 5,000 ft. (1520m) of ADS N-12 pipe (12" to 36") (300-900mm) and was accomplished well within the deadline and the limited budget. Since then, flooding complaints have been non-existent, despite a 100-year rain event in 1993.

Five years later, ADS cooperated in an internal inspection by an independent pipe cleaning company using a remotely controlled television camera. Three hours of video tape revealed no abnormalities with the 2,400 feet (730m) of sewer line inspected—no damage, no misaligned joints, no changes in line and grade.

Since the Lakeview installation, Madison Township has specified N-12 pipe on several other large drainage projects. Officials point to HDPE's ease of handling, and believe that it performs as well or better than the concrete and metal pipe used previously.

Lakeview was also the first HDPE sewer installation for the contractor, who cites several advantages of the lighter weight pipe: use of smaller equipment, which made it easier to negotiate the narrow right-of-ways with numerous trees; less risk of damaging the streets; the 10 loads of polyethylene vs. 29 loads if the pipe were concrete; and the ability to unload and move the N-12 pipe by hand.

HDPE pipe speeds work on Olympic highway

N-12 pipe played a key role in what was called the biggest design-build freeway project in North America. Early in 1998, Salt Lake City began the massive task of replacing and expanding 17 miles (27km) of the I-15 highway in preparation for the 2002 Winter Olympic Games. Normally an 8-year project, the time frame was cut to 4 1/2 years, placing a premium on time-saving methods and materials.

The project coordinator reported little difficulty in deciding on the drainage pipe material. “For the 33 miles (53km) of 24" (600mm) and 30" (760mm) pipe, polyethylene was the hands down winner. It should save us at least 15 percent in material and installation costs compared to reinforced concrete pipe. An 80-ft. (24m) run of PE requires three joints, while RCP needs ten. Two people can lay the 20-ft., (6m) sections in the trench and just ‘pop’ them together.”

Designers selected ADS N-12 ST IB pipe with its integral bell-and-spigot joining system. The even profile of this pipe eliminates the need for separate “digouts” to accommodate the protruding bell on standard pipe. The pipe’s toughness is another time-saving factor, according to the coordinator. “We can drop PE pipe 100 feet, (30m) and nothing will happen to it. If the bell on a concrete pipe is hit, the joint is gone and we have to get a new section.”

New trench design engineered for 1,000 ft. (300m) pipe burial

The Morenci Mine in Arizona, owned by Phelps Dodge, processes more copper than any other mine in North America. The extraction technique is called “heap leaching,” a process where an acid solution percolates through an extremely large stockpile of ore and is piped to a processing plant where the copper is recovered.

The consulting engineer, Dames and Moore (now URS), believed that corrugated HDPE pipe could handle the acid and abrasion, but were not sure how the pipe would perform at surcharge pressures of 833 psi under 1,000 feet (300m) of crushed ore.

Working with Dames and Moore, ADS engineers developed a new installation method involving a narrower trench, highly compacted side walls, and the comparatively loose placement of fill above and around the pipe. The theory was that the settling of this loose overhead fill would promote soil arching of the ore, placing the main load on the compacted areas on either side of the pipe. A test installation proved the theory’s viability, and three 1,000 ft. (300m) runs of 24" (600mm) N-12 perforated pipe were installed on the site of the ore stockpile. Several months later, the initial covering of ore was in place, and the acid leaching process was begun. After four years, the pile has reached several hundred feet, and the three N-12 pipelines are performing flawlessly, delivering 35,000 gpm (132,500 lpm) of copper leachate to the processing center.

Special school installs complex but economical drainage system

Small diameter N-12 pipe met all the requirements for an intricate drainage system to be installed at McArthy Teszler Elementary in Spartanburg, South Carolina, a school for physically handicapped children. The building consisted of many wings spaced 30 ft. (90m) apart, with an exit door from each classroom leading to sidewalks between the wings. Because of the special needs of the children, no standing water was permitted to accumulate on these walkways.

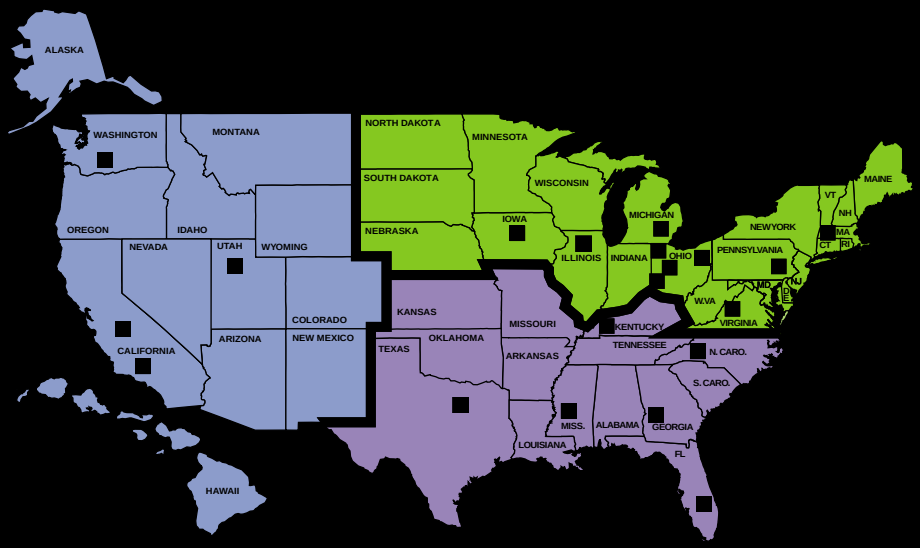
This requirement, plus the limited space between wings, created the need for extensive roof drainage and numerous inlets and fittings in the underground pipe system. The designer specified 4" (100mm) N-12 pipe for the roof drain connections, tying in to 6"-15" (150-380mm) N-12 trunk lines and 12" or 15" (300-380mm) watertight Nyloplast inline drains and drain basins.

After evaluating many products, the engineer determined that ADS “offered an extremely cost effective system . . . The smooth interior of N-12 pipe allowed us to use smaller pipe sizes around the building because of better hydraulics. The pipe is lightweight and since you don’t have to bevel the ends to connect with fittings, it is easier to install and more cost effective than PVC.”

Tomorrow's drainage system products available everywhere today

As time takes its toll on the service life of installed concrete and metal pipe, N-12 pipe is fast becoming the preferred choice for gravity-flow drainage applications. In addition to its proven performance and economy, ADS HDPE pipe has the same wide-spread availability as traditional pipe materials.

ADS Sales and Service Locations



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