

pipe world

A construction site in a rocky, mountainous area. Two workers in bright yellow-green safety gear and white hard hats are working with a large blue pipe. One worker is standing near a large blue pipe section, while the other is further back. In the background, there are yellow construction vehicles and a large black pipe lying on the ground. The terrain is rugged and rocky.

**360° PROJECT SERVICES
GUARANTEE SOLUTIONS
FOR EVEN THE MOST
DEMANDING PROJECTS**

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**WEHOLITE PROVIDES
A VALUE ENGINEERED
SOLUTION WITH
A 100-YEAR DESIGN LIFE**

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**TAILOR-MADE PIPES
ENSURE A BETTER
WATER SUPPLY**

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Uponor

Uponor Barrier PLUS.

Sustainable potable water pipelines
for contaminated soil.

INNOVATION!

The all-new Uponor Barrier PLUS system features a barrier made of a proven non-permeable polymer. Performance is equal to conventional barrier pipes, but without the corrosion risk when trichloroethylene is present. And it's easy and practical to recycle. In short: Barrier PLUS is a new and more sustainable way of keeping potable water clean in contaminated soil.

Let's build confidence.



Find out more at
www.uponor.com

Together, we build confidence

Many of the products we work with are ones that people care little about. Stormwater disappears below hard street surfaces and a warm shower – or fresh water from a tap – is often taken for granted. But what would happen if our underlying infrastructure did not work in the way we expected?

Right now, many of our innovations are about creating a better world, with a focus on health and the environment. These innovations build confidence in the future of the globe. We work together with our customers, creating the inspiration to aim for a cleaner world.

The brand new Uponor Barrier PLUS pipe is the result of close cooperation with the municipality of Copenhagen, which faced a major challenge due to soil contaminated with trichloroethylene. Today, we proudly present the first 100 % plastic barrier pipe solution, which is recyclable and has high chemical resistance.

Stormwater management is another of our focuses when developing sustainable solutions. Our new “Smart Trap” provides major opportunities for municipalities to prevent contaminated sand from flushing away with stormwater and polluting lakes and groundwater.

So, thank you all for contributing your ideas and expertise. Together, we can make a difference. Together, we can build confidence.

I hope you enjoy the many wonderful stories in this year’s Pipe World.

Best regards,

Sebastian Bondestam
President
Uponor Infra Ltd



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Barrier PLUS is the first 100% plastic potable water pipe for contaminated soil



CONTAMINATED SOIL in urban areas poses potential risks to human health. Standard polyethylene pipes can be permeated by some chemicals frequently found in contaminated soil. Uponor's new Barrier PLUS pipe system offers a solution to this problem. For the first time, the aluminium layer has been replaced with a non-permeable polymer, resulting in a durable, fully-recyclable piping system.

"The development of Barrier PLUS was actually initiated by some of our customers," says **Magnus Lundin**, VP Offering & Development at Uponor Infra.

The main driver of this was immediate concerns about the durability of aluminium barrier pipes in the presence of Trichloroethylene (TCE).

To solve the problem, Uponor engineers turned to a non-permeable polymer approved for foodstuffs applications and widely used in fuel containers. The resulting multi-layer potable water pipe has been tested by an international test institute.

The system will be launched in our Nordic markets in 2016. ■



Come visit us at K 2016!

K 2016, to be held from 19 to 26 October in Düsseldorf, Germany, will again be by far the biggest event for the plastics and rubber industry and will provide the starting point for momentous decisions on products and processes. The K Plastics & Rubber Exhibition is considered the world's number one trade fair for plastics and rubber products, where exhibitors present an array of raw materials, auxiliaries, semi-finished products, technical parts and reinforced plastics, machinery and equipment for the plastics and rubber industries, as well as services and much more besides.

More than 3,000 exhibitors will be presenting everything the sector has to offer in 2016.

Among other products, Uponor Infra Technology will display new production equipment for Weholite pipes and the field joint coating of oil and gas pipes. Come and visit us at stand F26 in hall 11 and discover our latest technologies and products! ■

Changes in leadership of Uponor Infra Sales Europe



Soile Kankaanpää has been appointed VP Sales & Marketing Infra Europe as of 16 August 2016. Soile joined us from Outotec, where she has held the position of VP Account Management and Sales Development for the last 3 years. Soile has extensive international experience of hands-on sales and account management and of a range of sales leadership positions in companies such as Nokia Networks and Konecranes.



In addition to his VP Sales & Marketing responsibilities, **Juha Kainulainen** has been leading Infra Sales in Finland for almost two years. From August 16th onwards he will fully focus on our biggest market as Director Sales and Marketing Infra Finland.



Uponor Decibel is a silent soil & waste system

UPONOR DECIBEL – the most modern silent soil & waste pipe system – combines innovative technology with good design. Although the system was recently launched, its development has just begun.

Uponor Decibel is a complete system of pipes and fittings with dimensions of 50, 75, 110 and 160mm, and is fully compatible with traditional indoor drainage. System development is ongoing and several interesting, new components will soon be ready for launch.

“Although Uponor Decibel is already the most modern silent soil and waste system on the market, it will soon be even better. Above all, it is easier to install,” concludes **Niila Tast**, Application Manager at Uponor Infra.

The system will be sold in Denmark, Norway, Finland, Sweden, Estonia and Russia. ■

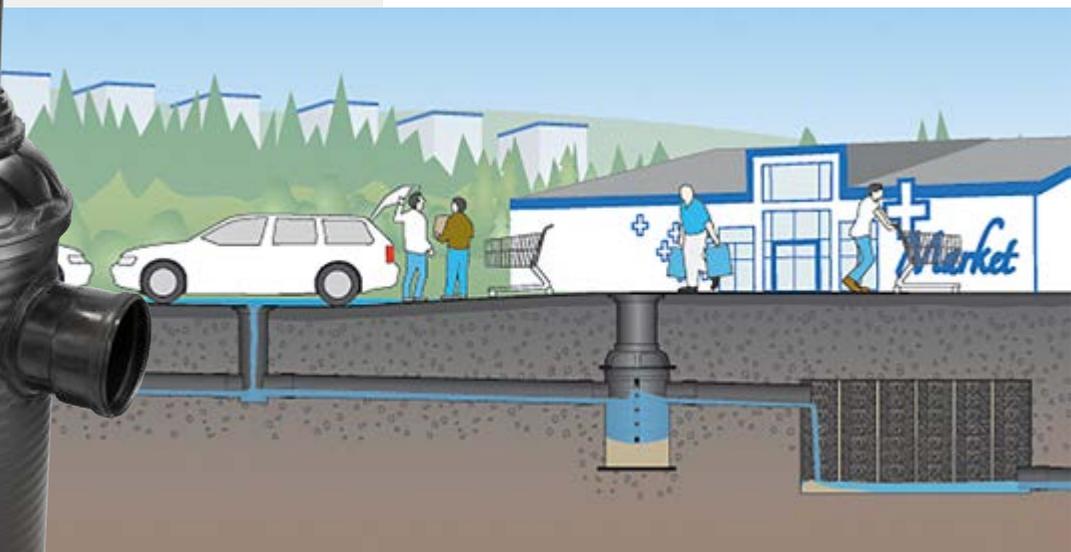
Smart Trap collects contaminated sediment

CONTAMINANTS accumulate on the ground during dry periods; when it rains, there is a major risk that such contaminants will be flushed into our stormwater systems. Failure to collect sediment therefore poses a major risk to groundwater and lakes.

Uponor Smart Trap is a well-proven and patented solution that effectively collects sediment and particle-bound contaminants, thus saving the environment.

Uponor Smart Trap will be launched in Sweden, Norway, Denmark, Finland and Poland in 2016. ■

Smart Trap prevents contaminated sand from flushing away with stormwater.



The award was received on behalf of Uponor Infra by Ms Edyta Zalewska, Sales Director.

TYTAN 2016 Award for VipLiner module

UPONOR INFRA POLAND has been awarded the TYTAN 2016 Award in the ‘Product of the Year’ category, for its slotted drainage VipLiner module.

The TYTAN Award is a widely recognised trophy within the industry and is unique in its Europe-wide coverage. TYTAN, which is granted by the magazine “Inżynieria Bezwykopowa” [Trenchless Engineering] and an outstanding group of panel members, is awarded each year to companies – from the whole of Europe, not only Poland – that distinguish themselves in the discipline of trenchless technology. The TYTAN Award has been granted since 2003.

The award ceremony was held on 15th of June, during the XIV International Conference “Trenchless Engineering” in Cracow. ■



360 degrees of service

Uponor Infra 360° Project Services guarantee the most suitable, ready-to-use comprehensive solutions for even the most demanding of projects. A full solution, meeting the customer's needs, can be tailored for any project from the various components of this service concept.

Uponor Infra now offers project services and solutions even more extensively tailored to the customers' needs. From Uponor Infra 360° Project Services, you can commission design, calculation and technical support, a range of tailored solutions and special products, installation services and project management. A full solution that provides a precise fit with the customer's needs can be built from the various service components.

If necessary, Uponor Infra will assume responsibility for the entire process, from the first drawing to turnkey deliveries and maintenance. Comprehensive solutions and turnkey services – where responsibility for the solution lies clearly with a single party – are rising in importance, particularly in highly challenging projects.

Good planning guarantees a successful project

Good planning and the correct dimensioning are decisive factors in the success of a project. It is important to know which product to use for which application and how different products and materials behave in different conditions.



Uponor Infra's design and calculation services include 3D drawings of the required solutions, simulations of marine installations, as well as flow rate, lifetime and hydraulic calculations.

Our special expertise is of particular benefit to our design partners in challenging projects where pipe dimensions are large, as well as demanding marine installations, for example.

Uponor Infra's extensive expertise also guarantees robust technical support for the duration of the entire project.

Tailoring provides a solution for even the most challenging application

Innovative, extensively tailored solutions are among Uponor Infra's strong core competence areas. The best possible solution can be found for even the most demanding application through tailoring.

Weholite technology, in particular, offers almost unlimited possibilities in the manufacture of innovative, extensively tailored solutions. Manufactured from a PE or PP profile using spiral seams, the Weholite pipe has a layered structure and can be used to build entire systems and a wide range of solutions. The Weholite pipe also



**UPONOR
INFRA 360° PROJECT
SERVICES OFFER**

- » Design and calculations
- » Tailor-made products
- » Technical support
- » Field services
- » Project management

enables very large applications, since the pipe is manufactured with a diameter of up to 3.5 metres. In Weholite pipes, both the length and diameter of the pipe, as well as its ring stiffness and colour, can be tailored.

In addition to pipelines, Weholite is used in the construction of solutions such as special pipe chambers and various tanks, such as alkalisation plants and stormwater and chemical tanks.

The solutions are delivered ready for installation, saving a significant amount of time and effort at the work site. This can be seen clearly in the installation costs.

Special applications also require special installation expertise

Uponor Infra also provides pipeline installation services for your projects.

Our partners are experienced geotechnical professionals. Uponor Infra's own special competencies include challenging pipeline installations, based on welding robots developed and manufactured by the company. Special competencies are also required in marine installations, for example. In applications of this kind, it is often important to the customer that, in addition to the products, the installed pipeline and its quality assurance are the responsibility of a single party.

In addition, comprehensive solutions are more and more often needed in renovation projects. Uponor Infra is a relining renovation professional that assumes responsibility for the delivery and installation of its products under the turnkey principle.

Project management assumes overall responsibility

We can offer project management as part of our comprehensive services, allowing the customer to deal with just one person in charge. The project manager is responsible for all contacts, material flows, subcontractors and schedules, and for supervising the work throughout the project. The larger and more demanding the project, the more important it is that communications flow smoothly and only a few contact persons are involved. ■



Polyethylene pipes for Polish power plant

Modern coal-fuelled plants must meet stringent EU standards on the reduction of CO₂ emissions and other harmful substances. One of Europe's largest power plants is being built in Kozenice in central Poland. Thanks to advanced technologies, this new power unit with a capacity of 1,075MW will have minimal negative consequences for the environment but positive consequences for the country's energy security. Uponor Infra pipes and manholes were used when building the raw water line. Uponor Infra also provided technical support, as well as welding and assembly work.



Enea Group is a leading producer, distributor and seller of electric power and heat. It is the third largest energy company in Poland, with a 13% share of the Polish electric power market. The party responsible for power generation within the Group is ENEA Wytwarzanie S.A., which operates Elektrownia Kozienice, a fossil-fuel power station with 10 high-duty power units and a cumulative generating capacity of 2,919MW, representing a market share of around 8%. The power generation and location of the Kozienice power plant make it a key part of the National Power System.

New power unit in Kozienice power plant

Enea Group's latest and biggest investment is the 11th power unit of Elektrownia Kozienice, with a capacity of 1,075MW (gross). This power unit will be the most modern coal-fuelled unit of its type. Based on its advanced and innovative technologies, the unit will operate within supercritical parameters, enabling it to generate the same amount of energy with much lower coal consumption. This will markedly reduce the amount of pollution emitted into the atmosphere while keeping the cost of energy generation relatively low. The new power unit will be entirely independent, supported by its own infrastructure. Thanks to a closed water circulation system, power generated by the new unit will not depend on issues such as the temperature of the River Vistula's water.

Construction of the new unit began at the end of 2013. The general contractor for the investment is a consortium comprising Mitsubishi Hitachi Power Systems Europe GmbH (MHPSE) and Polimex-Mostostal SA. In a process lasting 2.5 years, once the ground had been strengthened with reinforced concrete piles the main parts of the new unit of Elektrownia Kozienice were erected, including a cooling tower, boiler and communication towers, a flue gas desulphurisation unit, an engine room, a boiler room, an electrical device building, and retention reservoirs for the collection of solid ash. The completion of the work and the commissioning of the power unit are scheduled for the second half of 2017. The project's implementation has proceeded according to schedule so far.

Uponor Infra delivers raw water system elements

Uponor Infra was chosen to deliver the pipework for a raw water pipeline, which is an important part of the power unit. For the related water treatment plant, Uponor Infra will also supply two raw water intakes from an existing channel, a pressure pipeline connecting the raw water pumping station to the water treatment plant and a gravity pipeline providing the raw water pumping station with mechanically pre-treated water from the cold water intake.

The two raw water intakes, which were constructed using PE100 DN1,000 SDR17 pressure pipes, will provide the 500MW

power-unit pump station with cooling water from the River Vistula.

A pressure pipeline connecting the raw water pumping station with the water treatment plant was constructed using PE100 DN800 SDR22 pipes laid in a trench. For the pipeline, PE100 DN800 SDR17 pipes were installed – using the horizontal drilling method (HDD) – under the bed of the discharge canal.

A gravity pipeline feeding mechanically pre-treated water from the cold-water intake to the raw water pumping station was constructed using the Weholite DN1,000 SN8 pipe, with Weho DN1,800 manholes added for maintenance purposes.

Pressure pipeline with the help of HDD

The first section of the 405-metre-long PE100 PN7.5 SDR22 d.800x36.4mm pressure pipeline has already been laid in an open trench.

The second section had to be assembled using no-dig technology, HDD, enabling the installation of a 236-metre-long pipeline made of PE100 PN10 SDR17 d. 800x47.4mm pipes crossing the discharge canal of the Elektrownia Kozienice power plant. ▶

“The initial idea was to submerge the pipe freely in the canal when the water level of the Vistula was low” said **Zbigniew Góralczyk** of ENERGOPROJEKT – WARSZAWA SA, the Chief Designer for the project. “However, that would have required the use of specialised equipment – an excavator on a floating platform, barges to remove spoil and provide backfill, and extensive earthworks, which would have increased the overall cost.”

That is why the decision was made to change the construction method. As a result, PE-HD pipes were used instead of GRP pipes. Combined with the installation of a pipeline made of polyethylene pipes, the proposed HDD technology proved to be the optimum solution.

Drilling began in June 2015 with the preparation of pilot holes under the canal. When the pilot hole drilled with a tricone bit was ready, it was broached with a reamer. The maximum depth of the drilling was 26.1m. Next, polyethylene pipes, previously butt-welded to create a 236-metre-long section, were installed in the hole. The pipes were produced in the Uponor Infra plant in Kleszczów and delivered to the construction site in longer than usual, 15-metre-long segments, minimising the number of joints. The installation work proceeded without interruption and took around 10 hours. A pressure test demonstrated that the work had been completed successfully. The general contractor, Polimex Mostostal SA, pointed out that the drilling was carried out in a difficult environment with existing and operating infrastructure and limited space. Despite this, the construction work was successfully completed due to the decision to change the technology used from GRP to PE-HD.

Zbigniew Góralczyk concluded that the PE-HD technology was fast and easy to install, was reliable and was the perfect fit for the conditions. The system’s advantages, i.e. the ease of adjusting the piping fittings and the uniformity and durability of the connections, were also proven during the installation of the land section.

Wholite for gravity pipeline

Wholite pipes and manholes were used to build the gravity pipeline. Their low weight



Combined with the installation of a pipeline made of polyethylene pipes, the proposed HDD technology proved to be the optimum solution.

compared to other traditional materials, such as steel, concrete or cast iron, made them easy to transport and install in the power plant’s challenging terrain.

“Assembly of the gravity pipeline was very difficult due to the very deep trench with supported walls 10-metres high,” said **Paweł Pił**, the Project Manager from Uponor Infra who was responsible for providing technical support.

“The length of the Weholite pipes had to be precisely matched with the free access area between the trench wall supports. Installing a manhole of DN1,800mm 90 deg. proved particularly complex and had to be carried out in two stages. First, a 4-metre-high base was installed. Then – after the required compaction procedure – the top section of the manhole was extrusion welded by an Uponor Infra service team.”

The Weholite system proved to be the ideal solution to the challenges presented by the Kozienice project. The general contractor appreciated the Weholite technology’s high quality, the support provided by the Uponor

Infra technical department and the flexible terms of the service.

Reliable PE-HD technology

The construction of a power unit is an extremely complex process, requiring perfect teamwork from all of the parties involved, all the way from the design work to delivery logistics, scheduling the work of the contractors and subcontractors, and the attention paid to the quality of the supplied components.

When performing work in an environment with existing infrastructure and an operating power plant, each drawback, delay in supplies and failure during assembly has an effect on the schedule and therefore the potential financial benefits of the investment. This makes cooperation with experienced partners and reliable producers, and the use of proven methods and technologies, important. In the case described in this article, high-quality, durable and reliable pipes were used, and their assembly went smoothly. In other words, the PE-HD solution passed every test. ■

A fast and precise execution in Pattaya

Once again, Weholite showed its benefits, when two old outfalls urgently required replacement, in Pattaya, on the east coast of the Gulf of Thailand. Since the installation site was located right in the heart of the tourist area, fast and precise execution was a must.

Located in Chonburi Province on the east coast of the Gulf of Thailand, Pattaya is a resort city with a population of approximately 107,000.

Part of the waste waters and rain drainage for this population poured directly onto the beach, right on the shoreline, through two old outfalls in urgent need of replacement, in Central Pattaya and North Pattaya. Uponor Infra and Wiik Water (formerly KWH Pipe Thailand) were given the task of constructing these two new outfalls by the Pattaya Municipality. Since the installation site was located right in the heart of the tourist area, with the beach esplanade, jet ski rentals, and parasailing activities being affected by the work, fast and precise execution was a must.

Bearing this in mind, the Uponor Infra staff not only planned and designed the work quickly, but with maximum quality. Collaboration with Wiik Water made the process flow smoothly.

170 linear metres ballasted in one day

The welding and launching area of the Central and North Pattaya Weholite ID1,800mm outfalls was in Bang Lamung, 12km north of the sinking site. At the end of September 2015, welding of the Central Pattaya outfall began. 1,245m of pipeline, distributed in 5 strings of 240m and 1 shorter diffuser section of 45m were installed, connected by steel flanges designed by Uponor Infra, which would provide sufficient water flow (5.1m³/s) evacuation from this part of the city for the 25 years of the outfall's service life.

All of the pipes were ballasted by filling the Weholite wall profile and no concrete collars were used. Weholite enabled astonishing performances: 170 linear metres were ballasted in one day, once again, proving Weholite's cost saving benefits and advantages.

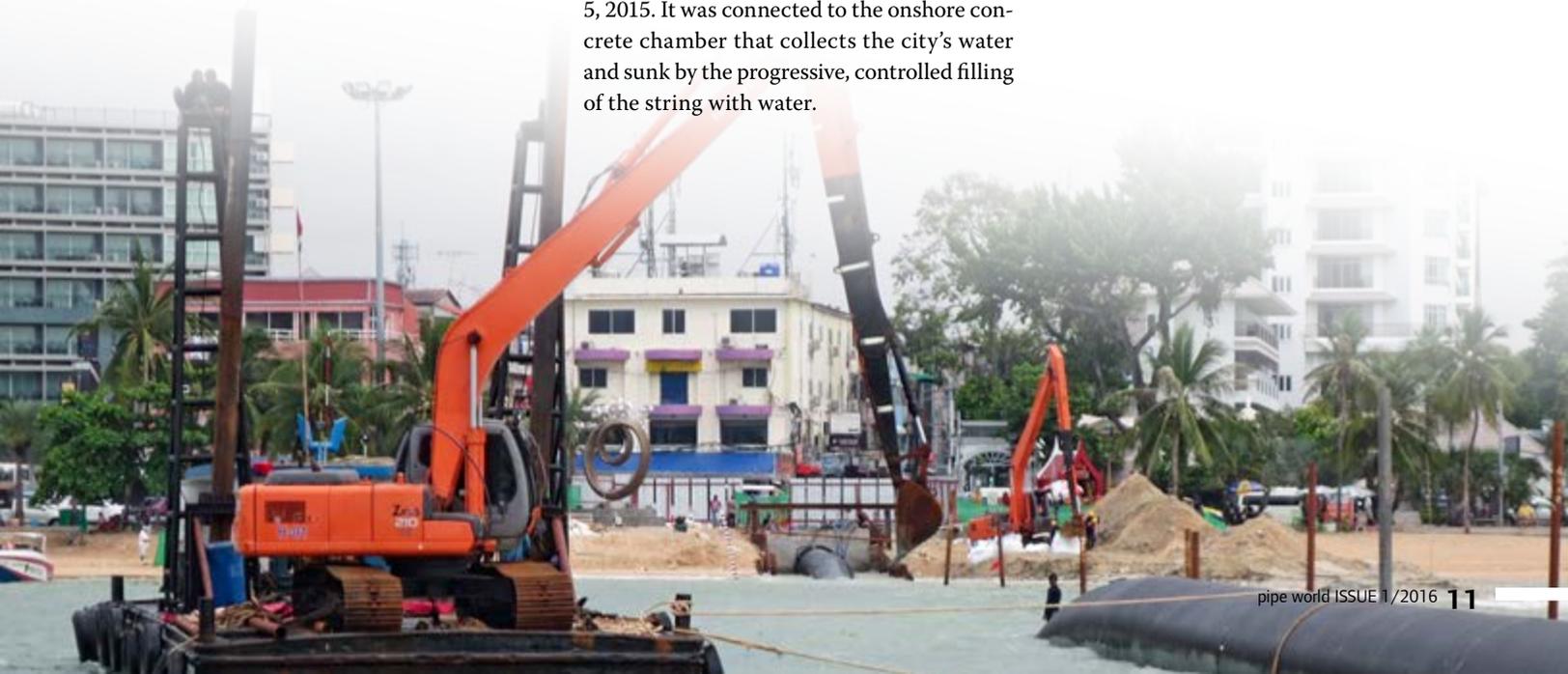
The Central Pattaya line diffuser string included four risers and was installed on the seabed at a depth of 12m, in two phases, with the first string being launched on November 5, 2015. It was connected to the onshore concrete chamber that collects the city's water and sunk by the progressive, controlled filling of the string with water.

The last string and the diffuser section of this outfall were installed on December 21, after a one-month break due to installation permit issues. It is hard to find any other option on the market that would equal Weholite's execution and installation times and provide such savings for clients. The foreman at CMP, the local Thai contractor chosen for the marine construction job, immediately saw the huge installation advantages and other benefits of using Weholite.

Another successful project

The North Pattaya welding job began at the beginning of March 2016. The 120m long line was welded in three days, needing only one additional day to ballast the Weholite profile. For the same bureaucratic reasons, this string was launched into the sea and stored in a nearby channel, while awaiting a permit for its installation on the seabed.

Once again, the Uponor Infra team and Wiik Water completed a successful project. It was the first Weholite marine project in Thailand, which will surely pave the way for many other opportunities in the future. ■



The global mineral fertiliser, industrial chemicals and environmental products supplier Yara of Norway renewed the water supply to its factory in Glomfjord, close to the Arctic Circle in the north of Norway, with 1.8 kilometres of PE1,000mm pressure pipe. Extremely demanding terrain, limited infrastructure and the most stringent safety requirements demanded exceptional expertise and planning.

Construction of Yara's new pipeline in Glomfjord proceeded in two stages and the work was completed in August 2016. The project was implemented as a partnership between local contractor Bernhardsen Entreprenør and Uponor Infra's own specialist unit, Project Services, from Vaasa in Finland. This is a specialist service that Uponor makes available for large and technically demanding projects of this type.

"Uponor provides services for a number of major projects that involve large dimension pipes. These include onshore and offshore pipelines, water intakes and outfalls for local authorities, municipalities, industry and mining. These are special projects and in our experience the results are most successful and effective when we are involved in their planning and implementation. This is normally done together with a local partner," says **Kari Karjalainen** from Project Services.

Unpredictable

The construction of pipelines for hydropower and water supplies in the mountains often involves difficult terrain with limited accessibility for machines and vehicles. Completing projects like this demands the relevant experience and technical expertise.

Water supply in very demanding terrain



"As well as the difficult terrain, we must also take account of unpredictable conditions, such as the weather bringing snow or flooding," explains Karjalainen.

One example of this occurred during the work, when there was a minor landslide of loose material as a result of the altered drainage routes for water caused by the new trench for the PE pipeline.

"Parts of the route have a slope of more than 40%, which is very steep; even the earthworks and laying gravel in the trench is a demanding job on such a gradient. On several occasions the rain created a flood that washed away the gravel, so it had to be filled again. If this had

happened when the pipe was lying on the gravel, and the gravel had washed away, it would have been very tricky to get new gravel under the pipe again," says Karjalainen.

"We also had to give proper consideration to the landscape, making the least possible environmental impact."

Inaccessible

The combination of steep and rugged terrain and local buildings down in the valley created special requirements for the safe transport of the sections of pipe, which were 18 metres long and weigh 5 tonnes per piece.

"It was also important to take account of the



Normally, the pipes were welded in the pipe trench, but to get around the sharper trench bends the welders had to weld the pipes across the service road and above the trees located further downhill.

Long curves

Getting the pipes into place in the most rugged spots means using mountain winches and several excavators in combination, with tandem lifts in the steepest parts.

“When anchoring the pipes into position, we take account of both the weight and pressure class of the pipe, as well as the water hammer effect. This means large, reinforced concrete reaction blocks, which have been cast on-site, for all sharper bends and T-pieces,” says Karjalainen.

“Welding and jointing was done strategically. Normally, the pipes were welded in the pipe trench, but to get around the sharper trench bends we had to weld the pipes across the service road and above the trees located further downhill. This was necessary in order to obtain the leverage needed by the excavators to force the pipeline, which was stiff due to its 100mm-thick walls, around the bend,” explains Karjalainen.

alpine ski centre, which is one of the biggest in Nordland, and the skiing slopes under which we buried part of the pipeline.”

“The sections of pipe were transported on steep and winding roads using two special vehicles. Safety is a basic consideration here. Just imagine a scenario in which a pipe came loose, went out of control and began to slide down into the valley. This could injure people and damage buildings; we need to be 100% sure that this won’t happen,” says Karjalainen.

Specialist expertise is therefore important for both consultants and contractors on site, who must understand the potential consequences of working in steep and challenging terrain.

Forward looking

For Yara, the water supply is of great importance for future industrial operations. This means that the pipeline is a long-term investment that will ensure access to a vital resource. This is a collaborative project between Yara Norway and Statkraft Energi.

Yara has signed agreements to share the water supply with other businesses in the industrial area. As well as the pipe, 15 parallel cable ducts are also being laid, which will be used for high-voltage cables and signal cables to carry electricity from the power station to the plant. Yara owns the pipeline and Statkraft owns the cable ducts. ■

RENOVATION OF WATER SUPPLY TO GLOMFJORD FACTORY

- » **Project start:** August 2015
- » **Completion:** August 2016
- » **Adviser and consultant:** Norconsult AS Bodø
- » **Local contractor:** Bernhardsen Entreprenør AS Bodø
- » **Specialist contractor and pipe supplier:** Uponor Infra, Project Services, Vaasa, Finland
- » **Pipe type:** PE pipe Ø 1,000mm SDR 13.6–SDR 10

GLOMFJORD AREA

Glomfjord factory consists of four production units: two for nitric acid, one for NPK and one for calcium nitrate. The product range includes approximately 60 types of mineral-based NPK fertiliser (Fullgjødsel®) in granulated form. A cavern has been constructed inside the mountain that can hold 40,000 tonnes of liquid ammonia, which is enough for three months’ production at full capacity. Production is based on imported raw materials that arrive by sea. Ships are also used to transport out the finished products, making Glomfjord one of the busiest ports in the country.

Glomfjord is the urban centre and industrial area of the municipality of Meløy in Nordland county. Glomfjord Industrial Park is the largest industrial area in the Salten region and helps to make Nordland Norway’s second largest industrial county. Yara is the biggest company in the industrial park and has about 180 employees.

Weholite limits overflows and pollution in London

Uponor's Weholite technology was the key solution in a unique project in London, where the Lee Tunnel and Thames Tideway tunnel have the task of capturing an average of 39 million tonnes of sewage a year from the 35 most polluting combined sewer overflows (CSOs). An upgraded pipeline system was designed to reduce the number of overflows – and their environmental impact – from the sewers and treatment systems serving London. A particular aim is to limit pollution from the sewers and treatment systems connected to the Beckton and Crossness sewage treatment works.

London's globally admired sewage system was created in the Victorian era. This system now faces the challenges of ongoing urbanisation and ever-growing sewer discharges.

Construction work on the Lee Tunnel began in 2010 and was completed by the end of 2015. In this 4.2 billion pound project, a Weholite culvert served as the final discharge point of the tunnel, transferring the sewer overflow to the extended Beckton Sewage Treatment Works. The Beckton Sewage Treatment Works was upgraded in 2013, with over 5km of Weholite high density polyethylene (PE-HD) pipe being supplied in different sizes ranging from 400mm to 3,000mm. The idea was to install the pipe for all of the associated chamber fabrications of this extensive, inter-process pipework project.

A trustworthy partner providing the best technology

The project included not only London's deepest ever tunnel, but also one of the most complex subterranean networks in the world, characterised by multiple navigational and engineering challenges. This required an experienced partner with the best possible technology. MVB, a joint venture between Morgan-Sindall, Vinci Construction Grand Projects and Bachy-Soletanche, contacted



Uponor Project Services which, together with the licensee Asset International Limited, used its design expertise in land and marine applications to re-engineer the project. This involved the creation of a landmark design – the largest plastic outfall ever installed in the UK and one of the largest in the world in terms of diameter.

Uponor was able to bring deep expertise and enormous versatility to this ambitious project, which included 880m of 3,000mm diameter

Weholite pipes laid as a twin culvert, alongside twelve large-scale Weholite modular PE-HD boxes. The project also involved the provision of installation, supervision and site services, and health and safety management.

The pipe-laying process consisted of a land section comprising 105m of twin culvert laid at 10m depths, in order to break through the tidal protection wall that prevents the Thames from flooding Europe's largest treatment works at Beckton. A giant 7m x 11m x 5m Weholite modular box was used to house a 3,000mm spool section in order to complete the installation.

The operation to install the remaining 335 metres of twin culvert section in the River Thames was carried out by marine contractor CMP, alongside the Asset and Uponor PS partnership. This ambitious marine project was further complicated by the fact that the pipes had to be submerged under an existing jetty structure and sections of the project were often isolated by the tide (which rises and falls by up to 7 metres in the Thames), with no access by land.

The innovative grouting process saved time and money

Thanks to Uponor's patented grouting process there was no need for risky, heavy concrete



THE PROJECT INCLUDED LONDON'S DEEPEST TUNNEL AND ONE OF THE MOST COMPLEX SUBTERRANEAN NETWORKS IN THE WORLD.

collars when ballasting the strings. Using Uponor's innovative technology, the hollow Weholite profile was filled with an inexpensive and pumpable grout, which is a much safer and faster methodology. Since concrete collars were not used, a smaller trench was needed, the dredging operation was minimised and excavation volumes were drastically reduced. Since submarine excavations are much more expensive than dry land excavations, the advantages of Weholite are clear.

Once the pipe strings were ready, they were towed individually upriver by tugboat and submerged. Specialist divers were used to bolt the innovatively designed quick-connect flanges joining each pipe string.

Additionally, steel sheet piling of over 11,000m² was installed to allow the riverbed to be dredged so that the pipes could be laid free of obstruction. Over 28,000m³ of riverbed materials were dredged, with much of the dredged material being reused to backfill the pipes once installed. This provided an en-

vironmental advantage based on vastly reducing the amount of materials taken off site and thereby reducing the carbon footprint.

The results speak for themselves

This successful project received positive comments from all sides. **Emmanuel Costes**, Construction Manager at MVB, declared: "We were very happy with the Weholite technology employed in the implementation of the Lee Tunnel Outfall pipeline. The specifications of the project were highly detailed, but the solutions provided by the Asset International/Uponor collaboration were impressive, ticking all of the boxes that this complex, and in many cases unique, project required."



Christian Vestman from Uponor Project Services says: "The Uponor/Asset Partnership demonstrated the full depth of knowledge and versatility available within our organisations. This unique project really allowed us to showcase the impressive capabilities of Weholite – the results speak for themselves." ■

A value engineered solution with a 100-year design life

Los Angeles (LA) has experienced four years of statewide drought following which large scale rainwater harvest systems are being utilised to address growing water scarcity and to meet the requirements of the LA Department of Water and Power's "Stormwater Capture Master Plan." Uponor Infra's Weholite rainwater harvest system provided a watertight solution with a 100-year design life for the Los Angeles Federal Courthouse in the center of downtown Los Angeles.

The New Los Angeles Federal Courthouse is located at 107 South Broadway in the center of downtown Los Angeles. The new building occupies most of the available site and space for an underground rainwater storage system was limited to a 170-foot long by 60-foot wide area at the corner of Broadway and West First Street. Underground storage vessels are soil-structure interaction systems that rely on uniform soil loading. Because the rainwater system was planned to fit snugly between the building and the existing road, the system's layout needed to account for both the horizontal site constraints and the vertical zone of influence associated with the

building's foundation loads.

Site logistics, staging, excavation and backfill considerations were also factored into the system's design. With the new building expected to be in place by the time of delivery, there was extremely limited room for storing excavated soil, select backfill, or the system itself.

Since this was a General Services Administration (GSA) Design Excellence Project, sustainability was a key element of its design. The LA Federal Court House project sought to achieve Leadership in Energy and Environmental Design (LEED) platinum certification and lead the industry by providing an environmentally friendly project to address potentially serious water scarcity challenges.

Speed of installation was a critical element

To solve these challenges, Uponor developed a single barrel 11-foot diameter rainwater system that would fit within the horizontal limits of the site and outside of the building foundation's zone of influence. Uponor also coordinated with the site sub-contractor responsible for the rainwater system, G.B. Cooke, to develop a phased installation sequence. The phased installation involved using of bulkheads to limit excavation and installation to individual 50-foot sections of the 150-foot system. Uponor further supported the project by providing preconstruction services and on-site support during each installation phase.

In order to maximise effective storage in



PROJECT DETAILS

- » **Location:** Los Angeles, California
- » **Owner:** US Federal Government, GSA
- » **Engineer:** Jacobs Engineering
- » **Contractor:** Clark Construction
- » **Specialty sub-contractor:** G.B.Cooke, Inc.

SYSTEM DETAILS

- » 106,000 gallons of rainwater storage
- » 19-foot deep vertical pump station
- » Integral filtration riser
- » Variable frequency drive pump
- » 150 LF of 11-foot diameter Weholite cistern
- » Hydrodynamic primary pre-filtration
- » 100 micron post filtration
- » Human machine interface control panel

a critical element of this project and the pump station was set and backfilled in just one day.

A number of custom elements improve functionality

Uponor further supported the project by leveraging its successful history of polyethylene fabrication, welding and design experience. To complement the versatility and strength of the Weholite system, Uponor designed and fabricated a number of custom elements which improved the system's functionality.

Large-scale Wehopanel polyethylene bulkheads were fabricated to support the structure's hydrostatic and soil loads without concrete or soil reinforcement. To ensure that the system's 100-year design life was maintained, the bulkheads were reinforced with structural steel fully encapsulated within the Wehopanel polyethylene profile. The inlet bay included an inflow energy dissipator to minimise the potential for the re-suspension of settleable solids. As a secondary water quality measure, discharge from the inlet bay was improved by incorporating an 18-inch perforated high density polyethylene (PE-HD) riser wrapped in geotextile filter fabric. Access was provided by 30-inch Weholite risers with 16-foot fibre reinforced plastic ladders mounted on the riser and the vessel interior.

In addition to the Weholite polyethylene pump station and vessel, Uponor provided a control and filtration skid system designed to provide constant pressure and flow of recycled water to the project's irrigation system.



A watertight system with 100-year design life

In summary, Uponor supported the New Los Angeles Federal Courthouse design LEED project by providing a comprehensive value engineered solution to meet the project's rainwater harvest needs within the available time frame. Uponor worked with G.B. Cooke, Inc. to develop a value engineering alternative to the 106,000 gallon multi-barrel tank system originally specified. Uponor's Weholite 11-foot diameter structural wall polyethylene vessel was chosen for its ability to minimise the system's footprint to a single barrel vessel, while providing a watertight system with a 100-year design life.

"Uponor provided tremendous value for this project by developing the right solution and delivering a superior quality system. Their support and service provided for our project has been exceptional," says **Brad Cooke**, a Project Manager and owner of G.B. Cooke, Inc. ■

the 11-foot horizontal storage vessel, Uponor provided an independent, 19-foot deep vertical pump station. Isolating the pump within a standalone pump station removed the minimum pump submergence depth requirement from the vessel and reduced the overall footprint of the horizontal storage system. The pump station was hydraulically connected to the larger horizontal vessel through a 12-inch pipe at the vessel invert. The combined system was designed in such a way that the water surface elevation of the pump station and vessel increase uniformly as the system fills. The vertical pump station's wet well was fabricated from Weholite RSC250 profile wall polyethylene pipes and delivered to the project turn-key. Speed of installation was

A project of large numbers

The topping out for the largest investment of the Finnish forest industry, the new bioproduct plant under construction in Äänekoski in Central Finland, took place on the construction site mid-May 2016. Hectic installation work on the site will continue before the plant's test runs begin next spring. Uponor Infra delivers municipal engineering to the site, such as water, sewer and stormwater pipes, and a massive Weholite cooling water discharge pipe that is over one kilometre in length.

Metsä Fibre, part of the internationally operating Finnish forest industry group Metsä Group, is currently building the world's first next-generation bioproduct plant next to its current pulp plant operating in Äänekoski. In addition to high-quality pulp, the plant also produces a diverse range of other bioproducts, for example pine oil, turpentine, biocomposite and biogas. The investment is the largest in the history of the Finnish forest industry, totalling EUR 1.2 billion.

Uponor Infra has delivered municipal engineering to the construction site, such as water, sewer and stormwater pipes, chambers, and related fittings. The first day of April also saw

the beginning of the installation of the plant's massive cooling water discharge pipe. The installation of the Weholite pipe with an inner diameter of 2,000 millimetres and more than one kilometre in length will take around six months in total.

"We are not going to do this for practice"

"A discharge pipe manufactured from Weholite is a cost-effective solution that fulfils the customer's requirements," states Project Manager **Teemu Lantto** of Graniittirakennus Kallio Oy.

The company is responsible for the underground pipework of the bioproduct plant, and is also involved in many other contracts on the site. Of the construction companies working

on the site, it has the most contract orders.

The selection criteria also emphasised that the company wanted a system with a long track record.

"In this kind of large, demanding and fast-paced project, we do not want to start practising with the products," Lantto says.

Heat resistance from polypropylene

Tom Karnela from Uponor Infra says that the design of the discharge pipe took account, among other things, of special requirements related to the heat resistance of the pipe. The design temperature is +65°C.

"The pipe will be manufactured from polypropylene instead of polyethylene, because polypropylene has better heat resistance.





ÄÄNEKOSKI BIOPRODUCT PLANT

- » The largest investment in the history of the Finnish forest industry, EUR 1.2 billion.
- » The overall employment impact during the construction time exceeds 6,000 person working years. Once the plant has started operating, 1,500 new jobs will be created in Finland throughout the whole value chain.
- » The pulp production capacity of the bioproduct plant is 1.3 million tonnes per year. In addition to pulp, the plant produces a diverse range of other bioproducts, for example pine oil, turpentine, biocomposite and biogas.
- » Test runs will begin in the spring of 2017 and the plant will begin operating in Q3/2017.

In industrial applications, the temperature of cooling water is rather high.”

According to Karnela, there are otherwise no significant differences between polypropylene and polyethylene.

“The materials are flexible and easy to work and weld.”

The discharge pipe is implemented as a gravity line, but its requirements include a pressure resistance of one bar.

Karnela emphasises that the discharge pipe manufactured from Weholite is extremely durable and tight.

“The pipe joints and bends are fully-welded, and there are no mechanical joints at all.”

Uponor’s own technicians will be responsible for welding the Weholite pipes.

“The pipes and fittings will be delivered pre-customised according to requirements to the site, where they will be welded together. This means that the customer will receive the product almost as a turnkey delivery,” Karnela sums up.

From the plant to the trench

There is plenty of bustle at the bioproduct plant’s construction site. Several areas are under construction at the same time, in addition to which the current pulp plant is constantly in full operation. Fitting pipe installations in the middle of all of this traffic is not exactly simple.

“Things must be carefully thought out in advance, and we need more supervision resources and coordination than at a more conventional site. The installations will also take

more time than usual. We must continually pay very careful attention to occupational safety, given the high number of traffic and cranes lifting large loads in the area,” Lantto describes.

Quick reacting

Uponor delivers materials to the bioproduct plant construction site flexibly, in accordance with the progress made in the work. Since there is no possibility of storage, lorries transport the pipes from the factory directly to the side of the trench. This also means fewer work stages.

“Less lifting and handling of the pipes,” Lantto says.

“In narrow places, we need bends and shorter pipe sections. At their longest, the pipe sections are 22 metres in length. When you join a couple of long sections, the work can progress fairly well in just one day,” Tom Karnela describes.

Lantto reserves special praise for Uponor’s sales.

“It is important that we can contact the sales department and that they are ready to react quickly to our wishes. For example, we needed the first pipe sections quickly so that we could fill in the trench and get the traffic moving. Uponor met this challenge with flying colours.”

Pipes to the waste water treatment plant as well

Uponor also delivers pipes to the enlarged waste water treatment plant, which will also be built at the bioproduct plant. The project will be implemented by the project consortium,

Keski-Suomen Betonirakenne Oy/Porrokki Oy.

Various pressure pipes and other pipes, fittings and chambers will be delivered for the plant. Uponor technicians will join the smaller PE63–250mm pipes by butt welding or using electric sockets. The larger PE630–1,200mm pipes will be butt welded.

“With a diameter of 1,200 millimetres, pressure pipes are of a pretty heavy-duty design. But in this, too, we are able to offer the customer an excellent total package, including welding,” Karnela states. ■



Tailor-made pipes

ensure a better water supply

Population increases and industrial expansion have been challenging the local water company in Søborg, a busy urban environment on the edge of Copenhagen, Denmark, for years. Consumers have struggled with insufficient water supply and low water pressure. However, Uponor Infra has designed a complete pipe solution for a new water tank, which should begin operating in December 2016. End users can soon look forward to an improved water supply.

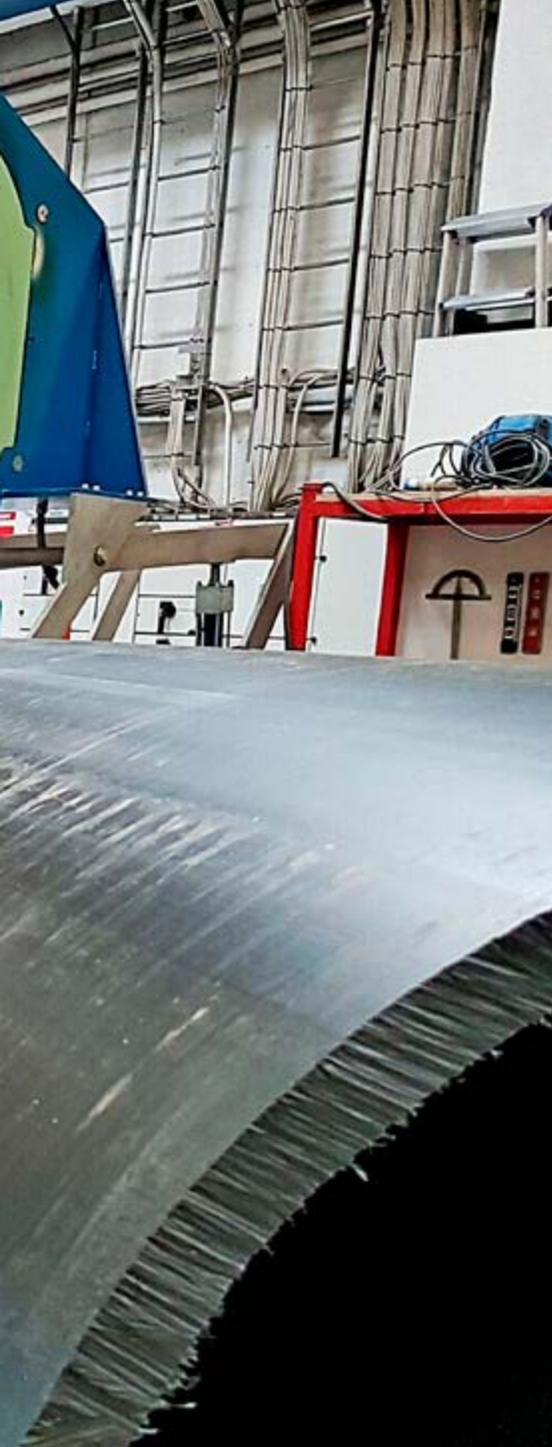
Denmark's largest water reservoir, which is about to be completed, can be found in Søborg, a busy urban environment on the edge of Copenhagen. The reservoir contains enough water – 300,000m³ – to meet Copenhagen's needs for around one day.

The first section of the original reservoir

opened in the 1930s and it was expanded later in the 1970s. In the 1990s, the water company discovered several leaks in the foundation of the largest tank, tank 12, causing it to be closed down for renovation.

In 2015, a new solution was ready for implementation. In cooperation with the engineering company, Krüger, and the contractor,

NCC, HOFOR decided to build a new tank inside the old, closed one. During this process, Uponor Project Service engineers, **Sine Sørensen** and **Jan Lunding** were consulted regarding pipes for the tank. Specially designed pipe solutions were required in order to meet the need for both emptying and filling the tank with water.



SØBORG PROJECT AT A GLANCE

- » **Product:** Water reservoir, PE100 pressure pipes
- » **Customer:** HOFOR
- » **Engineering company:** Krüger
- » **Contractor:** NCC
- » **Pipe supplier:** Uponor Infra Denmark

UPONOR 360° PROJECT SERVICE OFFERED

- » Tailor-made pipes
- » Design & calculations
- » Advice on choice of pipes
- » Technical support
- » Onsite welding service
- » Project management

complete pipe solution and provided HOFOR with a 3D demonstration of how to make their vision a reality. Uponor was chosen to produce and deliver 400m DN800 pipes and 300m DN630 pipes.

Ready in December 2016

HOFOR found Uponor's solution so compelling that Uponor was also asked to weld the pipes inside the container. On this occasion too, Uponor proved to be both service minded and cost competitive.

Project Manager **Ib Hansen** and Project Engineer Sine Sørensen have worked closely with the contractor throughout the project, to ensure that Uponor meets the deadlines in accordance with the project schedule.

The project was almost completed by mid-July 2016. All that remains is to perform the final pressure tests assigned to Uponor. The water tank is expected to begin operating in December 2016, when end users can look forward to a better water supply. ■



Lightweight pipes without corrosion

Uponor recommended PE100 pressure pipes, which are lightweight and designed not to corrode over time. HOFOR needed the pipes to be perforated in a very specific way to fit in with their fill simulation; in response, Uponor designed a solution based on which the perforation worked as required.

Throughout the project, Uponor has provided technical support on issues such as pull strengths, calculations of flowability and recommendations for fitting solutions – all based on cost-effectiveness and competitive prices.

The pipes were put out to tender in February 2016. Uponor's technical team designed a



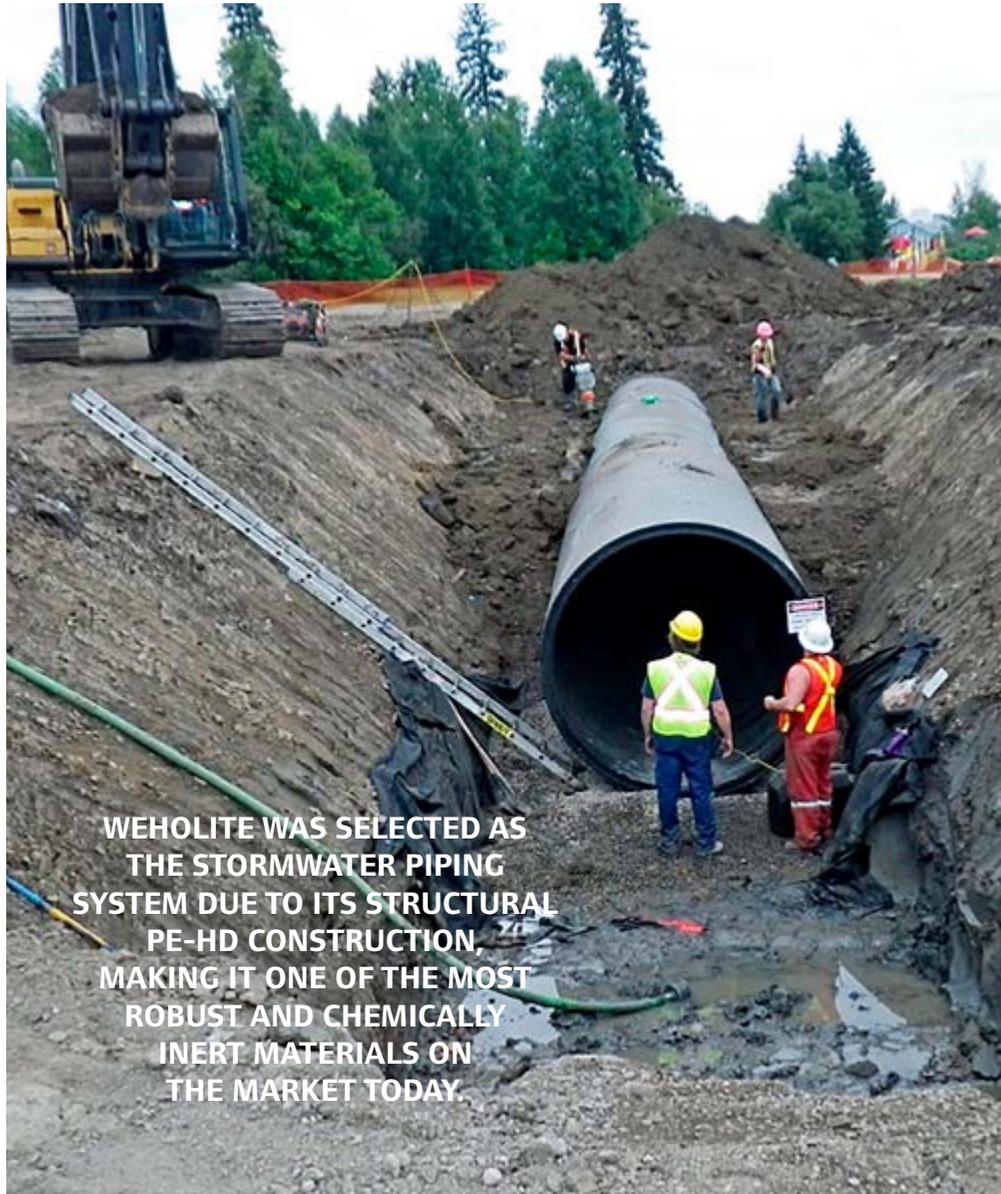
Weholite relieves of stormwater overflows

Weholite showed the advantages of a tougher and structurally advanced piping system when it was selected as the stormwater piping system for the City of Fort St. John, in the province of British Columbia, Canada.

The City of Fort St. John, situated in the province of British Columbia, has experienced a substantial population growth within the last few years. In support of population growth, the city installed many new, hard surface roads and sidewalks. As the number of these hard surfaces grew, the amount of rainfall that could be absorbed by the ground decreased and the volume of stormwater to be managed increased. As a result, the existing stormwater piping could no longer handle the increased volume flow after large rainstorms and there was a risk of street flooding. To solve the street flooding issue, the city commissioned the development of a new Stormwater Master Plan in 2013, prepared by Urban Systems Ltd.

The plan examined current and future stormwater capacity requirements in the south central area and concluded that the size of the drainage piping system needed to be increased to address flooding and soil erosion and minimise any impact on aquatic life.

In 2015, Chilliwack-based Jakes Construction Ltd. was selected to perform the proposed stormwater upgrades to the existing stormwater piping system in Fort St. John, located along 96A Street just north of Frontage Road. In addition to the new piping system requiring to handle the higher stormwater flow rates, it also needed to provide connections to the existing storm drains, catch basins and laterals. The challenge lay in the fact that the existing stormwater infrastructure piping was made from various piping materials; concrete, PVC and possibly ductile iron. Any solution being



WEHOLITE WAS SELECTED AS THE STORMWATER PIPING SYSTEM DUE TO ITS STRUCTURAL PE-HD CONSTRUCTION, MAKING IT ONE OF THE MOST ROBUST AND CHEMICALLY INERT MATERIALS ON THE MARKET TODAY.

proposed would have to provide connections that could easily join these different materials to the new piping.

Since stormwater piping can be subjected to huge variations in pH, hydrogen sulfide attacks, microbiological growth, corrosion, etc., a piping material able to withstand these types of aggressive environments, with no or minimal effect over its design life had to be selected. By selecting a robust material, life cycles cost could be significantly reduced.

100% chemically inert

Weholite was selected as the stormwater piping system of choice due to its high density polyethylene (PE-HD) construction, making it one of the most robust and chemically inert materials on the market today. Selecting a material which is 100% chemically inert and not simply coated means that, over the 100 year design life of the material, operations and maintenance costs remain low as there are no coatings to be worn out. In addition, as stormwater passes over the surfaces of roads and sidewalks, it absorbs many contaminants such as fertilisers, gas, oil, salt, battery acid,

etc. These contaminants can easily dissolve and corrode materials such as concrete and steel, whereas PE-HD remains inert.

Light weight is an advantage of Weholite

Due to the high strength-to-weight ratio of Weholite, the pipe was easier to load, transport, handle and install in comparison to concrete, which is extremely heavy and cumbersome to handle. For example, a 25ft. length of Weholite weighs 4,750lbs. An 8ft. length of concrete pipe weighs 20,000lbs. The light weight of Weholite resulted in an increase in installation efficiency and a decrease in machinery and labor costs. Another benefit of Weholite, which contributed to completing the project on time, was its long lengths of pipe. Longer lengths meant fewer joints, which resulted in fewer welds and accelerated installation in comparison to other piping materials.

A tougher piping system

When phase II of the project was completed, 2,165ft (660m) of 84" Weholite pipe had been installed. Since Weholite was selected, it was possible to take advantage of a newer, tougher

and structurally advanced piping system. The installation was completed on schedule and on budget and the pipe has performed as it was designed to do to date; relieve the City of Fort St. John of its stormwater overflows.

"Uponor came through by delivering on all pipe and welding services which enabled the conclusion of the installation on schedule. This was very important given that the winter months were rapidly approaching," says **Eric Sears**, the Design Engineer of Urban Systems Ltd.

"The installation went smoothly and was completed on-time. Weholite has the advantage over other materials that it is light and its long lengths enable much faster installation compared to other materials. We look forward to the next Phase in 2016," states **Victor Shopland**, Director of Integrated Services of the City of Fort St. John.

Phase III will be a continuation of this pipeline along 94 Avenue, from 96A Street to 100 Street, and will form part of the 2016 Capital Budget. Given the successful delivery of this project, Uponor expects to be a full participant in this new development. ■



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Uponor Infra 360° Project Services



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