Update on Canada’s water, wastewater and storm water sectors

Mark Knight
Rizwan Younis
Jai Jung
Zhining Huang
Andres Vissuetti
Thomas Nowak
Allison Kennington
Olivia Scagnetto

Centre for Advancement of Trenchless Technologies
Ensuring Sustainable Buried Infrastructure for Liveable Communities

University of Waterloo
200 University Ave. W.
Waterloo ON Canada N2L 3G1

www.catt.ca
Tel: (519) 888 – 4770
Fax: (519) 746 – 6556
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About CATT
The Centre for Advancement of Trenchless Technologies (CATT) was established in 1994 to help municipalities address their buried infrastructure challenges with specific reference to trenchless technologies. CATT consists of university, municipal, industry, business and government personnel who are committed to the advancement of knowledge, materials, methods and equipment used to replace or renew aging and deteriorating buried pipelines and the elimination of the well-established buried infrastructure deficit.

Since its inception, CATT has been recognized as a national and international leader in trenchless technologies and water infrastructure research, training, and asset management.

CATT welcomes new members and opportunities to develop and promote cost saving and environmentally friendly technologies that will help municipalities reduce their water infrastructure deficits and provide cost effective high quality drinking water to its residences and businesses. To learn more about CATT please visit www.catt.ca.

Disclaimer
Findings presented in this report are CATT’s analysis of the survey results provided by the survey participants. The survey results are provided “as is”, without liability for their use, and to provide general industry trends.
Summary

The Centre for Advancement of Trenchless Technologies (CATT) conducted the second annual Canadian Municipal Infrastructure survey from September 2014 through April 2015. The objective of the survey is to assess the market conditions related to construction, renewal, and financing of water, wastewater and storm water pipelines.

This report provides a broad-based aggregated summary of the survey results. Responses are analyzed by categorizing the respondents into small (population less than 50,000), medium (population from 50,000 to 300,000), and large (population greater than 300,000) municipalities. Aggregated results are presented except where marked differences in responses from small, medium and large municipalities are observed.

Critical Issues Lack of sufficient funds for operation and maintenance (O&M) activities, as well as for capital expenditures are major issues reported by the survey respondents. Particularly, small municipalities are in a precarious situation as all of the respondents report having insufficient funds for capital works, while only 17% report having sufficient funds to meet Operation and Maintenance requirements. For medium and large municipalities, only 21 and 28% respectively indicate having sufficient funds for capital works. For Operation and Maintenance, only 21% of the Medium and 39% of the Large municipalities report having sufficient funds. This survey suggests that 60 to 80 % of medium and large municipalities do not have sufficient funds to operate and maintain their systems and have no funds to renew or rebuild their networks.

The top three critical issues for water distribution systems are: reducing watermain breaks (67% respondents); ensuring pipes’ structural integrity (60% respondents); and reducing leaks (55% respondents).

Top critical or very critical issues for wastewater collection pipes are: inflow (75% respondents); infiltration (69% respondents); capacity (57% respondents); and pipe collapses (55% respondents).

For storm water pipes critical or very critical issues flow capacity (67% respondents), surcharging (55% respondents), and pipe collapse (50% respondents).

Addressing Infrastructure Backlog

To address infrastructure backlog/deficit, the responding municipalities realize the importance of a multipronged approach that includes: public and professional education (60% and 55% respondents, respectively); government regulation and grants (56% and 49% respondents, respectively); increase in user fees (42% respondents); and access to long-term financing (56% respondents).
Pipe Renovation and Replacement Methods

Municipalities ranked the renovation and replacement methods for watermains, and wastewater and storm water pipes.

Open cut is reported to be the predominant method for renovation/replacement of watermains (95% respondents), wastewater (98% respondents), and storm water pipes (100% respondents).

Horizontal directional drilling is ranked second for replacement of watermain (90% respondents), wastewater pipes (95% respondents), and storm water pipes (80% respondents).

Cured-in-place-pipe is ranked high for renovation of watermains (80% respondents), wastewater (92% respondents), and storm water pipes (73% respondents).

The respondents also rated the benefits of various trenchless construction methods. The top three methods for renovation/replacement of watermains, and wastewater and storm water pipes are: Horizontal directional drilling, Cured-in-Place-Pipe, and microtunnelling/tunnelling.

Average Age of Pipelines

Approximately 10% of watermains in the municipalities are greater than 70 years old whereas 61% are in the 30-50 years category. In the case of wastewater pipelines, 15% are greater than 70 years old and 49% are in the 30-50 years age category.

Effectiveness of Trenchless Technologies

When asked about the effectiveness of trenchless technologies (TT), respondents found TT effective or very effective in terms of cost (51%), effective or very effective in deep pipe renovation/installation (63%), in congested areas (57%), and in environmentally sensitive areas (67%).

Barriers to the use of Trenchless Technologies

Municipalities ranked cost as the biggest barrier (4.27 out of 5) to the use of trenchless technologies for pipeline renovation and construction. This is followed by the lack of sufficient training/knowledge (3.33 out of 5), consultants lack of knowledge (2.47 out of 5), and contractors’ availability (2.42 out of 5).

Contractors’ and Consultants’ Performance

Approximately 73% of the respondents indicate that they are satisfied or very satisfied with trenchless contractors’ performance. This dropped to 65% who are satisfied with open-cut contractors’ performance. When asked to comment on the consultants’ performance on trenchless projects, only 46% of the respondents are satisfied or very satisfied. Municipalities expected consultants to provide more expertise in project management and to devise innovative designs and solutions for buried infrastructure issues.

Education

Approximately 98% of the respondents consider continuing education to be important or very important. However, 41% of the respondents budgeted $10,000-$20,000; 38% between $5,000 and $10,000 and 21% less than $5,000 for education and training purposes.

Asset Management

Approximately 3% of the respondents have no asset management system, whereas 59% of the respondents report having a basic asset management system in place. As far as organizational structure is concerned, 53% of the respondents have separate asset management groups.
Key Findings

Critical Issues

**Funding:** When asked about the availability of funds for capital, and operation and maintenance (O&M) expenditures, there are marked differences in the responses from small vs. medium and large municipalities. In the case of small municipalities, none of the respondents have sufficient funds for capital works, whereas 21% of the respondents from medium and 28% of the respondents from large municipalities report having sufficient funds for capital works. For O&M expenditures, 61% of the respondents from small municipalities do not have adequate funds. For medium and large municipalities, the percentage was 26% and 16%, respectively.

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**Watermains:** Ensuring pipeline structural integrity and reducing the annual number of watermain breaks are critical issues followed by reducing pipe leakage, improving water quality and increasing fire flows.

**Wastewater Pipes:** Infiltration/inflow and inadequate capacity are critical issues.

**Storm Water Pipes:** Flow capacity, surcharging, and pipe collapses are critical issues.
Key Findings

Asset Management

Small Municipalities (population < 50,000)

69% of the respondents do not have a separate asset management group. However, 85% of the respondents reported having a basic asset management system in place.

Medium (population 50,000 to 300,000)

About 10% of the responding municipalities do not have any asset management system in place, whereas about 70% of the respondents have a basic asset management system. About 62% of the respondents have separate asset management groups.

Large (population > 300,000) Municipalities

55% of the responding municipalities have an advanced asset management system and rest of the respondents have a basic asset management system in place. 45% of the respondents do not have a separate asset management group.

Addressing Infrastructure

Backlog/Deficit

Rate Increase

42% of the respondents consider that a rate increase is important or very important.

Government Grants

49% of the respondents indicate that access to government grants is critical or very critical.

Long-term Financing

56% of the respondents find long-term financing to be useful or very useful.

Education

60% of the participants consider public education to be important or very important.

Public-Private Partnerships

33% of the respondents think public-private partnerships to be useful or very useful.

Government Regulations

56% consider regulatory requirements to be useful or very useful.

Staff Training/Education

About 98% of respondents consider staff training to be important or very important. 21% of the respondents allocated less than $5,000 for staff training/education. 38% of the respondents allocated $5,000-$10,000 for staff training whereas 41% allocated $10,000-$20,000 for staff training.
Key Findings (cont’d)

Trenchless Technologies

Cost Effectiveness

51% of the respondents indicate trenchless construction to be effective or very effective.

Deep Pipelines

63% of the respondents found trenchless construction to be useful or very useful for deep pipeline rehabilitation or installation.

Urban Congestion

57% of the respondents categorized trenchless methods to be useful or very useful in congested urban settings.

Environment

67% of the respondents consider trenchless construction to be useful or very useful in environmentally sensitive areas.

Barriers to the use of Trenchless Technologies.

The majority of the respondents ranked (4.27 out of 5) cost as the biggest barrier to the use of trenchless renovation and construction methods. This is followed by lack of knowledge/training (3.33 out of 5), consultants’ lack of knowledge (2.47 out of 5), and contractors’ availability (2.42 out of 5).

Contractors’ Performance

Open-cut

65% of the respondents reported being satisfied or very satisfied.

Trenchless

73% of the respondents reported being satisfied or very satisfied.

Project Management

41% of the respondents are satisfied or very satisfied.

Innovation

37% of the respondents are satisfied or very satisfied with innovative designs and solutions.

Consultants’ Performance

Open-cut

62% of the respondents are satisfied or very satisfied with the consultants’ performance.

Trenchless

46% of the respondents are satisfied or very satisfied with the consultants’ performance.

Project Management

51% of the respondents are satisfied or very satisfied.

Innovation

40% of the respondents are satisfied or very satisfied with innovative designs and solutions.
Watermains

Average Age
10% of the watermains are older than 70 years. About 61% of the networks are 30-50 years old.

Budget for Capital Works
30% of the respondents allocated more than $6 million for watermain capital works, whereas 47% of the respondents allocated less than $2 million.

Water Network Issues
Reducing watermain breaks and ensuring pipe structural integrity are ranked as critical issues with scores of 3.88 and 3.83, respectively. These are followed by reducing pipe leakage (score 3.62), improving water quality (score 3.33) and increasing fire flow (score 3.22).

Primary Construction Methods
Open cut is ranked the most widely used method for water main renovation and construction (score of 4.7 out of 5). This was followed by CIPP (score 4.08), HDD (score 3.97), and microtunnelling (score 3.18).
Renovation/Construction Performed Using Trenchless and Open Cut

25% of the respondents carried out over 4 km of trenchless renewal of watermains. 7% of the respondents used trenchless technologies for 3-4 km of watermain renovation/construction work. 47% of the respondents used open cut for over 4 km of watermain renewal.

Ranking of Trenchless Methods in Practice

The respondents ranked horizontal directional drilling (HDD) to be the most beneficial with a score of 3.47 (out of 5) followed by CIPP and microtunnelling/tunnelling for watermain renovation/construction.
Wastewater Collection Networks

Average Age
23% of the wastewater collection pipelines are older than 50 years and 15% are older than 70 years.

Budget for Capital Works
37% of the responding municipalities report a budget allocation of less than $1 million for capital works.

Wastewater Network Issues
Infiltration, inflows, flow capacity and pipe collapses are ranked to be the top four most critical issues with scores of 4.06, 3.77, 3.62, and 3.45 (out of 5), respectively.

Primary Construction Methods
Open cut is the most prevalent renovation/construction method with a score of 4.52 (out of 5). This is followed by HDD (score 4.01), CIPP (3.97) and Microtunnelling (3.31).
Renovation/Construction using Trenchless and Open-cut

26% of the respondents carried out over 4 km of wastewater pipeline renovation/construction using trenchless methods, whereas 40% of the respondents used open-cut.

Ranking of Trenchless Methods in Practice

The respondents ranked cured-in-place-pipe (CIPP) as the most beneficial method (score of 3.79 out of 5) followed by microtunnelling/tunnelling (score of 3.13), and HDD (score of 3.12).
Storm Water Collection Networks

Budget for Capital Works

47% of the respondents allocated less than $1 million for capital works, whereas 23% of the responding municipalities budgeted over $6 million.

Storm Water Network Issues

Flow capacity (scored 3.8 out of 5) is ranked the most critical issue for storm water networks. This was followed by surcharging (3.56), and pipe collapse (3.29).

Primary Construction Methods

Open cut is the predominant renovation/construction method scored 4.81 out of 5. This is followed by HDD (score 3.06), and CIPP (2.88).
Renovation/Construction using Trenchless and Open-cut

Open-cut is the predominant method for storm water pipelines’ renovation/construction. 20% of the respondents carried out over 4 km of renovation/construction using trenchless methods, whereas 38% used open-cut.

Ranking of Trenchless Methods in Practice

Amongst the various trenchless methods, CIPP is ranked the most beneficial (scored 3.22 out of 5). This was followed by HDD, and microtunnelling/tunnelling.
Survey Participants

In what province or territory are you located?

Small Municipalities
- Ontario: 97.0%
- British Columbia: 1.5%

Medium Municipalities
- Ontario: 77.3%
- British Columbia: 9.1%
- New Brunswick: 4.5%
- Nova Scotia: 4.5%

Large Municipalities
- Ontario: 88.6%
- British Columbia: 3.8%
- Manitoba: 3.8%
Rate the importance of the following with respect to removing water and sewer infrastructure backlog within your network.

**Small Municipalities**

- Creating stormwater fee: 3.31
- Professional education: 3.75
- Public education: 3.62
- Access to long-term financing: 3.15
- Public private partnerships: 2.00
- Government regulations: 3.75
- Access to government grants: 3.77
- Increased water/sewer rates: 2.85

**Medium Municipalities**

- Creating stormwater fee: 2.53
- Professional education: 3.64
- Public education: 3.47
- Access to long-term financing: 3.47
- Public private partnerships: 2.50
- Government regulations: 3.42
- Access to government grants: 3.42
- Increased water/sewer rates: 3.00

**Large Municipalities**

- Creating stormwater fee: 3.18
- Professional education: 3.57
- Public education: 3.72
- Access to long-term financing: 3.64
- Public private partnerships: 3.17
- Government regulations: 3.76
- Access to government grants: 3.44
- Increased water/sewer rates: 3.45
Does your municipality/utility have sufficient funds to meet capital expenditures for the next 5-10 years?

**Small Municipalities**
- We have sufficient funds: 0%
- We have just enough funds: 39%
- We do not have sufficient funds: 61%

**Medium Municipalities**
- We have sufficient funds: 21%
- We have just enough funds: 42%
- We do not have sufficient funds: 37%

**Large Municipalities**
- We have sufficient funds: 28%
- We have just enough funds: 41%
- We do not have sufficient funds: 31%
Does your municipality/utility have sufficient funds to meet operation and maintenance (O&M) expenditures?

- **Small Municipalities**
  - We have sufficient funds to meet O&M requirements: 17%
  - We do not have sufficient funds to meet O&M requirements: 50%
  - We have just enough funds to meet O&M requirements: 33%

- **Medium Municipalities**
  - We have sufficient funds to meet O&M requirements: 21%
  - We do not have sufficient funds to meet O&M requirements: 26%
  - We have just enough funds to meet O&M requirements: 53%

- **Large Municipalities**
  - We have sufficient funds to meet O&M requirements: 16%
  - We do not have sufficient funds to meet O&M requirements: 45%
  - We have just enough funds to meet O&M requirements: 39%
During the current fiscal year, what is your municipality’s estimated budget for capital works for rehabilitation and/or replacement of the following networks?

**Small Municipalities**

- Stormwater Network: 78% < $500,000, 11% $500,000 to $1 million, 11% $1 million to $2 million
- Wastewater Network: 58% < $500,000, 25% $500,000 to $1 million, 17% $1 million to $2 million
- Water Distribution Network: 54% < $500,000, 25% $500,000 to $1 million, 8% $1 million to $2 million

**Medium Municipalities**

- Stormwater Network: 7% > $6 million, 13% $4 million to $6 million, 13% $2 million to $4 million, 13% $1 million to $2 million, 47% $500,000 to $1 million, 7% < $500,000
- Wastewater Network: 18% > $6 million, 24% $4 million to $6 million, 6% $2 million to $4 million, 23% $1 million to $2 million, 29% $500,000 to $1 million, 35% < $500,000
- Water Distribution Network: 18% > $6 million, 18% $4 million to $6 million, 12% $2 million to $4 million, 17% $1 million to $2 million, 35% $500,000 to $1 million, 35% < $500,000

**Large Municipalities**

- Stormwater Network: 34% > $6 million, 8% $4 million to $6 million, 8% $2 million to $4 million, 16% $1 million to $2 million, 16% $500,000 to $1 million, 18% < $500,000
- Wastewater Network: 54% > $6 million, 8% $4 million to $6 million, 13% $2 million to $4 million, 15% $1 million to $2 million, 15% $500,000 to $1 million, 10% < $500,000
- Water Distribution Network: 46% > $6 million, 11% $4 million to $6 million, 11% $2 million to $4 million, 14% $1 million to $2 million, 10% $500,000 to $1 million, 8% < $500,000
What is the asset management (AM) maturity level?

**Small Municipalities**
- No asset management: 0%
- Basic asset management: 85%
- Advanced asset management: 15%

**Medium Municipalities**
- No asset management: 9%
- Basic asset management: 68%
- Advanced asset management: 23%

**Large Municipalities**
- No asset management: 0%
- Basic asset management: 45%
- Advanced asset management: 55%
Is asset management a separate group in your municipality or is it part of water/wastewater operations?

**Small Municipalities**
- Water/wastewater Operations: 69%
- Separate Group: 31%

**Medium Municipalities**
- Water/wastewater Operations: 38%
- Separate Group: 62%

**Large Municipalities**
- Water/wastewater Operations: 45%
- Separate Group: 55%
Water Distribution System

What are the critical issues in your watermain network?

**Small Municipalities**
- Pipe structural integrity: 3.22
- Increasing fire flows: 3.13
- Reducing the number of annual watermain breaks: 3.44
- Reducing pipe leakage: 3.56
- Improving water quality: 3.67

**Medium Municipalities**
- Pipe structural integrity: 3.22
- Increasing fire flows: 3.13
- Reducing the number of annual watermain breaks: 3.44
- Reducing pipe leakage: 3.56
- Improving water quality: 3.67

**Large Municipalities**
- Pipe structural integrity: 4.12
- Increasing fire flows: 3.47
- Reducing the number of annual watermain breaks: 4.00
- Reducing pipe leakage: 3.59
- Improving water quality: 3.06
Water Distribution System

Rate the benefit of the following trenchless construction methods for watermain/renovation/construction in your network.

**Small Municipalities**
- Spray-on or Spray-in Place Pipe (SIPP) lining: 2.44
- Cement mortar lining: 2.56
- Cured in Place Pipe (CIPP): 2.67
- Sliplining: 2.56
- Micro-tunneling/Tunneling: 2.11
- Directional drilling: 3.22

**Medium Municipalities**
- Spray-on or Spray-in Place Pipe (SIPP) lining: 2.00
- Cement mortar lining: 2.00
- Cured in Place Pipe (CIPP): 3.82
- Sliplining: 1.82
- Micro-tunneling/Tunneling: 2.47
- Directional drilling: 3.35

**Large Municipalities**
- Spray-on or Spray-in Place Pipe (SIPP) lining: 2.28
- Cement mortar lining: 2.81
- Cured in Place Pipe (CIPP): 3.44
- Sliplining: 2.84
- Micro-tunneling/Tunneling: 3.34
- Directional drilling: 3.61
Water Distribution System

Rank the methods (1 being the primary method) that you see being used for watermain renovation and construction in your utility/municipality (check N/A if not used at all).
Water Distribution System

What length (in total) of watermains were rehabilitated or replaced using the following methods?

**Small Municipalities**
- Trenchless: 11% > 4.0km, 11% 3.0 to 4.0km, 22% 2.0 to 3.0km, 56% 1.0 to 2.0km, 0.5 to 1.0km, < 0.5km
- Open Cut: 33% > 4.0km, 11% 3.0 to 4.0km, 22% 2.0 to 3.0km, 34% 1.0 to 2.0km, 0.5 to 1.0km, < 0.5km

**Medium Municipalities**
- Trenchless: 25% > 4.0km, 6% 3.0 to 4.0km, 13% 2.0 to 3.0km, 13% 1.0 to 2.0km, 25% 0.5 to 1.0km, 25% < 0.5km
- Open Cut: 44% > 4.0km, 17% 3.0 to 4.0km, 17% 2.0 to 3.0km, 17% 1.0 to 2.0km, 17% 0.5 to 1.0km, 5% < 0.5km

**Large Municipalities**
- Trenchless: 33% > 4.0km, 7% 3.0 to 4.0km, 10% 2.0 to 3.0km, 10% 1.0 to 2.0km, 17% 0.5 to 1.0km, 23% < 0.5km
- Open Cut: 52% > 4.0km, 6% 3.0 to 4.0km, 10% 2.0 to 3.0km, 26% 1.0 to 2.0km, 3% 0.5 to 1.0km, 3% < 0.5km
Water Distribution System

What percentage of the following pipe diameters makes up the total watermains’ network in your municipality?

### Small Municipalities

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Water Distribution System

What is the average age of watermains in your municipality?

Small Municipalities: 56% 30-50 Years, 22% 50-70 Years, 11% <30 Years, 11% >70 Years

Medium Municipalities: 70% 30-50 Years, 12% 50-70 Years, 12% <30 Years, 18% >70 Years

Large Municipalities: 58% 30-50 Years, 15% 50-70 Years, 15% <30 Years, 12% >70 Years

What is the estimated total length of watermains in your municipality?

Small Municipalities: 67% <300km, 22% 300-500km, 11% 500-800km, 0% >800km

Medium Municipalities: 50% 300-500km, 28% 500-800km, 11% <300km, 11% >800km

Large Municipalities: 56% 300-500km, 19% 500-800km, 13% <300km, 12% >800km
What are the critical issues in your wastewater collection system? (1 Not Critical, 5 Very Critical).

- **Small Municipalities**
  - Other: 3.50
  - Roots: 3.25
  - Flow capacity: 3.00
  - Pipe collapse: 2.75
  - Surcharging: 3.25
  - Encrustation: 2.13
  - Inflows: 4.63
  - Infiltration: 4.63

- **Medium Municipalities**
  - Other: 2.33
  - Roots: 3.20
  - Flow capacity: 3.53
  - Pipe collapse: 3.60
  - Surcharging: 3.15
  - Encrustation: 3.36
  - Inflows: 3.93
  - Infiltration: 4.27

- **Large Municipalities**
  - Other: 4.11
  - Roots: 3.28
  - Flow capacity: 3.83
  - Pipe collapse: 3.57
  - Surcharging: 3.48
  - Encrustation: 3.07
  - Inflows: 3.60
  - Infiltration: 3.80
Rate the benefit of the following trenchless construction methods for wastewater pipes’ renovation/construction in your network (1 Not Beneficial, 5 Very Beneficial).
Wastewater Collection System

Rank the methods (1 being the primary method) that you see being used for wastewater network construction/renovation in your network (check N/A if not used at all).

---

### Small Municipalities

- **Spray-on or Spray in Place Pipe (SIPP) lining**: 4.00
- **Cement mortar lining**: 4.50
- **Slip lining**: 3.00
- **Micro-tunneling/Tunneling**: 4.00
- **Cured in Place Pipe (CIPP)**: 3.00
- **Directional drilling**: 2.17
- **Open cut**: 1.14

### Medium Municipalities

- **Spray-on or Spray in Place Pipe (SIPP) lining**: 6.32
- **Cement mortar lining**: 4.70
- **Slip lining**: 4.89
- **Micro-tunneling/Tunneling**: 3.56
- **Cured in Place Pipe (CIPP)**: 2.69
- **Directional drilling**: 2.64
- **Open cut**: 1.73

### Large Municipalities

- **Spray-on or Spray in Place Pipe (SIPP) lining**: 6.93
- **Cement mortar lining**: 6.53
- **Slip lining**: 5.95
- **Micro-tunneling/Tunneling**: 4.24
- **Cured in Place Pipe (CIPP)**: 3.74
- **Directional drilling**: 2.55
- **Open cut**: 1.97
What length of wastewater pipes were renovated or replaced using the following methods?

### Small Municipalities
- **Trenchless**
  - > 4.0km: 14%
  - 3.0 to 4.0km: 14%
  - 2.0 to 3.0km: 72%
- **Open Cut**
  - > 4.0km: 37%
  - 3.0 to 4.0km: 13%
  - 2.0 to 3.0km: 37%
  - < 0.5km: 13%

### Medium Municipalities
- **Trenchless**
  - > 4.0km: 14%
  - 3.0 to 4.0km: 7%
  - 2.0 to 3.0km: 7%
  - 1.0 to 2.0km: 36%
  - 0.5 to 1.0km: 14%
  - < 0.5km: 22%
- **Open Cut**
  - > 4.0km: 36%
  - 3.0 to 4.0km: 14%
  - 2.0 to 3.0km: 21%
  - < 0.5km: 29%

### Large Municipalities
- **Trenchless**
  - > 4.0km: 38%
  - 3.0 to 4.0km: 10%
  - 2.0 to 3.0km: 10%
  - 1.0 to 2.0km: 21%
  - 0.5 to 1.0km: 10%
  - < 0.5km: 10%
- **Open Cut**
  - > 4.0km: 43%
  - 3.0 to 4.0km: 14%
  - 2.0 to 3.0km: 7%
  - 1.0 to 2.0km: 14%
  - 0.5 to 1.0km: 11%
  - < 0.5km: 11%
What percentage of the following pipe diameters makes up the total wastewater pipe network in your municipality?

### Small Municipalities

<table>
<thead>
<tr>
<th>Diameter</th>
<th>0 - 10%</th>
<th>10 - 20%</th>
<th>20 - 30%</th>
<th>30 - 40%</th>
<th>40 - 50%</th>
<th>50 - 60%</th>
<th>60 - 70%</th>
<th>70 - 80%</th>
<th>80 - 90%</th>
<th>90 - 100%</th>
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<tbody>
<tr>
<td>&gt; 900mm</td>
<td>80%</td>
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<td>600 - 900mm</td>
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<td>300 - 600mm</td>
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<tr>
<td>&lt; 300mm</td>
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### Medium Municipalities

<table>
<thead>
<tr>
<th>Diameter</th>
<th>0 - 10%</th>
<th>10 - 20%</th>
<th>20 - 30%</th>
<th>30 - 40%</th>
<th>40 - 50%</th>
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<td>600 - 900mm</td>
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<td>300 - 600mm</td>
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<td>&lt; 300mm</td>
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### Large Municipalities

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<tr>
<th>Diameter</th>
<th>0 - 10%</th>
<th>10 - 20%</th>
<th>20 - 30%</th>
<th>30 - 40%</th>
<th>40 - 50%</th>
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<th>70 - 80%</th>
<th>80 - 90%</th>
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<tbody>
<tr>
<td>&gt; 900mm</td>
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<td>35%</td>
<td>32%</td>
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<td>600 - 900mm</td>
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<td>300 - 600mm</td>
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<tr>
<td>&lt; 300mm</td>
<td>7%</td>
<td>11%</td>
<td>6%</td>
<td>24%</td>
<td>31%</td>
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</tbody>
</table>
What is the estimated total length of wastewater network in your municipality?

![Pie charts showing the distribution of wastewater network lengths by municipality size.]

What is the average age of wastewater pipes in your municipality?

![Pie charts showing the distribution of wastewater pipe ages by municipality size.]

---

31
What are the critical issues in your stormwater collection system?

**Small Municipalities**

- Other: 3.00
- Roots: 3.00
- Flow capacity: 3.50
- Pipe collapse: 3.25
- Surcharging: 3.63
- Encrustation: 1.86
- Inflows: 3.13
- Infiltration: 3.75

**Medium Municipalities**

- Other: 1.33
- Roots: 2.67
- Flow capacity: 3.70
- Pipe collapse: 3.56
- Surcharging: 3.40
- Encrustation: 2.78
- Inflows: 3.00
- Infiltration: 3.11

**Large Municipalities**

- Other: 3.63
- Roots: 3.31
- Flow capacity: 3.93
- Pipe collapse: 3.33
- Surcharging: 3.73
- Encrustation: 3.00
- Inflows: 3.35
- Infiltration: 3.40
Rate the benefit of the following trenchless construction methods for wastewater pipes’ renovation/construction in your network (1 Nor Beneficial, 5 Very Beneficial).

**Small Municipalities**

- Other: 3.00
- Grout in Place Pipe (GIPP): 2.50
- Cured in Place Pipe (CIPP): 2.38
- Sliplining: 2.63
- Tunnelling: 2.00
- Directional drilling: 2.75

**Medium Municipalities**

- Other: 1.75
- Grout in Place Pipe (GIPP): 2.30
- Cured in Place Pipe (CIPP): 2.80
- Sliplining: 2.89
- Tunnelling: 3.11
- Directional drilling: 3.00

**Large Municipalities**

- Other: 3.30
- Grout in Place Pipe (GIPP): 2.85
- Cured in Place Pipe (CIPP): 3.77
- Sliplining: 3.00
- Tunnelling: 3.46
- Directional drilling: 3.15
Rank the methods (1 being the primary method) that you see being used for stormwater network construction/renovation in your network (check N/A if not used at all).

**Small Municipalities**
- Other methods: 7.00
- Spray-on or Spray in Place Pipe (SIPP) lining: 4.67
- Cement mortar lining: 5.00
- Slippine: 2.50
- Micro-tunneling/Tunneling: 4.00
- Cured in Place Pipe (CIPP): 3.35
- Directional drilling: 2.25
- Open cut: 1.00

**Medium Municipalities**
- Other methods: 6.67
- Spray-on or Spray in Place Pipe (SIPP) lining: 5.00
- Cement mortar lining: 5.00
- Slippine: 4.25
- Micro-tunneling/Tunneling: 4.00
- Cured in Place Pipe (CIPP): 2.60
- Directional drilling: 2.29
- Open cut: 1.60

**Large Municipalities**
- Other methods: 7.55
- Spray-on or Spray in Place Pipe (SIPP) lining: 6.93
- Cement mortar lining: 5.81
- Slippine: 4.40
- Micro-tunneling/Tunneling: 3.64
- Cured in Place Pipe (CIPP): 2.42
- Directional drilling: 2.92
- Open cut: 1.30
Storm Water Collection System

What length of stormwater pipes were replaced/renovated in the past year using the following methods?

**Small Municipalities**

- **Trenchless**: 100%
- **Open Cut**: 37% 13% 25% 25%

**Medium Municipalities**

- **Trenchless**: 22% 11% 67%
- **Open Cut**: 30% 10% 30% 30%

**Large Municipalities**

- **Trenchless**: 32% 12% 4% 12% 12% 28%
- **Open Cut**: 40% 4% 30% 7% 15%
What percentage of the following pipe diameters makes up the total stormwater pipe network in your municipality/utility?

### Small Municipalities

<table>
<thead>
<tr>
<th>Diameter Range</th>
<th>0 - 10%</th>
<th>10 - 20%</th>
<th>20 - 30%</th>
<th>30 - 40%</th>
<th>40 - 50%</th>
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<td>&gt; 900mm</td>
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### Medium Municipalities

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<th>Diameter Range</th>
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### Large Municipalities

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<th>Diameter Range</th>
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<th>40 - 50%</th>
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<th>70 - 80%</th>
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<tbody>
<tr>
<td>&gt; 900mm</td>
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<td>15%</td>
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<td>12%</td>
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</table>
What is the estimated total length of storm water network in your municipality/utility?

**Small Municipalities**
- <300km: 87%
- 300-500km: 13%
- >800km: 0%

**Medium Municipalities**
- <300km: 12%
- 300-500km: 62%
- 500-800km: 13%
- >800km: 13%

**Large Municipalities**
- <300km: 24%
- 300-500km: 16%
- 500-800km: 24%
- >800km: 36%
General Perception

Overall, How much are you satisfied with the consultants’ performance?

**Small Municipalities**
- Innovative design/solutions: 2.50
- Project management: 2.88
- Trenchless: 2.88
- Open cut: 3.13

**Medium Municipalities**
- Innovative design/solutions: 3.10
- Project management: 3.50
- Trenchless: 3.40
- Open cut: 3.64

**Large Municipalities**
- Innovative design/solutions: 3.32
- Project management: 3.41
- Trenchless: 3.86
- Open cut: 3.66
General Perception

Do you expect consultants to help with policy and decision-making with respect to increased water/sewer rates, access to government grants, government regulations, public-private partnerships, and access to long-term financing?

**Small Municipalities**

- Increased water/sewer rates: 28.6%
- Access to government grants: 71.4%
- Government regulations: 71.4%
- Public private partnerships: 57.1%
- Access to long-term financing: 42.9%

**Medium Municipalities**

- Increased water/sewer rates: 42.9%
- Access to government grants: 42.9%
- Government regulations: 71.4%
- Public private partnerships: 71.4%
- Access to long-term financing: 57.1%

**Large Municipalities**

- Increased water/sewer rates: 48.0%
- Access to government grants: 52.0%
- Government regulations: 72.0%
- Public private partnerships: 84.0%
- Access to long-term financing: 12.0%
Rate the effectiveness of trenchless technologies from the following perspectives: environmental impact, reducing urban congestion, depth of pipeline, and cost effectiveness.
General Perception

How much budget is allocated for training/education of water/wastewater staff?

Small Municipalities
- $10,000-$20,000: 29%
- $5,000-$10,000: 43%
- < $5,000: 28%

Medium Municipalities
- $10,000-$20,000: 10%
- $5,000-$10,000: 70%
- < $5,000: 20%

Large Municipalities
- < $5,000: 20%
- $10,000-$20,000: 56%
- $5,000-$10,000: 24%

How important is the offering of Continuing Education Units (CEU's) for staff training/education?

Small Municipalities
- <30 Years: 0%
- 30-50 Years: 37%
- >70 Years: 25%
- 50-70 Years: 38%

Medium Municipalities
- >70 Years: 0%
- 30-50 Years: 53%
- 50-70 Years: 27%
- <30 Years: 20%

Large Municipalities
- <30 Years: 13%
- 30-50 Years: 50%
- 50-70 Years: 17%
- >70 Years: 20%
General Perception

Rank the barriers to the use of trenchless renovation and construction methods.

Small Municipalities

- Contractors' availability: 2.75
- Consultants' lack of knowledge: 3.38
- Lack of sufficient knowledge/training: 2.25
- Cost: 1.63

Medium Municipalities

- Contractors' availability: 3.09
- Consultants' lack of knowledge: 3.18
- Lack of sufficient knowledge/training: 2.27
- Cost: 1.45

Large Municipalities

- Contractors' availability: 3.30
- Consultants' lack of knowledge: 3.20
- Lack of sufficient knowledge/training: 2.30
- Cost: 1.50