SEWER BYPASS GUIDELINES

OCTOBER 2020

Contents

1.0 SCOPE

This document identifies key considerations for the design, installation, and operation of a bypass system required when temporary diversion of existing City of Calgary (The City) owned (possessing a Final Acceptance Certificate or FAC) sewer (sanitary or storm water) systems must occur during or as a result of construction-related activities. This guideline is applicable to all bypass system designs, including (but not limited to) those involving pipeline plugs, pond dewatering, and open channel flows.

Designing a bypass system to meet these guidelines is applicable to all sewer system bypasses, including both those required by third parties, and those required on behalf of or executed by internal (City of Calgary) staff.

Pursuant to the Alberta Environmental Protection and Enhancement Act, any bypass system shall meet all applicable regulatory requirements such as AR 117/1993 Release Reporting Regulation and AR 119/1993 Wastewater and Storm Drainage Regulation. In addition, the bypass system shall comply with the current edition of the following documents:

a. Standard Specifications, Sewer Construction

b. Standard Specifications, Waterworks Construction

c. Wastewater Bylaw #14M2012, Part VI: Section 20, Part VII: Section 23, and Part XIII: All

d. Drainage Bylaw #37M2005

e. Government of Alberta (Alberta Environment and Parks) Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems (Part 3)

f. Stormwater Management and Design Guideline (2011) (City of Calgary)

g. Alberta Dam and Canal Safety Regulatory Framework

This document is intended solely as guidance for planning bypass systems and their operation, and all rights for approval of a plan are retained by The City.

2.0 SUBMISSION REQUIREMENTS

The Contractor engaged by the Owner shall prepare and submit a Bypass Plan (the Plan, or bypass design) to Water Services a minimum of six (6) weeks prior to starting any portion of the proposed scope of work. Once the Plan has been reviewed and approved internally, The City will issue a Bypass Pumping Permit (the Permit) which must be received, and a copy delivered to the site prior to mobilization of any equipment for use in the bypass operation.

A pre-design meeting with stakeholders is recommended prior to submission of the Bypass Plan application to discuss preliminary design information such as project background, site condition, pump placements, flow rates, and allowable manhole surcharge levels (as provided upon request by Operations Engineering staff following an evaluation of upstream or service connection impacts).

All documents, questions, and requests for pre-design meetings should be submitted electronically to WSCOperationsEngineering@calgary.ca. All documents submitted should be typed (or legibly hand-written providing scanning/sending does not degrade the document) with pages numbered (as XX out of YY so as to ensure all pages are accounted for), written in plain-language English, and all documents should use a consistent set of units (SI/Metric is preferable, but Imperial is acceptable).

The following must be submitted (at a minimum) as part of the Plan application; failure to provide any of the following will result in the submission being returned as *Incomplete*:

a. Cover letter with the following information:

   - Project name, location, and detailed visual clearly showing area of interest (include labelling of nearby streets and/or key points of interest);
   - Reason for requiring bypass, including project owner (which may be The City), and whether the project is greenfield or brownfield (I.E. re-development);
   - Organization names and addresses for the Contractor, and Consultant (if applicable);
   - Organization names and addresses for any sub-Contractors being used in any part of the bypass operation;
   - Name and contact information of the Project Manager, Consultant (if applicable), and the person preparing the bypass operation;
   - Emergency contact information (including name, title, and 24-hour accessible number) of the person(s) on-site responsible for the bypass operation, as well as the person who will fill the Incident Manager role in case of an emergency (if that person differs from the daily on-site contact); and
   - A detailed written description of the planned bypass work to be performed, including (but not limited to):

      i. Purpose of the bypass operation;

      ii. How the bypass operation integrates into the larger construction operation (if applicable);

      iii. Proposed timeline and major milestones for the operation, including the proposed start and end dates for the Permit;

iv. Expected timing for starting/completing the operation (including any constraints on timing that may affect the Plan); and

v. Impacts on the project if the bypass operation cannot proceed.

b. Description and source of the design sanitary sewer bypass flow rates, including how the flow rate was determined/provided, who provided it (if provided by The City), data sources used, and a description of any monitoring (including flow measurement devices used) performed to either determine or validate the provided flow rate;

c. Justification for the storm sewer bypass flow rate to be designed, including how the flow rate was determined/provided, who provided it (if provided by The City), data sources used, and the estimation method chosen;

d. Detailed plan, design, and clearly written plain-language description of the proposed bypass system, including (but not limited to):

- Detailed drawing(s) showing suction pipe depth, plug, and pump connections (if plugging and pumping from a sewer is included in the design) as per Appendix A;

- Detailed drawing(s) showing channel dimensions (including bottom width, side slopes, depth, and longitudinal slope), centerline alignment, hydraulic grade line, depth of flow, and overland spill direction/impact should channel capacity be exceed (if an open channel bypass is included in the design) as per Appendix B;

- Detailed drawing(s) showing pond layout, suction details, erosion and sediment control measures, and any measures that would be undertaken during a rain event (if the bypass design includes dewatering of a pond) as per Appendix C;

- Detailed drawing(s) showing the system layout, and including all process/instrumentation required (including flow, pressure, or other meters installed), number and type of pumps used, power supply provided/used, and with all existing sewer infrastructure to either be used or bypassed clearly indicated as such;

- Detailed drawing(s) showing proposed equipment placement, site access and access to each equipment placement location (particularly if the operation includes multiple sites), and any fencing or other means of protection used to protect/isolate equipment;

- Detailed drawing(s) showing the locations and sizes of all temporary pipe supports, thrust blocks, and restraints;

- Calculations, evaluation, and any drawings required for clarity for selection of equipment used, including:

  i. Static lift, friction loss, flow velocity, Total Dynamic Head (TDH), and Net Positive Suction Head Allowable (NPSHa) (if pumping is included in the design);

ii. Bypass pump, piping/fitting size (including capacities of piping/fittings chosen), and materials used for process equipment;

iii. Back pressure required for pump(s) (if required);

iv. Plugging method selected, and plugs chosen (if required);

v. Hydraulic calculations (including free board) for open channel bypasses (if included in design);

vi. Rates of dewatering and effects on downstream systems (if dewatering of a pond is included in the design);

vii. Heat tracing minimum duty, energy source, and installation method (if required for winter operations); and

viii. Required flow rate calculations.

– Pump choice (if pumping is included in the design), including (but not limited to):

i. Manufacturer/vendor;

ii. Type (centrifugal, submersible, etc.);

iii. Model (including all options);

iv. Power supply (including clear identification of power source, and any plans for fuel storage or refueling that will be required);

v. Physical characteristics (including dimensions, suction/discharge diameters, weights, materials of all parts, and any other relevant information);

vi. Control narrative/methodology (including whether pumps will be manually controlled or if any control transmitters will be used);

vii. Pump curve showing the operating range (capacity, head, and power values) and duty point clearly indicated; and

viii. Clearly highlighted NPSHr, and calculation showing that NPSH (as calculated by NPSH = NPSHa – NPSHr) is greater than or equal to 0.9m (3′).

– Redundancy plans/methods to ensure 100% redundancy (including redundant power supplies, secondary pumping that matches or exceeds primary pumping capacity, and any other miscellaneous equipment required to eliminate the risk of the bypass operation failing) and the number of each component of the Plan to be kept on-site;

– Methods of noise control for each pump, generator, and any other sources of noise that may exceed noise guidelines for the area in which the operation is occurring (this is particularly important for residential areas and operations with overnight operations);

- Methods to protect suction/discharge manholes and/or other structures (such as existing interior drop) from being damaged due to bypass operations;

- Methods/plans for controlling traffic and vehicular/pedestrian access (including if a third-party is performing this part of the work) as well as copies of all permits required for traffic control;

- Procedures for monitoring upstream and downstream facilities (piping, pumping stations, and all other infrastructure etc.) if applicable;

- Procedures and an integrated schedule for key operational milestones including (at minimum) set-up, bypass start, high-risk activities, bypass completion, and dismantlement.

e. City permits obtained from all departments as required, including but not limited to Street Use Permit, and Pathway Closure and Detour Permit;

f. Agreements executed with rights-holders for any land that will be crossed (crossing agreement) or encroached upon (proximity/encroachment agreement) as part of the bypass operation, or plans for how these rights-holders will be engaged;

g. A water quality testing plan which meets requirements laid out by Water Quality Services for testing and monitoring of drainage (if applicable), or procedures detailing how the proposed bypass design will not alter the fluid(s) in the systems bypassed such that a water quality testing plan would be required (note that engaging Water Quality Services for review may result in extended approval timelines);

h. A site-specific Emergency Spill Response Plan detailing procedure to be followed in the event of pump failures, overflow of sewers or other water-containing infrastructure, service backups, and/or fluid spillage which includes (but is not limited to):

   - Personnel (including roles and responsibilities) involved in the spill response;

   - Plans for containing the spill and addressing the source of the spill;

   - Plans for preventing public exposure to the spill including procedures for redirecting pedestrians and traffic away from the impacted area, and plans for protecting downstream infrastructure/property;

   - Identification of any service connections, storm drains, watercourses, or other infrastructure that can be negatively impacted by the spill, as well as the approximate time from failure/spill to impact; and

   - Measures to be taken to avoid or mitigate the adverse effects of the spill on the environment.

The contractor shall maintain a copy of the Emergency Spill Response Plan on-site for the duration of the bypass operation.

i. Completed checklists (Design/Submission Checklist and Risk/Mitigation Plan Checklist) in Appendix E; and

j. Formal certification of accountability/ownership of the design, operation, function, and consequences of the Plan by having:

   - Design plans and calculations reviewed and stamped/signed by a competent Professional Engineer registered in the Province of Alberta; and/or

   - Completing and signing (in the presence of a signing witness) the Accountability Agreement for bypass operations (in Appendix E).

3.0 DESIGN CONSIDERATIONS

The following are essential factors to be considered when designing bypass systems..

a. Flow Rate Determination

Accurate determination of the flows to be bypassed is critical for ensuring that the bypass operation is successful. The system needs to be designed such that it can meet the full range of expected flowing conditions, including the minimum, maximum, and typical flow rates. The design must also include consideration of how the flows are validated prior to and during the bypass operation.

Sanitary Systems

Flow rates to be used for sanitary system bypass design are either provided by The City or determined via flow measurement in advance of the operation.

For flow rates provided by The City, the bypass design submission must document the rates (minimum, maximum, and typical), as well as who provided the information. Any plans for validating the flow rates must be included in the bypass design (including all devices, and equipment used to do so), as well as plans for how to monitor flows during the operation to ensure they stay within the designed rates (again, including all devices and equipment used to do so).

For flow rates measured, the Plan must detail the procedure for flow measurement. The design must include a description of the time period for flows to be measured, and how this time period is expected to capture the full minimum-maximum range expected. The submission must include all devices and equipment used to measure the flows, as well as any calculations or external data sources used to support the rate determination.

Storm Systems

Flow rates to be used for storm system bypass design are either provided by The City or calculated as the collected runoff that would be captured by the system.

For flow rates provided by The City, the bypass design submission must document the rates (minimum, maximum, and typical), as well as who provided the information. Any plans for validating the flow rates must be included in the bypass design (including all devices, and equipment used to do so), as well as plans for how to monitor flows during the operation to ensure they stay within the designed rates (again, including all devices and equipment used to do so).

Flow rates can be calculated by continuous simulation of peak flow, or estimated using the Rational Method; the bypass design must document the runoff coefficient, land use type, contributing area size, time of concentration, and intensity of the rainfall, as well as how each was chosen. When bypassing from April 1st through October 31st, the design peak flow rate should be based on the 1:2 year, 1-hour duration storm event; while bypassing from November 1st through March 31st, the design peak flow rate (in L/s) can be estimated by dividing the drainage area (in hectares) by three (3).

If an alternate method is used to calculate the flow rate, it must be clearly documented, and all calculation steps included as an appendix. If the bypass operation is designed for a flow rate based on assumptions other than those mentioned above, the design must justify the flow and document how the flow rate is applicable to the time period during the bypass operation will be ongoing. Any plans for monitoring flows during the operation to ensure they stay within the designed rates must be included in the bypass plan (again, including all devices and equipment used to do so).

A hybrid flow rate determination where maximum flow rate is calculated (via continuous simulation, or the Rational Method), and typical flow rate is measured may be used; the bypass design must clearly document how the flow rate has been measured (including devices, equipment, and the time period analyzed).

When a temporary water detention structure is considered, the storage capacity of the structure can be estimated based on the 1:2 year, 24-hour runoff event, or at the discretion of the Design Engineer if bypassing from April 1st through October 31st. When bypassing from November 1st through March 31st, the storage capacity required can be estimated as the volume resulting from an 8-hour duration event at a rate of one-half (1/2) of the flow peak, or at the discretion of the Design Engineer.

When a temporary water detention and/or conveyance structure is considered, the structure should be in compliance with the Alberta Dam and Canal Safety Regulatory Framework.

b. Pumping

All pumps must be either automatic self-priming or prime-assisted units that do not require the use of foot-valves or vacuum pumps in the priming system. Pumps can be electric or diesel-powered.

Centrifugal Pumps

Centrifugal pumps are commonly used in most pumping bypass designs. These pumps allow for suction pipes to be managed through most manhole openings and are available in a variety of styles, capable of meeting most design requirements.

The following information is required to adequately size centrifugal pumps; these calculations must be included in the Plan submission as an appendix:

– Flow Rates (minimum, typical, and maximum);

– Total Suction Lift = Suction Lift + Friction Losses;

– Total Discharge Head = Discharge Head + Friction Losses;

– Total Dynamic Head (TDH) = Total Suction Lift + Total Discharge Head;

– Net Positive Suction Head Available (NPSHa);

– Net Positive Suction Head Required (NPSHr); and

– Net Positive Suction Head (NPSH).

Pumps are selected such that they are able to provide the required flow rate for the system at the calculated TDH. Pumps chosen should also be checked to ensure that the required NPSH (NPSHr) does not exceed the available NPSH (NPSHa) of the bypass system designed; this will ensure that the pump does not cavitate. Pump cavitation occurs when the pressure at the pump inlet drops below the liquid's vapour pressure creating vapor bubbles. The bubbles trigger shockwaves causing premature wear and ultimately leading to failure of the pump. Cavitation is identified by:

- Loud noise often described as marble sounds in the pump;
- Loss of capacity because bubbles are now taking up space instead of liquid; and/or
- Pitting damage to parts as material is removed by the collapsing bubbles.

NPSH is calculated as the difference of NPSHr subtracted from NPSHa; the NPSH of the system must be designed to a minimum of 0.9m (3′) to ensure that cavitation does not occur.

NPSHa must be calculated as a function of the bypass system, whereas NPSHr is a function of the pump and must be provided by the pump manufacturer. NPSHa must be greater than NPSHr for the pump to operate efficiently (the system must have more suction pressure available than the pump requires).

$$NPSH_a = Head_{Static} + Head_{Surface\ Pressure} - Pressure_{Liquid\ Vapour} - Losses_{Friction}$$

$$NPSH_r = Pump\ Characteristic$$

Submersible Pumps

Submersibles are centrifugal pumps which are attached directly to a motor; the entire assembly is submerged in the fluid to be pumped. Submersible pumps push fluid to the discharge port while suction pumps have to pull the fluids then be able to release. This type of pump is recommended for bypass operations with suction lifts greater than 4m (13′) as this reduces the likelihood of cavitation.

Submersible pumps require a specific depth of submergence in order to operate properly and to ensure proper cooling of the motor. Users should strictly follow manufacturer specifications for these pumps to ensure they function as designed.

Multiple Pumps

Bypassing a major storm or sanitary system may not be possible using a single pump. Pumps can be installed in parallel when larger total flow rates are required and can be installed in series when a larger TDH is required.

If multiple pumps are being used, each pump must have an individual Stop/Start control.

Pumps in Parallel

Peak flows can easily exceed the capacity of any single pump therefore multiple pumps operating in parallel may be necessary. This design enables two or more pumps to take suction from a common structure and discharge into a common destination, all operating against the same discharge head. Preliminary design for pumps operating in parallel can sum the flow rates of each pump at the required head value; however, in practice, the total flow rate will be less than the sum due to additional frictional effects introduced by operating in parallel.

Pumps in Series

In a large system, the required TDH can be large enough as to make a single pump infeasible (I.E. it would operate at such a low flow rate as to be unusable) so multiple pumps operating in series may be necessary. This design enables two or more pumps to operate as a multi-stage system allowing the overall pressure (and thus the TDH able to be overcome) to be higher. Preliminary design for pumps operating in series can sum the head values for each pump at the required flow rate; however, in practice, the TDH of the system may be lower due to various issues.

Multiple Pump Considerations

Using multiple pumps in a system (either in parallel or in series) can accommodate larger bypasses; however, pumping design is more complex, and consideration should be given to soliciting design advice from the vendor or from personnel experienced in using the chosen pumps in a parallel or series configuration.

Operating multiple pumps can induce unexpected frictional effects, or other unexpected issues. Pumps operating in series will see increasingly higher pressures through the series, which can result in exceeding the pressure rating of the pump (including the pump body itself, and seals etc.). Pumps operating in parallel are often not operating at identical conditions, and often have one pump near shut-off while the other operates far outside of its curve; consideration should be given to validating that pumps are operating where designed. As system designs require either all pumps to operate at the same head or the same flow rate, it is usually simplest to choose all identical pumps; however, consideration must be given to ensuring that all are in similar condition (I.E. wear on the impeller which might change the pump characteristic).

c. General System Design

Suction Manhole Depth: The construction or repair area must be isolated from the suction and discharge locations. The plug must be installed at least one manhole upstream from the working area. Lift is a key component in the assessment of pumping systems therefore selection of the suction manhole is critical; larger lifts contribute to requiring a pump (or pumps) with higher head.

Pond Dewatering Suction: Pond dewatering suction should be designed to be floating to reduce the likelihood of sediment agitation.

Allowable Manhole Surcharge: The allowable surcharge in a specific manhole will vary. Once the manhole is plugged it is important to determine how high the level in that specific manhole can be reached before negatively impacting surrounding properties. It is critical to consult with The City engineers to determine what is allowable in an area.

Distance from Manhole to Pump: The distance that a fluid must travel is significant in determining frictional losses through the hose or pipe. Additional suction/discharge distance will also increase the time that the pump needs to self-prime as there is more air to evacuate prior to normal operation start-up.

Discharge Pressure: A bypass system must reach a certain TDH to pump to a physical location; TDH is a function of discharge head, which is a function of location and discharge pressure. Once pumped to the receiving location, a design that allows fluid to exit the pipe (I.E. at atmospheric pressure) and be influenced by gravity down into the receiving manhole will result in a smaller (or negligible) discharge head.

Open Channel Liners: If an open channel is included in the design, consider whether the channel requires a liner. A liner can help prevent erosion when the channel is used to store and convey storm water and can help prevent contamination when sanitary water is conveyed.

Odour: Bypass systems that alter flow (particularly for sanitary water) have the potential to allow odorous gases to reach surface, potentially causing harm or complaints from the public. Consideration for odour control is important in all systems; however, this is mandatory for open channel bypass designs where the water is open to surface.

Gas Monitoring: Bypass operations can result in the release of increased concentrations of H_2S (or other atmospheric contaminants), or in the release of H_2S in locations where it was previously not a risk (particularly in areas of increased turbulence/agitation of a waste water stream). Gas monitoring (either via a temporary area monitor or via personal gas monitors) is critical to ensure that personnel are aware of and can mitigate hazardous gaseous environments (both for themselves and for any members of the public in the area).

Pump Clogging: The bypass design must include redundant secondary pumping capacity to match primary pumping capacity; this allows continuous flow in case of emergencies due to clogging or pump failure. Clogging indicators can include fluid level starting to rise in the suction manhole, or pump vibration due to the suction bin being clogged and the pump impeller not receiving sufficient liquid.

Spill Prevention and Mitigation: When designing the bypass, methods for preventing spills, and for limiting the effects of spills must be considered. Systems should be designed with a focus on spill prevention, which can include considerations such as limiting the overland piping distance or bypass operation period, including spill trays or similar at connection points, and minimizing exposure of the equipment to potentially-damaging environments (i.e. placing piping away from roadways and the risk of damage from vehicles). Designing for spill mitigation can include placing equipment away from entry-points to storm systems or watercourses and limiting available piping volume that can spill during a rupture (i.e. shorter systems, or smaller diameters).

4.0 EQUIPMENT AND PIPING

Plugs must be in good condition and shall not have any visible damage such as cracks, holes, tears, cuts, abrasions, loose/damaged fittings; selected and installed according to the size of the line to be plugged. They must be adequately secured and anchored to prevent plug movement.

All pumps must be either automatic self-priming or prime-assisted units that do not require the use of foot-valves or vacuum pumps in the priming system. They can be electric, or diesel powered. Each pump must have the Stop/Start control.

Piping shall be homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, or other deleterious faults. Piping shall be assembled and joined onsite using couplings, flanges or butt-fusion method to provide leak proof joint.

Flexible hose, couplings and connectors shall be abrasive resistant and rated for external and internal loads anticipated including test pressure. External load design shall incorporate anticipated traffic loadings.

All rigid or hard piping shall be constructed with positive restrained joints.

5.0 EXECUTION

It is the Contractor's responsibility to protect the environment, public, and private properties from any damage during the installation, operation, and removal of the bypass system. All provisions stated in the Plan must be followed throughout the course of any bypass operations.

a. Installation

Contractor is responsible for locating any existing utilities in the area selected to place the bypass operation, and for obtaining all approvals for required by all regulatory agencies (including other departments of The City).

Non-Process Equipment

All equipment must be in good condition and shall not have any visible damage such as cracks, holes, tears, cuts, abrasions, loose/damaged fittings. Process equipment must be adequately secured and anchored to prevent movement (pumps, piping, as well as plugs). Plugs must be chosen to accommodate the size of piping to be plugged (I.E. plugs must not be used in an under or over-inflated manner).

Piping shall be homogeneous throughout, free of visible cracks, discoloration, pitting, varying wall thickness, holes, foreign material, or other deleterious faults. Piping shall be assembled and joined onsite using couplings, flanges, or butt-fusion welding to provide leak-proof joints. All rigid or hard piping shall be constructed with positive restrained joints.

Flexible hose, couplings, and connectors shall be abrasion-resistant and rated for external and internal loads anticipated (including test pressure). External load design shall incorporate anticipated traffic loading throughout the entire operation.

Siting and Location

Siting of equipment and placement of piping/hoses etc. should be done in a way so as to minimize risk of the bypass operation failing, and further, to minimize the impact should the bypass operation fail.

When the bypass piping crosses local streets and/or private driveways, use roadway ramps or place the pipe in trenches and cover with temporary pavement or other protective means of pipe crossing. Consider more permanent protection if bypass piping is intended to be in use for a significant period of time. Protective crossings used must be adequate for both regular vehicular traffic and any construction traffic that may need to cross the piping.

Design the site layout such that all components of the bypass operation are easily protected from vandalism and vehicular damage. Consider the degree of fencing required to isolate the site and equipment (I.E. more significant in populated areas, or more protective in areas with heavy vehicle traffic).

Use low noise pumps and generators in residential areas or places where excessive noise levels could create disturbance while in operation. Implement sound attenuation measures such as soundproof canopies if necessary.

Readiness Testing

Prior to starting operation, Contractor shall perform leakage and pressure testing of the discharge line to withstand at least twice the maximum system pressure based on the approved Plan for a period of 2 hours.

Prior to installing any plugs, the Contractor must inspect the existing pipe for any flaws that might cause plug damage or result in the plug not being able to seal properly. All designs should include the provision for a secondary plug in the event that the primary plug fails. Sanitary odours shall be minimized by using snug lids and shroud covers.

b. Operation

All equipment specified in the Plan must be on-site and operating as designed for the duration of the bypass operation. All required documentation demonstrating the equipment is as specified and in working order must be available on-site.

The Contractor shall have full-time (24-hour), on-site qualified personnel for monitoring the entire bypass installation while it is in operation (including all pumps, monitoring devices, piping, etc.). The entire length shall be inspected hourly to check for leaks; Contractor shall provide all necessary monitoring devices to notify crews of any pump (or other equipment) failure. Hourly checks should also include back-up equipment to ensure it can be used if and when required.

Contractor representatives should be in contact with The City as the bypass operation is ongoing to update with any changes in timing, or any issues encountered. Contractor must notify The City via WSCOperationsEngineering@calgary.ca upon completion of the bypass operation.

c. Removal, Cleanup, and Restoration

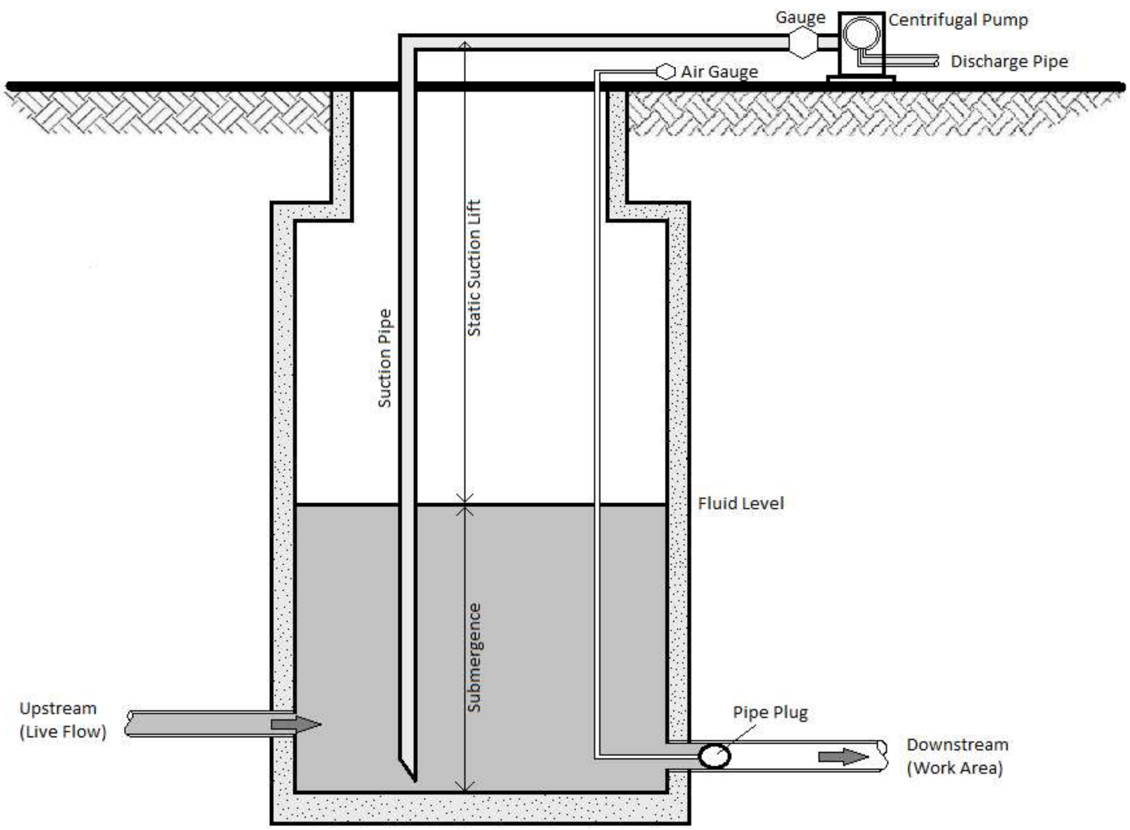
Once the bypass operation is complete, Contractor is required to return the site to its normal operating mode. Ensure that all fluids from the bypass pipes, pumps, and fittings, etc. are discharged to the specified sanitary or storm sewer system. Flush all bypass lines before removal so as to ensure there is no risk of uncontrolled release of fluids.

If the bypass design included an open channel flow, remove any berm or other earthworks installed as part of the bypass. Dispose of any temporary liner installed as per environmental requirements.

When the bypass operation has included plugging of a line, remove the plug by slowly deflating it so as to allow flow to return gradually to the normal flow condition.

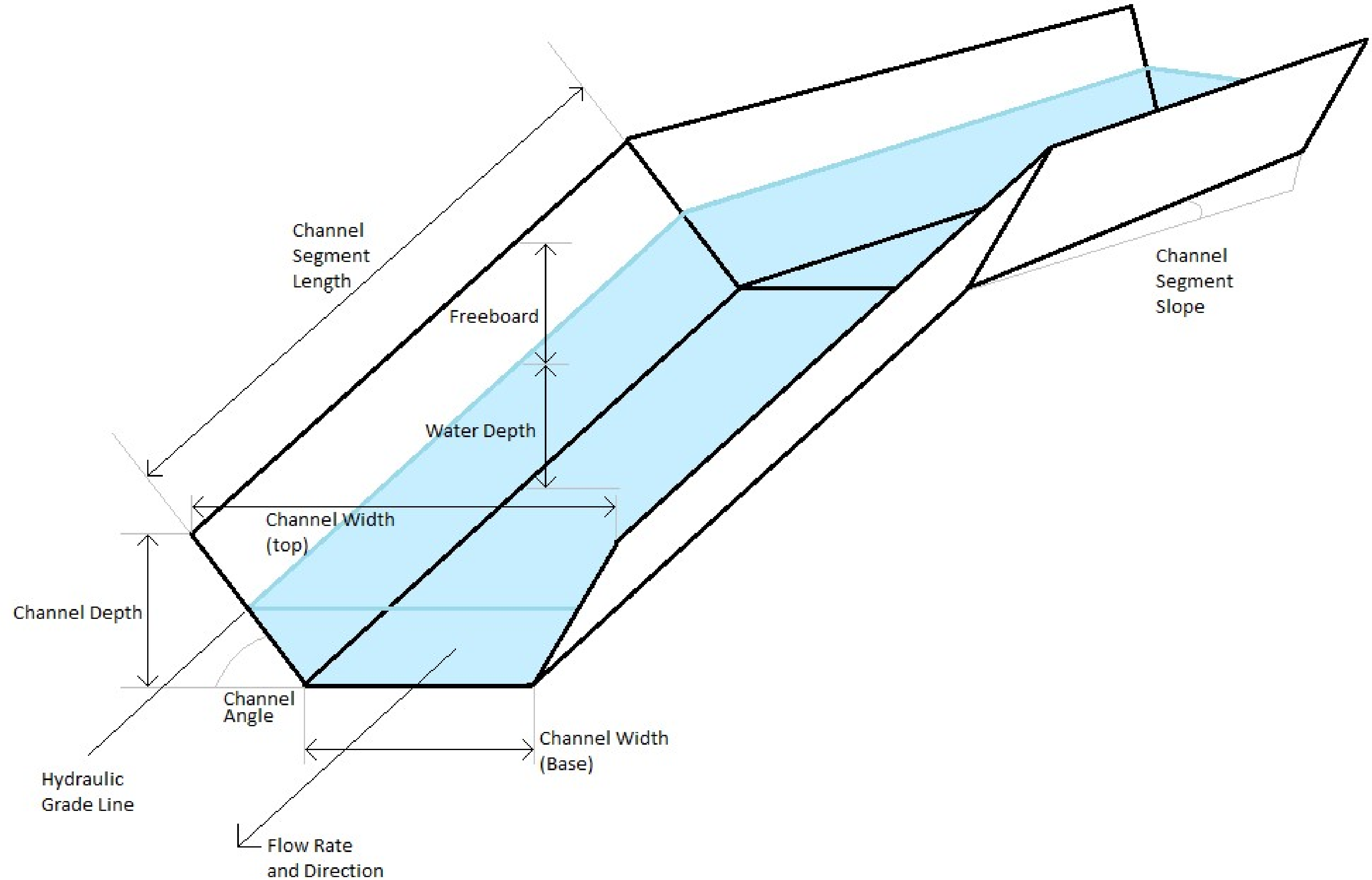
Once all bypass operation equipment has been drained and removed, Contractor must restore all properties to their pre-bypass condition including restoration of pavement and opening of roadways to normal traffic.

6.0 APPENDIX A – PUMPING BYPASS DETAIL

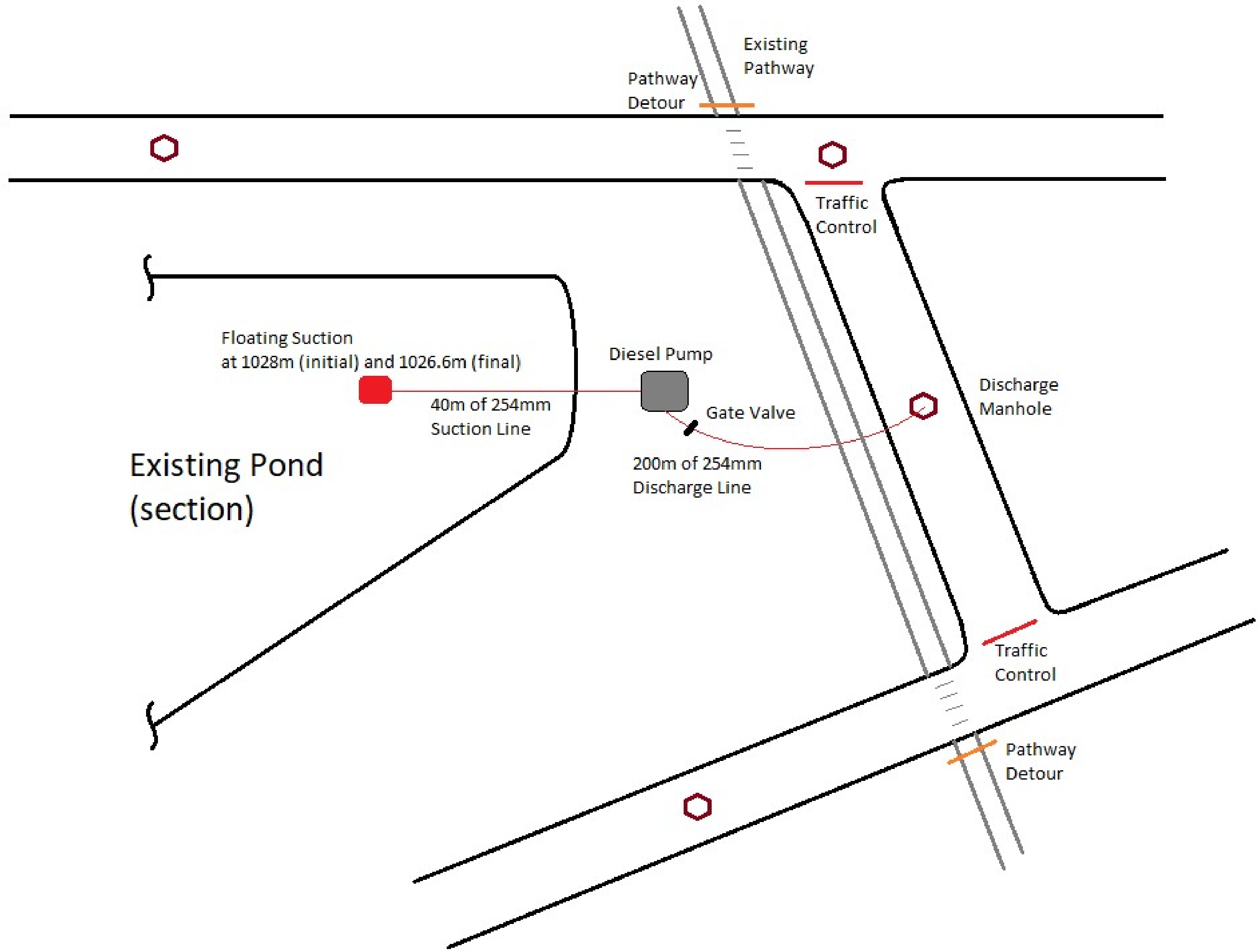


Suction Manhole Details			
Item	Units	Value	Notes
Pipe Inner Diameter	mm		
Pipe Length to Discharge	m		
Submergence (provided)	m		
Submergence (required)	m		
Static Suction Lift	m		
Maximum Fluid Surcharge Level in Manhole	m		
NPSHa	m		
NPSHr	m		
NPSH	m		
Pump Capacity	m^3/s		

7.0 APPENDIX B – OPEN CHANNEL BYPASS DETAIL



8.0 APPENDIX C – POND DEWATERING DETAIL



9.0 APPENDIX D – SPECIFIED REGULATORY REQUIREMENTS

Regulatory requirement documents discussed in the document are linked below. Note that this list may not be exhaustive, and persons in charge of designing the bypass are responsible for ensuring that the latest version of all regulatory requirements have been followed.

- Water Development Approval Submissions
- Stormwater Management & Design Manual
- Bylaw 14M2012 Wastewater
- Bylaw 37M2005 Drainage
- Environmental Construction Operations (ECO) Plan Framework
- Environmental Protection and Enhancement Act (EPEA) Release Reporting Regulation
- Environmental Protection and Enhancement Act (EPEA) Wastewater and Storm Drainage Regulation
- Alberta Wastewater Systems Standards for Performance and Design

10.0 APPENDIX E – CHECKLISTS AND ACCOUNTABILITY AGREEMENT

Checklists and Accountability Agreement

Stormwater/Wastewater Bypass Submission

Project Name and Location: ______________________________

Contractor: ______________________________

This application requirement list outlines the (minimum) information necessary to evaluate and provide a timely decision on the bypass operation plan submitted.

Only complete applications will be accepted. Applications and all relevant materials submitted must be clear, legible, and precise.

Please complete the following checklists, and subsequent accountability approval. These checklists, the accountability approval, and all documents submitted as part of the design will be considered as part of the Bypass Plan.

Design and Submission Checklist

YES	NO	N/A		
			1. Cover Letter	
			•	Project information and reasoning for bypass request
			•	Contact details of relevant staff
			2. Site Details	
			•	Work area with labelled nearby streets / points of interest
			•	Detailed manhole and plugging drawing (if applicable)
			•	Detailed channel drawing (if open channel bypass)
			•	Detailed pond layout drawing (if dewatering a pond)
			•	System layout (process, instrumentation, electrical, etc.)
			•	Equipment placement, access plans, and site security

• Support details/drawing (including temporary supports)
3. Flow Rate and Volume Determination • Description of the methods used to estimate the flow and volume • Calculations relevant to flow rate estimates (if applicable) • Description of monitoring to determine or validate flow rates (if applicable)
4. Design Evaluation • Calculations/drawings for equipment selection • Drawings/evaluation for materials and sizes • Evaluation for plugging method/sizes chosen (if applicable) • Hydraulic calculations for open channel bypasses (if applicable) • Rates of dewatering and downstream effects for pond dewatering bypasses (if applicable) • Heat tracing calculations and evaluation (if applicable for winter operations)
5. Pump Selection and Details • Manufacturer, vendor, and model details • Power supply and description of source • Physical characteristics (dimensions, weights, diameters, materials, etc.) • Control narrative/methodology (including any controlling transmitters if used) • Pump curves showing operating range and duty point indicated • NPSHr (for pump), and calculation showing NPSH ≥ 0.9 metres
6. Redundancy Planning • Secondary pumping ≥ primary pumping capacity • Redundant power supplies • Miscellaneous equipment required (hoses, piping, etc.)
7. Noise Control Details
8. Existing Equipment Protection Plans • Suction/discharge manhole protection • Upstream/downstream facility monitoring and protection

	9. Integrated Schedule for Operation • Milestones for key activities • Referenced to detailed plan activities
	10. Water Quality Plan • Testing plan meeting Water Quality Services requirements (if applicable) • Procedures detailing why design does not require testing (if applicable)
	11. Emergency Spill Response Plan • Plans for containing and addressing spills • Plans for preventing public exposure and protecting infrastructure • Measures taken to mitigate adverse environmental effects • Plans shared with and stored on-site with on-site representation
	12. Risk Assessment and Mitigation Plans (and Checklist)
	13. Traffic Control and Access Plans
	14. Detailed explanations of any item checked as **NO** or **N/A** above
	Please enter any explanations below and reference the number above:

Risk and Mitigation Checklist

YES NO N/A

1. Administrative Controls					
				a)	Staff and sub-contractors are trained in risk identification, mitigation, and emergency response
				b)	An individual or group is dedicated to risk ownership and risk process ownership
				c)	All involved in the operation understand their responsibility to stop work if a risk event is imminent or has occurred
				d)	Communication channels for risk events and their mitigations are planned, documented, and available to all involved in the operation
2. Environmental Impacts and Controls					
				a)	All site-specific sensitive features that could be impacted by the operation have been identified
				b)	All project permits, approvals, authorizations, and notifications are in place
				c)	Specific regulatory requirements directly impacting or restricting the project have been met
				d)	Corporate policy and/or program requirements directly impacting or restricting the project have been met
				e)	Procedures, controls, and/or Best Management Practices (BMPs) applicable for preventing/reducing adverse environmental impacts have been applied
				f)	Jurisdiction-appropriate erosion and sediment controls have been applied
				g)	Jurisdiction-appropriate tree protection measures have been applied
3. Hazardous Materials and Wastes					
				a)	Hazardous materials that are (or could be) on-site are identified and recorded
				b)	Anticipated hazardous wastes that are (or could be) on-site are identified and recorded
				c)	All staff and sub-contractors who (may) handle hazardous materials or wastes are trained in handling, containment, storage, and disposal
4. Site-Specific Risk Planning					
				a)	Operation scope-of-work has been analyzed and risks have been formally identified
				b)	Schedule for operation has been evaluated, and shut downs or restricted periods have been included where required or suggested by BMP

				c)	Risks identified have a defined trigger, owner, and response
				d)	Monitoring plans and procedures are in place to determine if risk events are occurring (or will imminently occur) and must be mitigated
5. Closure and Certification					
				a)	Detailed explanations of any item checked as **NO** or **N/A** above are provided
				b)	Documented risk planning is included in submission for operation
				c)	Contractor is accepting responsibility for ensuring that risk and mitigation planning is complete, and is adequate for the operation being designed

Please enter any explanations below and reference the number above:

Accountability Agreement

I have prepared the bypass plan for the project identified above and have used sound judgment in all facets of the plan preparation including but not limited to any pump sizing calculations, design of pipe plugs, discharge point protection, and emergency backup systems. I have followed industry standard practices, in addition to all applicable industry codes and regulations. If there have been any deviations from these standards I have clearly identified same in the final documents of the bypass plan.

I acknowledge and agree that The City of Calgary ("The City") fully relies on the above representations in accepting, processing, and in making a decision on the issuance of a bypass permit for the above-noted application, and that I will indemnify and save fully harmless The City against any claims, damages, suits, actions, liabilities and causes of action, costs, or sums of money whatsoever that The City may suffer in relation to such reliance.

I further agree to immediately notify The City in writing, of any changes regarding the above information.

____
Date

______________________________ ______________________________
Signature of Representative Witness

of: ______________________________

______________________________ ______________________________
Name Name