TECHNICAL MEMORANDUM

To: Danny Wallace
Director, City Services
City of North Pole
125 Snowman Lane
North Pole, AK 99705

From: Keith Hanneman
RESPEC
1028 Aurora Drive
Fairbanks, AK 99709

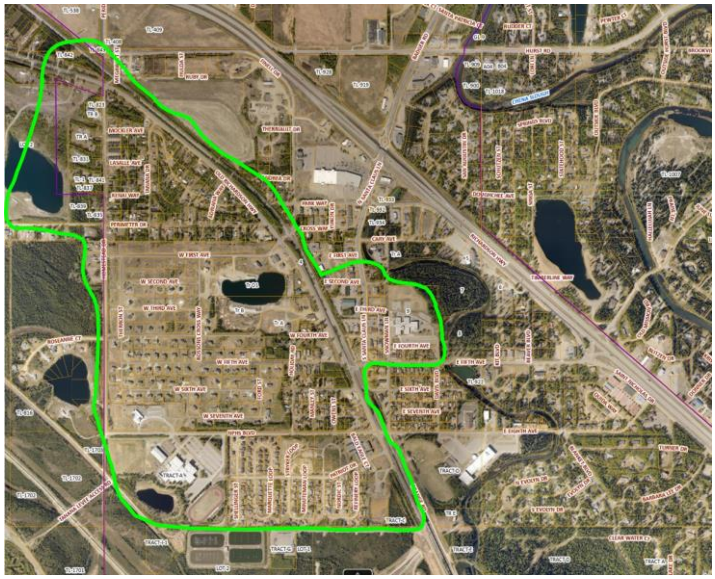
Date: June 30, 2023

Subject: City of North Pole – West of Old Richardson Highway Stormwater Drainage Study

BACKGROUND

The City of North Pole desired a drainage study of two low-lying areas in North Pole. Every spring, due to runoff during breakup which results in significant flooding at two locations:

- west of the Old Richardson Highway in the northwest corner of Ford Subdivision which flows north along the Homestead Drive ditches into the adjacent slough within Highway Park to the north and then onto the nearby city's utility maintenance yard
- northwest of the elementary school that ponds onto the road and the City's adjacent dog park.



Project Study Area.

1028 AURORA DRIVE
FAIRBANKS, AK 99709
907.452.1414

The City desired an initial evaluation to assist in the planning process to understand these issues and to determine strategies to mitigate them so that they can pursue funding to construct the desired drainage improvements.

To provide a roadmap for planning changes to the City's drainage/culverts/etc to reduce the flooding we have developed this Concept Design - Technical Memo describing alternatives, recommendations, and cost estimates.

EXISTING CONDITIONS

We observed the site starting before spring breakup with a site visit with Cody, the director of Public Works, during the peak of breakup, several visits during the following two weeks as the flooding/ponding receded, and periodically through the early summer.

Based on our observations from our earlier site visits, we developed a survey plan to get ditch profile and culvert size and invert elevations along the key drainage pathways. This resulted in us getting survey information on all the major crossroad culverts and the majority of the driveway culverts in Ford Subdivision.

From our discussion with the City, we learned that the flooding issue had appeared to increase in response to the accelerated development of the northwest corner of Ford Subdivision (1st to 4th Avenue from Therron Street to Rosson Cross Way). It is anticipated the runoff/flooding will continue to get worse as the remainder of the subdivision is developed.

We observed that the spring runoff generally flowed north or west as needed to get to the low point in the northwest corner by the intersection of 1st Ave and Therron Street. There were varying levels of ponding and flooding throughout the study area.

To characterize the drainage problems, it seems analogous to "death by a thousand cuts". There isn't a solution at one location that will fix the problem but instead there are numerous interrelated issues that when solved together will result in a good drainage system.

The key items are shown on the attached Fig 1 – Existing Drainage Conditions. The numbers indicate their relative importance of the problem and the associated impact of the solution on reducing the flooding:

- 1-5 being what needs to be collectively solved to significantly improve the overall flooding/ponding issue at the North Pole Public Utilities Building, along Homestead Drive in Highway Park, and within Ford Subdivision.
- 6-12 being localized drainage issues
- 13 being partially to nearly fully blocked culverts that is nearly universal,
- 14 being roughly 40% of all the culverts whose inverts are significantly higher than the general flowline established by the ditch and/or culverts upstream and downstream.

PROPOSED SOLUTIONS

The proposed solutions to the problems are shown on Figure 2 along with the problem.

To address the overall flooding/ponding issue (problems 1-5), the proposed solutions were developed based on the following guidelines:

1. Utilize existing drainage pathways, or those with past use first
2. Improve retention of water and control of flow out of the detention basin at the corner of Homestead and 1st Ave.
3. Increase number of outlets from, and pathways within, the Ford Subdivision so that the overall flow north along Homestead is reduced and water is distributed amongst all three adjacent gravel pits/lakes and the old the historic slough in Highway Park. Increasing the number of pathways reduces the chance of flooding if one is blocked.
4. Acquire drainage easements where needed so that the drainage pathways are preserved, and the City has the right to maintain them.

With these in mind, the following summarizes the goal of each solution for problems 1-5 to mitigate the overall issue:

1. Resolution of the proposed solutions for problems 2-5 is the ultimate goal but each individual one is really important and can be pursued independently if one is stalled or will take longer.
2. Establishing a pathway from the historic slough in Highway Park to the old gravel pit west of Homestead along a path that has a ditch that is now blocked would give the whole Highway Park/Ford Subdivision drainage system a relief point. A drainage easement would be required.
3. Providing a berm around the detention basin northeast of the intersection of Homestead and 1st and installing an outlet culvert would increase the storage and reduce the current erosion from overflow without increasing the flooding upstream.
4. Installing an equalization culvert across Rosson Cross Way would allow water to flow either to the detention pond or to Rosson's gravel pit along the existing drainage path. This spring the water elevation was 9"-12" higher on the west side than the east side.
5. For part a, establishing a clear drainage path on the east side of Homestead Drive that would allow flow south from 1st Ave to NPHS Blvd would connect the two existing outlets from this block. The southwest outlet invert is only 0.4 feet above the north outlet invert to the detention basin. We recommend digging the ditch with a profile that would allow (under part b) lowering the culvert at Homestead/NPHS Blvd a foot and lowering the existing drainage to Kimberly Lake. The toe of the existing embankment is tight to the existing property lines so drainage easements are likely needed for all of this work along Homestead and certainly for the portion to Kimberly Lake. As part of this, we also recommend obtaining drainage easements to preserve the existing drainage swales/pathways from Therron Street to Homestead Drive at 2nd, 3rd, 4th, 5th, and 6th avenues.

The rationale for the solutions for problems 7-11 are self-explanatory.

For number 12, the ponding at the detention basin at the dog park, we couldn't come up with a solution short of a buried storm drain system. That didn't seem to warrant the additional maintenance it might require and significant cost, so we are recommending continuing with the status quo of a pump and hose.

Finally, we made general drainage recommendations with numbers 13 and 14 to restore the broader functionality of the culverts and ditches. The biggest item is clearing the ends and removing/fixing the damage culvert crowns and removing the sediment to restore the capacity of the culvert and reduce ponding along the ditch lines. Then, the adjustment of about 40% of the culverts that are too high down to create a "uniform" flowline and regrading the ditches as necessary should significantly reduce the ponding within the subdivision

COST ESTIMATE

The concept level budgetary costs are presented in Table 1.

Table 1. Engineers Concept Level Budgetary Estimate

Problem #	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	AMOUNT	MOB/SURVEY/SWPPP/TRAFFIC/MISC	CONTINGENCY	SUBTOTAL	ENGINEERING ALLOWANCE	EASEMENT ALLOWANCE	CONSTRUCTION PHASE	TOTAL
						30%	40%		15%		20%	
1												
2	CLEARING AND GRUBBING	0.17	ACRE	$ 5,000	$ 826	$ 248	$ 331	$ 37,672	$ 5,651	$ 10,000	$ 7,534	$ 60,857
	UNCLASSIFIED EXCAVATION	267	CY	$ 80	$ 21,333	$ 6,400	$ 8,533					
3	BORROW	267	T	$ 40	$ 10,667	$ 3,200	$ 4,267	$ 30,883	$ 4,633	$ -	$ 6,177	$ 41,693
	CSP 24 INCH	30	FT	$ 250	$ 7,500	$ 2,250	$ 3,000					
4	CSP 18 INCH	310	FT	$ 170	$ 52,700	$ 15,810	$ 21,080	$ 149,237	$ 22,386	$ -	$ 29,847	$ 201,470
	CLEARING AND GRUBBING	0.26	ACRE	$ 5,000	$ 1,309	$ 393	$ 523					
	UNCLASSIFIED EXCAVATION	422	CY	$ 80	$ 33,778	$ 10,133	$ 13,511					
5	CLEARING AND GRUBBING	0.33	ACRE	$ 5,000	$ 1,653	$ 496	$ 661	$ 41,891	$ 6,284	$ 36,000	$ 8,378	$ 92,553
	UNCLASSIFIED EXCAVATION	111	CY	$ 80	$ 8,889	$ 2,667	$ 3,556					
	ADJUST CULVERT-30 INCH	1	LS	$ 10,000	$ 10,000	$ 3,000	$ 4,000					
	AGGREGATE BASE COURSE, D-1	30	TON	$ 70	$ 2,100	$ 630	$ 840					
	HMA, TYPE II, CLASS B	10	TON	$ 200	$ 2,000	$ 600	$ 800					
6	CSP 12 INCH	30	LF	$ 200	$ 6,000	$ 1,800	$ 2,400	$ 10,200	$ 1,530		$ 2,040	$ 13,770
7	CLEARING AND GRUBBING	0.12	ACRE	$ 5,000	$ 620	$ 186	$ 248	$ 28,254	$ 4,238	$ 10,000	$ 5,651	$ 48,143
	UNCLASSIFIED EXCAVATION	200	CY	$ 80	$ 16,000	$ 4,800	$ 6,400					
8	CSP 18 INCH	100	FT	$ 170	$ 17,000	$ 5,100	$ 6,800	$ 40,989	$ 6,148	$ 5,000	$ 8,198	$ 60,335
	UNCLASSIFIED EXCAVATION	89	CY	$ 80	$ 7,111	$ 2,133	$ 2,844					
9	CLEARING AND GRUBBING	0.23	ACRE	$ 5,000	$ 1,171	$ 351	$ 468	$ 53,368	$ 8,005	$ 40,000	$ 10,674	$ 112,047
	UNCLASSIFIED EXCAVATION	378	CY	$ 80	$ 30,222	$ 9,067	$ 12,089					
10	CLEARING AND GRUBBING	0.07	ACRE	$ 5,000	$ 344	$ 103	$ 138	$ 15,697	$ 2,354	$ 5,000	$ 3,139	$ 26,190
	UNCLASSIFIED EXCAVATION	111	CY	$ 80	$ 8,889	$ 2,667	$ 3,556					
11	CLEARING AND GRUBBING	0.01	ACRE	$ 5,000	$ 69	$ 21	$ 28	$ 3,139	$ 471	$ -	$ 628	$ 4,238
	UNCLASSIFIED EXCAVATION	22	CY	$ 80	$ 1,778	$ 533	$ 711					
12	N/A					$ -	$ -					
13	CLEAN CULVERTS	139	EACH	$ 2,000	$278,000	$ 83,400	$ 111,200	$ 472,600	$ 70,890	$ -	$ 94,520	$ 638,010
14	ADJUST CULVERTS	2000	FT	$ 170	$340,000	$ 102,000	$ 136,000	$ 681,964	$ 102,295	$ -	$ 136,393	$ 920,652
	AGGREGATE BASE COURSE, D-1	593	TON	$ 70	$ 41,481	$ 12,444	$ 16,593					
	HMA, TYPE II, CLASS B	98	TON	$ 200	$ 19,674	$ 5,902	$ 7,870					
					TOTAL							$2,360,309

The combined cost to address problems 2-5 is approximately $400,000. The other items relate directly to the individual problems.

CONCLUSION

While we have laid out this plan in order of what we believe should be the priorities and encourage any aspect of items 2-5 to be pursued first, we recognize that any of the other items would also make significant improvements to the drainage and benefit the City and public.

We thank you for the opportunity to identify the problems, evaluate and recommend the solutions and priorities and look forward to the possibility of helping the City implement these recommendations.

Existing Drainage (Observed)
Parcels
Detention Pond
Project Boundary
Historic Slough
Key Drainage Problems

1 - No outlet from historic slough - threatens NP Public Utilities Building.

2 - Historic drainage on private property blocked.

3 - Overflow from detention basin flows north along Homestead Dr.

4 - No culvert across Rossen to allow flow to distribute east/west. Driveway culverts too high.

5 - No ditching. Drainage interrupted by access routes or original ground, primarily southern 1,500 feet of Homestead Dr.

6 - No culverts to drain area between bike path and road - overtops road in spring.

7 - Ditch overgrown. Humps reduce flow in spring.

8 - Outlet to outlet culvert from detention pond buried.

9 - Extremely shallow ditch ineffective in spring.

10 - No outlet for drainage - ponds onto the road.

11 - Ponding in spring on to road.

12 - Ponding in the spring can exceed limits of detention basin - ponds onto road.

General Drainage Problems - Apply to Entire Subdivision

13. Nearly all culverts partially plugged at inlet and outlet and have sediment in the barrel.
14. Approximately 40% of the culverts create highpoints in the flowline of the ditch relative to others.

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City of North Pole - Existing Drainage Conditions
June 2023

N

0 500 1,000
Feet

Figure 1

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Existing Drainage (Observed)
Parcels
Detention Pond
Project Boundary
Historic Slough
Key Drainage Problems
Recommendations

1 - Resolution of the proposed solutions for problems 2-5.

1 - No outlet from historic slough - threatens NP Public Utilities Building.

2 - Historic drainage on private property blocked.

2 - Pursue drainage easement from landowner for re-establishing drainage and maintenance.

3 - Overflow from detention basin flows north along Homestead Dr.

3 - Berm around the detention basin and add outlet culvert to control outlet flow without risk of erosion.

4 - Install culvert at Rossen and replace all culverts with 18" culverts and reditch at a depth 0-12" deeper all along the south side of 1st Ave.

4 - No culvert across Rossen to allow flow to distribute east/west. Driveway culverts too high.

5 - No ditching. Drainage interrupted by access routes or original ground, primarily southern 1,500 feet of Homestead Dr.

5 - a. Pursue drainage easements to clear trees, and remove humps to establish flowline for about northern 900 feet and clear trees and ditch for southern 1500 feet to allow future lowering of inlet of culvert on northeast side of Homestead/NPHS Blvd a foot.

b. Pursue drainage easement and reconstruct 500' of ditch so that the 30" culvert across Homestead can be lowered a foot and become the primary outlet for the area.

6 - Install 12" culvert under bike path to connect drainage to ditch in front of Library on the north side of NPHS Blvd.

6 - No culverts to drain area between bike path and road - overtops road in spring.

7 - Ditch overgrown. Humps reduce flow in spring.

7 - Clear trees and re-establish ditch for 900'.

8 - Construct culvert west to east side of NPHS driveway.

8 - Outlet to outlet culvert from detention pond buried.

9 - Extremely shallow ditch ineffective in spring.

9 - Pursue drainage easements to construct and maintain a ditch.

10 - No outlet for drainage - ponds onto the road.

10 - Pursue drainage easement for broad swale from 4th to pond.

11 - Ponding in spring on to road.

11 - Re-establish swale/clean 100' of Patriot Drive ditch.

12 - Continue to use portable pump and 400 feet of hose to pump this out in the spring.

12 - Ponding in the spring can exceed limits of detention basin - ponds onto road.

General Drainage Recommendations - Apply to Outlined Area

13. Starting with the culverts that cross the roads or run along Therron, Rosson, West 1st, east side of Homestead, or NPHS Blvd: clean all culvert inlet and outlets to the invert level for a distance of at least 2 feet immediately. Flush or vacuum all sediment out of the culverts

14. To be completed in the future: adjust all "high" culverts down to create a "uniform" flowline and regrade ditches as necessary.

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City of North Pole - Proposed Drainage Solutions
June 2023

N

0 500 1,000
Feet

Figure 2

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TECHNICAL MEMORANDUM

To: Danny Wallace
Director, City Services
City of North Pole
125 Snowman Lane
North Pole, AK 99705

From: Keith Hanneman
RESPEC
1028 Aurora Drive
Fairbanks, AK 99709

Date: December 1, 2023

Subject: City of North Pole – West of Old Richardson Highway Stormwater Drainage Study, Response to Department of Environmental Conservation's comments

RESPONSE TO DEPARTMENT OF ENVIRONMENTAL CONSERVATION'S COMMENTS

PROBLEM (1) NO OUTLET FROM HISTORIC SLOUGH – THREATENS NP PUBLIC UTILITIES BUILDING.

DEC'S RECOMMENDATIONS

- Since the gravel pond is completely artificial and isolated, there appears to be no problem with RESPEC's proposed solution to open slough and divert water into it for increased drainage.
- The slough currently has a robust native plant community and would recommend keeping this intact to help filter any potential contaminates.

RESPEC'S RESPONSE

If designed in the future, we will strive to maintain vegetation in the slough.

PROBLEM (2) HISTORIC DRAINAGE ON PRIVATE PROPERTY IS BLOCKED.

DEC'S RECOMMENDATIONS

- Inaccessible due to private property. DEC Suggestions.
- Cannot provide any green infrastructure recommendations given inaccessibility.

RESPEC'S RESPONSE

If designed in the future, we will construct ditching as a grass-lined ditch or bio-swale as most appropriate.

PROBLEM (3) OVERFLOW FROM DETENTION BASIN FLOWS NORTH ALONG HOMESTEAD DRIVE

DEC'S RECOMMENDATIONS

- Examine if doing some redesign of the current detention basin and/or increasing its capacity through soil amendments and/or sizing differently would increase holding capacity.
- Consider designing and installing a large capacity bioretention swale at the location which would provide treatment of stormwater and allow for infiltration. Benefits also include removing coarse to medium sediments and finer particulates and associated contaminants. Stormwater runoff flows into the swale and slowly percolates through the soil (which acts as a filter) and into the groundwater; some of the water is also taken up by the plants.
  - The swale would be sized appropriately to account for the runoff that it would be interacting with.
  - Design features of a bioretention swale include:
    - Infiltration, Subdrains, and Liners
    - Safe overflow/bypass
    - Native vegetation comprised of species of trees, shrubs, perennials, grasses, and sedges.

RESPEC'S RESPONSE

- As revised in our technical memorandum from August 16, 2023, we propose to increase the detention basin volume by 2.5X by extending the pond width to the edge of the parcel on the east and south sides and the public utility easement limits on the north and west sides. The pond rim elevation would be maintained at the current approximate ground surface elevation of 489.85 ft. The future basin would be graded at 4H:1V side slopes down to the estimated groundwater level (482 ft asl), and then at 2H:1V slopes into the groundwater until the basin reached a total depth of 20 feet (470 ft asl). The active volume of the enlarged basin considered for detention is the volume above the groundwater table, or 3.4 ac-ft. The depth of the basin should keep it from freezing all the way to the bottom of the basin so that in the spring the snow meltwater that enters a basin connected to the water table could infiltrate into the site soils which are very permeable.
- In addition, adding a culvert across Rossons Cross Way will reduce the area draining to the detention basin by about half, from 122.8 acres to 63.6 acres by effectively capturing the area noted "To East Gravel Pond". This will in turn reduce the daily average, daily maximum, and event total runoff volumes to the 1st Ave detention basin to 2.6 ac-ft, 6.9 ac-ft, and 30.7 ac-ft, respectively. The remaining flow, or 2.5 ac-ft, 6.4 ac-ft, and 28.7 for the daily average, daily maximum, and event total runoff, respectively, will be conveyed to the East Gravel Pond.

PROBLEM (5) NO DITCHING DRAINAGE INTERRUPTED BY ACCESS ROUTES OR ORIGINAL GROUND, PRIMARILY SOUTHERN 1,500 FEET OF HOMESTEAD DR.

DEC'S RECOMMENDATIONS

- Look at using bioretention instead of discharge to Kimberly Lake.
- If decide to move forward with stormwater discharge to the lake, work with DEC for any permits needed within the MS4.

RESPEC'S RESPONSE

- The culvert across Rossons Cross Way will be constructed first which will allow stormwater to drain freely to the "East Gravel Pond", reducing the flow to Kimberly Lake.
- We propose using bioswales or grassy ditches in the Kimberly Lake drainage areas to increase the stormwater infiltration and decrease the runoff into Kimberly Lake.
- In the spring, when the soil is frozen, overflow runoff will continue to discharge to Kimberly Lake but the overall discharge will be decreased.
- The overland flow that does reach Kimberly Lake will be either snowmelt or rainwater that will not mix with the groundwater and thus should be free from contamination. Therefore, we do not expect it will affect the contamination concentration in the lake.

PROBLEM (12) PONDING IN THE SPRING CAN EXCEED LIMITS OF DETENTION POND BASIN. PONDING ON ROAD.

DEC'S RECOMMENDATIONS

- DEC's recommendation would be to install a large bioretention swale (rain garden), which would provide treatment of stormwater to remove coarse to medium sediments, while the bioretention system would remove finer particulates and associated contaminants. Stormwater runoff flows into the swale and slowly percolates through the soil (which acts as a filter) and into the groundwater; some of the water is also taken up by the plants.
- The swale would be sized appropriately to account for the runoff that it would be interacting with.
- Design features of a bioretention swale include:
  - Infiltration, Subdrains, and Liners
  - Safe overflow/bypass
  - Native vegetation comprised of species of trees, shrubs, perennials, grasses, and sedges.
  - With the school in near proximity this location would be excellent as an educational opportunity/outdoor classroom experience.
- Pumping the ponding area directly into Thirty-mile Slough/Beaver Springs is not recommended without some type of pretreatment due to the likelihood of pathogen bacteria in that stormwater from the dog park.
- CONP could apply for future ACWA grant funding from DEC, which would cover design and construction of the green infrastructure.

RESPEC'S RESPONSE

- We recommend improving the infiltration in the retention basin by excavating to remove clogged soils. Reconstruction will include the addition of 18 inches of bioretention media to the pond bottom to create a natural filter that will resist future clogging and wetland plugs that will increase infiltration and encourage pollutant uptake. A riser pipe that is perforated and encased with gravel beneath the filter media will serve as a pumping location to both minimize soil and organics uptake to the pump, and to provide for initial pretreatment of the ponded water prior to discharge from the pond. The dimensions of the improved retention basin will be 35 feet by 50 feet with 4:1 side slopes.
- In the springtime, even with the improvements, the frozen soil will continue to cause the retention basin to overflow and require pumping. We propose to make use of the considerable City of North Pole right-of-way to the west of Snowman Lane to construct a bioswale, which will include the construction of a culvert under Kevin's Way. This 30 foot culvert will allow the city to better control ponding in the outdoor exercise yard and will allow the city to pump from the retention basin to

within the upstream end of the culvert. The 90-foot bioswale will have structures to encourage ponding and infiltration, such as check dams. This will provide an opportunity for sediment retention to encourage infiltration and treatment of the runoff by the bioswale before it reaches the slough. The bioswale will discharge to an existing lawn ditch for about 35 feet before flowing about 30 feet overland down the side of the slough to water.

COST ESTIMATE

The concept level budgetary costs for the recommended replacements of existing culverts with 8' multiplates at the four locations are presented in Table 1. A budget cost was not developed for the continued maintenance or potential lining of the two 5' culverts under the Richardson Highway as those are within the State of Alaska Department of Transportation right-of-way and not under the city's control.

Table 1. Engineers Concept Level Budgetary Estimate

ENGINEERS ESTIMATE - CONCEPT PHASE with DESIGN PHASE SUMMARY - 11/30/23												
CITY OF NORTH POLE STORMWATER DRAINAGE												
	LOCATION	MAJOR CONSTRUCTION ITEMS SUBTOTAL	MOB/SURVEY/SWPPP/TRAFFIC/MISC	CONTINGENCY	CONSTRUCTION SUBTOTAL	ENGINEERING ALLOWANCE	PERMITTING ALLOWANCE	EASEMENT ALLOWANCE	CITY ADMINISTRATION ALLOWANCE	CONSTRUCTION PHASE ALLOWANCE	TOTAL	ENGINEERING, PERMITTING, EASEMENT, CITY ADMIN FOR DESIGN PHASE
			30%	40%		20%	10%		10%	20%		
12	Dog Park Retention Basin and Bioswale	$ 62,000	$ 18,600	$ 32,240	$ 112,840	$ 22,568	$ 11,284	$ -	$ 11,284	$ 22,568	$ 180,544	$ 45,136

Image 1: Proposed culvert under Kevins Way/Snowman Lane curve and bioswale in the right-of-way to the west of Snowman Lane

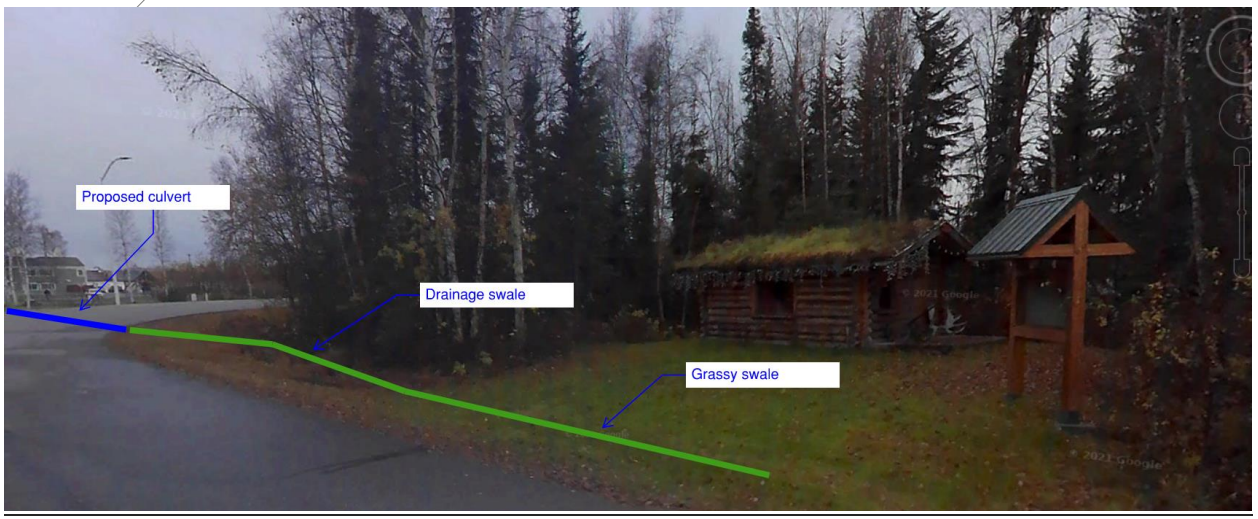

Image 2: Proposed culvert under Kevins Way/Snowman Lane curve and bioswale in the right-of-way to the west of Snowman Lane

TECHNICAL MEMORANDUM

To: Danny Wallace
Director, City Services
City of North Pole
125 Snowman Lane
North Pole, AK 99705

From: Keith Hanneman & Rachel Armstrong
RESPEC
1028 Aurora Drive
Fairbanks, AK 99709

Date: October 13, 2023

Subject: City of North Pole – City-Wide Drainage Integrity Overview

BACKGROUND

A city-wide drainage integrity overview was desired by the city. By reviewing the major drainages throughout the city looking for blockages, failed/failing structures, and other readily visible items of concern, RESPEC identified items that might disrupt the flow of stormwater and potentially create future problems. After consultation with the city, RESPEC understood that there were no known issues outside of the recently completed "West of Old Richardson Highway Study". So, it was decided to focus on the culverts under the 10 road crossings of Thirtymile slough since it provides the main drainage pathway through the city and receives flow from the ditches of adjacent neighborhoods.

EXISTING CONDITIONS

SITE OBSERVATIONS

The culverts shown in Figure 1 were visited and a summary of the observations is presented in Table 1 below. One item of note was the abundance of fish and waterfowl in the slough and traveling through the culverts.

Figure 1 – Location of 10 Thirtymile slough culverts

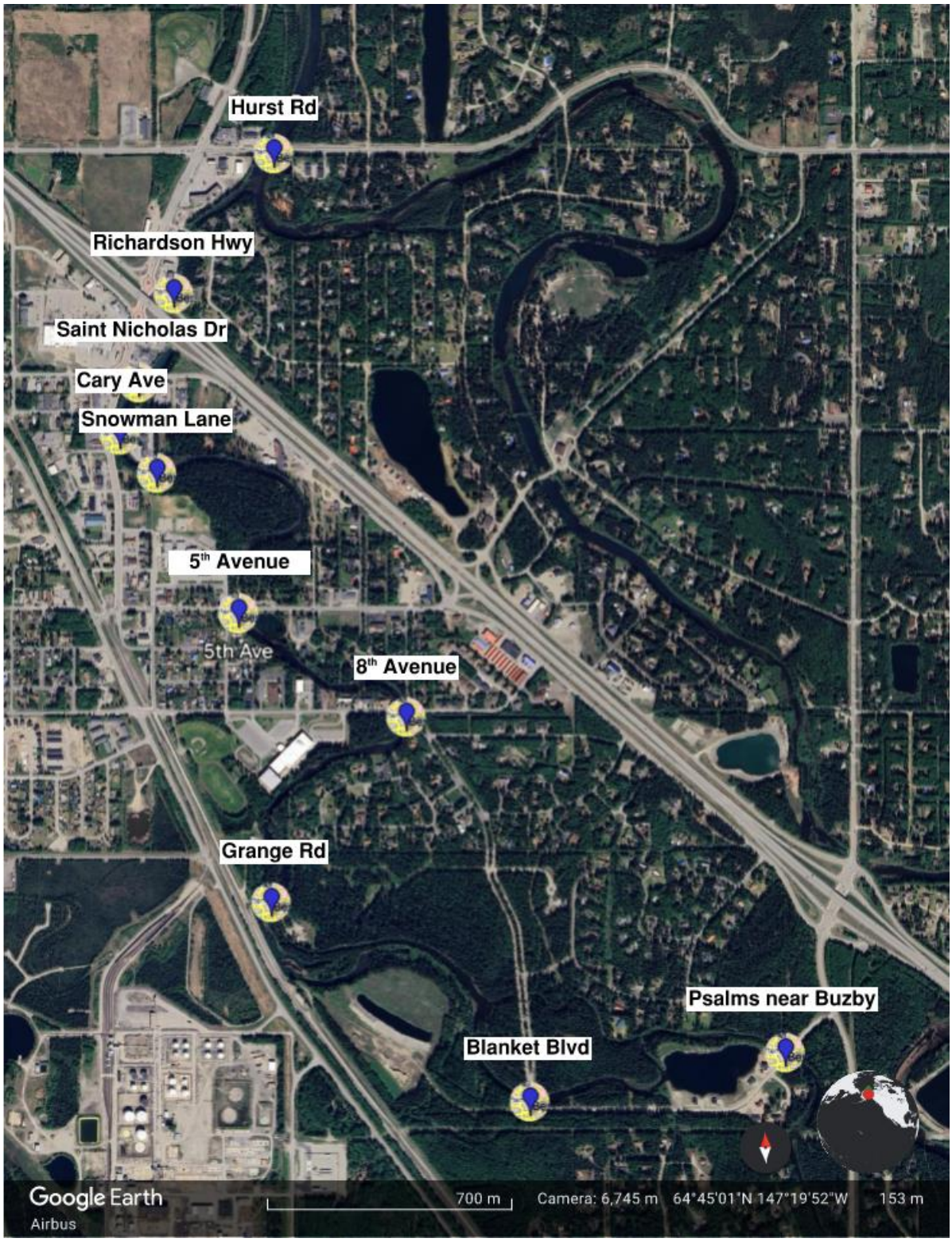

Table 1 – Field Observations

	Location	Diameter	Depth of flow	Notes
1	Psalms Blvd near Buzby Rd	Two 6' x 4' pipe arches w/ end sections	3'	Good condition – no deformation or settlement observed
2	Blanket Blvd near Psalms Blvd	7' & two 3'	3.5'	Good condition – slight vertical settlement and slight circular deformation
3	Grange Rd	8' multi-plate	3.7'	Good condition – slight vertical settlement and slight circular deformation
4	East 8th Avenue near Blanket Blvd	6'thin-wall multi-plate	1.5'	Replacement needed, culvert is deteriorating (rusting out and separated seams near inlet), and road is settling overtop on south side of 8th.
5	East 5th Avenue near Davis Blvd	6'	1.5'	Replacement needed; culvert is flattening on the upper quadrant on the east side which could lead to failure
5SD	East 5th Avenue storm drain near Davis Blvd			Clogged with sediment
6	Snowman Lane near City Hall	6'	3'	Good condition – slight vertical settlement and slight circular deformation
7	Cary Ave near North Santa Claus Lane	5'	2.5'	Culvert is undersized compared to upstream and downstream culverts, potential impact on fish passage under high flow conditions
8	Saint Nicholas Drive near North Santa Claus Lane	8' multi-plate		Great condition - no vertical settlement or circular deformation
8SD	North Santa Claus Lane and Saint Nicholas Drive storm drain			Storm drain outlet partially obstructed
9	Richardson Highway near North Santa Claus Lane	Two 5'	3.25'	Maintenance required, vertical settlement and beaver stick buildup/blockage. Maintenance is recommended to ensure these culverts maintain their integrity
9SD	McDonald's parking lot storm drain			Maintenance required to restore drainage to parking lot
10	Hurst Road near Badger Road	9'multi-plate		Great condition – no vertical settlement or circular deformation

CULVERT 1: PSALMS BLVD NEAR BUZBY RD

Culverts are in good condition with no deformation or settlement observed.

Picture 1 – Culvert inlet

Picture 2 – Culvert inlet

Picture 3 – Culvert outlet

Picture 4 – Culvert outlet

CULVERT 2: BLANKET BLVD NEAR PSALMS BLVD

Two 3' culverts and a 7' culvert are in good condition with a rust level to ⅓ the height of the 7' culvert

Picture 5 – Culvert outlets

Picture 6 – Interior of 7' culvert demonstrates culvert's integrity

CULVERT 3: GRANGE RD

This culvert is in good condition with little to no rust and only slight deformation.

Picture 7 – Culvert outlet

Picture 8 – Culvert interior shows minimal rust and deformation.

CULVERT 4: E 8TH AVE NEAR BLANKET BLVD

This culvert is deteriorating. As seen in the picture below, the culvert is rusted out near the inlet and the seams are separating at both ends of the culvert. 8th Avenue is settling over the south end of the culvert, where the culvert deterioration is the most severe.

Picture 9 – Road settlement occurring over culvert inlet

Picture 10 – Culvert seams separating at inlet

Picture 11 - Culvert rusted out and seams separating

Picture 12 - View from culvert outlet

Picture 13 – Seams separating at outlet

CULVERT 5: E 5TH AVE NEAR DAVIS BLVD

Replacement is needed for this culvert. Culvert is flattening on the upper quadrant on the east side which could lead to failure. Rust is present to ½ of its height.

Picture 14 - Scouring along the exterior of the culvert

Picture 15 – Flattening of culvert is evident in the middle section; rust is present to 1/3 of culvert height.

STORM DRAIN 5SD: E 5TH AVE NEAR DAVIS BLVD

This storm drain is on the south side of east 5th Avenue and is not connected to the adjacent culverts. However, it was noted that the storm drain is not currently functional because it is 90% full of sediment, consequently providing little to no drainage.

Picture 16 - Sorm drain is filled with sediment

CULVERT 6: SNOWMAN LANE NEAR CITY HALL

Culvert is in good condition with slight vertical settlement and slight circular deformation. Culvert is rusted to ⅔ the interior height and some scour is present at the inlet and outlet.

Picture 17 - Interior rust to ⅔ height of the culvert wall

Picture 18 - Scour evident at culvert inlet and outlet

CULVERT 7: CARY AVE NEAR NORTH SANTA CLAUS LANE

This culvert is undersized (5' diameter) compared to upstream and downstream culverts, which has a potential impact on fish passage under high flow conditions. The rust level is ⅔ to ¾ of the culvert's interior height indicating the water level is regularly nearer to capacity than other culverts. Mild scour and bank erosion are present.

Picture 19 - Rust visible on sidewall with fish swimming in culvert

Picture 20 - Culvert has maintained structural integrity

Picture 21 - Rust at culvert outlet

CULVERT 8: SAINT NICHOLAS DR NEAR NORTH SANTA CLAUS LN

Culvert is in great condition with a rust level of ¼ the culvert height and no indication of deflection. The high-water mark on this culvert is near the crown of the culvert and likely comes from when the downstream Richardson Highway culverts were plugged, causing the slough to back-up. This culvert is maintained by DOT but is included in this study because its functioning affects the city of North Pole's drainage system.

Picture 22 - Rock at the inlet and outlet prevent bank scour

Picture 23 - Culvert integrity is evidenced by a lack of deflection; high-water mark is visible near the crown of the culvert.

STORM DRAIN 8SD: NORTH SANTA CLAUS LN AND SAINT NICHOLAS DR INTERSECTION

This storm drain outlet is near the outlet of the Saint Nicholas Drive culvert. The outlet is partially obscured and could affect drainage during high flow conditions. The pipe appears in fair condition at the outlet.

Picture 24 - Storm drain outlet is partially obscured

Picture 25 - Interior pipe wall appears in fair condition at the outlet

CULVERT 9: RICHARDSON HIGHWAY NEAR NORTH SANTA CLAUS LANE

Maintenance is needed on these two approximately 400-foot-long culverts under the Richardson Highway near Santa Claus Lane. Continued cleaning is required to counteract vertical settlement and blockage due to beaver activity. Options for lining the culverts should be investigated to ensure the culverts maintain their integrity over the long-term.

The culverts are maintained by DOT but are included in this study because their functioning affects the city of North Pole's drainage system.

Picture 26 - The outlet of east culvert is in the background and outlet of west culvert is in the foreground. The east culvert has been cleared of debris and is fully functional. The west culvert is partially blocked by both debris and culvert settlement.

The east culvert was completely blocked by beaver debris and consequently submerged this past spring. DOT contracted with divers to completely clear the culvert and it is now fully operational, although it is experiencing minor settlement. The end of the culvert can be sighted with a sightline approximately 6" below the top of the culvert. Approximately 4 to 6 inches of sediment was measured in the culvert at the inlet and outlet.

Picture 27 - East culvert inlet, rust line shows that the culvert frequently ran full in the past (likely when plugged by beaver debris)

Picture 28 - East culvert outlet. Some settlement is evident.

The west culvert is operating at a limited capacity. The settlement in this culvert is significant. The end can be sighted at a sight line approximately 18" below the culvert top and according to DOT, a significant amount of beaver debris is present. Approximately 6 to 8 inches of sediment was measured in the culvert at the inlet and outlet.

Picture 29 & 30 - West culvert inlet shows debris and significant rust accumulation.

Picture 31 - West culvert outlet. Culvert settlement is occurring mid-culvert.

STORM DRAIN 9SD: BACK OF MCDONALD'S PARKING LOT

The outlet of the storm drain shows rust over ¾ of the pipe height and sediment adhered to the top of the pipe. Pipe settlement is suspected but was not visible from the outlet. The storm drain serves the McDonald's parking lot, which is a known trouble spot for stormwater ponding.

Picture 32 - Outlet of storm drain coming from McDonald's parking lot

Picture 33 – Rust present to more than ¾ of pipe height and mud adhered to the top of the pipe

Picture 34 – Some debris was observed inside the pipe

CULVERT 10: HURST ROAD NEAR BADGER ROAD

Culvert is well-sized with a 9' diameter and is in great condition. It has a rust height of only 1/3 of the pipe height and is not deforming or settling vertically. This culvert is maintained by DOT but is included in this study because its functioning affects the city of North Pole's drainage system.

Picture 35 - Hurst Road culvert inlet

Picture 36 - Culvert is not settling or deforming

EVALUATION

Our study found five culverts in good or great condition and five culverts that need maintenance or replacement. The storm drains near the Thirtymile slough were not part of the project scope, but three were noted during the field work as particularly in need of maintenance.

Replacement of the 6' diameter culvert at East 8th Avenue near Blanket Blvd is the top priority of this study. The culvert shows significant structural deficiencies. The culvert is rusting out near the water line and the seams are separating at the inlet and outlet. East 8th Avenue is also settling on the south side over top of the most severe culvert deterioration. Replacement is necessary to ensure drainage and roadway integrity. Replacing the culvert with a larger 8' diameter culvert will both match the upstream and downstream culvert sizes and likely be required to meet current fish passage requirements.

The 2nd priority is maintenance of the Richardson Highway culverts near North Santa Claus Lane because vertical settlement and the partial blockage of the west culvert affect both drainage and fish passage. Continued cleaning is necessary to prevent the culverts from becoming blocked again. Options for lining the culverts should be investigated to ensure the culverts' long-term integrity.

Replacement of the 6' diameter culvert at East 5th Avenue near Davis Road is the 3rd priority. This culvert is flattening which could lead to failure. Replacement of the culvert with a larger culvert to match the upstream and downstream 8' diameter culvert sizes will also likely be required to meet current fish passage requirements.

One important aspect of the Thirtymile slough is the wealth of wildlife habitat it provides for both fish and water birds. During the field work, an abundance of fish and birds were observed in and around the culverts. Replacement or maintenance of the following two culverts will ensure that fish passage and wildlife habitat is preserved.

The 4th priority is the replacement of the Cary Avenue culvert near North Santa Claus Lane to ensure fish passage in high flow conditions and meet current fish passage requirements. Currently, it is the only 5′ diameter culvert on the Thirtymile slough and shows signs that it often flows at near-capacity, which decreases the ability of fish to travel through the culvert.

The 5th priority, replacement of the 6′ Snowman Lane culvert near City Hall will be the final culvert in the slough to be resized to an 8′ or larger diameter to meet current fish passage requirements and to bring the culvert sizes along the slough into conformity with each other.

PROPOSED SOLUTIONS

CULVERT PROPOSED SOLUTIONS

Culvert Location	Diameter	Priority	Proposed Solution
East 8th Avenue near Blanket Blvd	6'thin-wall multi-plate	1	Replacement to facilitate drainage and protect road surface.
Richardson Highway near North Santa Claus Lane	Two 5'	2	Continued cleaning and investigating lining options recommended to ensure these culverts perform adequately in high flows, allow fish passage, and maintain long-term integrity considering vertical settlement occurring and beaver stick buildup/blockage. Options for lining the culverts should be investigated to ensure the culverts long-term integrity
East 5th Avenue near Davis Blvd	6'	3	Replacement because deformation is occurring, and culvert is undersized.
Cary Ave near North Santa Claus Lane	5'	4	Replacement, this culvert is the smallest of slough culverts and likely undersized for fish passage requirements.
Snowman Lane near City Hall	6'	5	Replacement, culvert is undersized in relation to upstream and downstream culverts and will likely need to be resized to meet fish passage requirements.

STORM DRAIN PROPOSED SOLUTIONS

Storm Drain Location	
East 5th Avenue storm drain near Davis Blvd	Remove sediment from storm drain to restore functionality
North Santa Claus Lane and Saint Nicholas Drive storm drain	Remove sediment and blockages from pipe to restore functionality
McDonald's parking lot storm drain	Remove blockage or restriction to restore functionality

COST ESTIMATE

The concept level budgetary costs for the recommended replacements of existing culverts with 8' multiplates at the four locations are presented in Table 1. A budget cost was not developed for the continued maintenance or potential lining of the two 5' culverts under the Richardson Highway as those are within the State of Alaska Department of Transportation right-of-way and not under the city's control.

Table 1. Engineers Concept Level Budgetary Estimate – Phase 1

ENGINEERS ESTIMATE - CONCEPT PHASE with DESIGN PHASE SUMMARY - 10/12/23												
CITY OF NORTH POLE STORMWATER DRAINAGE - CITY WIDE INTEGRITY STUDY												
	LOCATION	MAJOR CONSTRUCTION ITEMS SUBTOTAL	MOB/SURVEY/SWPPP/TRAFFIC/MISC	CONTINGENCY	CONSTRUCTION SUBTOTAL	ENGINEERING ALLOWANCE	PERMITTING ALLOWANCE	EASEMENT ALLOWANCE	CITY ADMINISTRATION ALLOWANCE	CONSTRUCTION PHASE ALLOWANCE	TOTAL	ENGINEERING, PERMITTING, EASEMENT, CITY ADMIN FOR DESIGN PHASE
			30%	40%		15%	5%		5%	20%		
1	8th Avenue near Blanket Blvd	$ 260,000	$ 78,000	$ 135,200	$ 473,200	$ 70,980	$ 23,660	$ -	$ 23,660	$ 94,640	$ 686,140	$ 118,300
2	5th Avenue	$ 350,000	$ 105,000	$ 182,000	$ 637,000	$ 95,550	$ 31,850	$ -	$ 31,850	$ 127,400	$ 923,650	$ 159,250
3	Snowman Lane	$ 260,000	$ 78,000	$ 135,200	$ 473,200	$ 70,980	$ 23,660	$ -	$ 23,660	$ 94,640	$ 686,140	$ 118,300
4	Cary Avenue	$ 320,000	$ 96,000	$ 166,400	$ 582,400	$ 87,360	$ 29,120	$ -	$ 29,120	$ 116,480	$ 844,480	$ 145,600
SUBTOTAL					$ 2,165,800	$ 324,870	$ 108,290	$ -	$ 108,290	$ 433,160		$ 541,450
		TOTAL									$ 3,140,410	

CONCLUSION

The Thirtymile slough is not only essential to the drainage of the city but also an important habitat for wildlife, especially fish and water birds. Consequently, the integrity of these 10 culverts has a significant impact for the city and for wildlife habitat.

Many of the culverts are well-sized, 8 to 9 feet in diameter and in good to great condition. However, five culverts need replacement or maintenance with various levels of urgency in each case. The reasons for work include structural deterioration, including vertical settlement, circular deformation, and rust damage, blockages, and being undersized which limits fish passage.

One culvert in particular, (East 8th Avenue near Blanket Boulevard) has significant structural damage and is recommended for timely replacement.

The second priority is maintenance on the Richardson Highway culverts near North Santa Claus Lane to improve and maintain their performance in peak flow conditions and to maintain fish passage. Options for lining the culverts to provide long-term integrity should be investigated. Since these culverts are within the State of Alaska Department of Transportation right-of-way and not under the city's control we recommend continued coordination by the City with the State to help keep these a priority and reliable to pass the peak flows.

The third priority culvert is at East 5th Avenue near Davis Road which should be replaced because of the circular deformation occurring and be resized for fish passage. The 4th (Cary Avenue near North Santa Claus Lane) and 5th (Snowman Lane near City Hall) priority culvert replacements are to increase the size of the culverts to meet fish passage requirements and to match the size of upstream and downstream culvert sizes.