City of West Chicago
Tabulation of Bids

2018 Parkway Tree Planting Program

Date: January 23, 2018 10:30 A.M.
Opened by: Tim Wilcox
Recorded by: Ashley Cunningham

	ITEMS	Units	Quantity	Approved Estimate of Cost		Acres Group 23940 W. Andrew Road Plainfield, IL 60585 5% Bid Bond		Americana Landscape Group P.O. Box 63 Elgin, IL 60121 5% Bid Bond		Brancato Landscaping, Inc. 2130 Oxford Road Des Plaines, IL 60018 5% Bid Bond	
				Unit Price	Total	Unit Price	Total	Unit Price	Total	Unit Price	Total
1	State Street Maple	Ea.	20	$325.00	$6,500.00	$255.00	$5,100.00	$298.00	$5,960.00	$325.00	$6,500.00
2	Crimson King Maple	Ea.	20	$325.00	$6,500.00	$255.00	$5,100.00	$284.00	$5,680.00	$325.00	$6,500.00
3	Hackberry	Ea.	10	$325.00	$3,250.00	$255.00	$2,550.00	$288.00	$2,880.00	$325.00	$3,250.00
4	Tulip	Ea.	10	$325.00	$3,250.00	$252.00	$2,520.00	$282.00	$2,820.00	$325.00	$3,250.00
5	Skyline Honey Locust	Ea.	10	$325.00	$3,250.00	$252.00	$2,520.00	$289.00	$2,890.00	$325.00	$3,250.00
6	English Oak	Ea.	10	$325.00	$3,250.00	$275.00	$2,750.00	$312.00	$3,120.00	$325.00	$3,250.00
7	Coffee, Stately Manor	Ea.	10	$325.00	$3,250.00	$270.00	$2,700.00	$282.00	$2,820.00	$325.00	$3,250.00
8	Shantung Maple	Ea.	10	$325.00	$3,250.00	$275.00	$2,750.00	$298.00	$2,980.00	$325.00	$3,250.00
9	Ivory Silk Lilac	Ea.	10	$350.00	$3,500.00	$270.00	$2,700.00	$288.00	$2,880.00	$325.00	$3,250.00
		Total	As read				$28,690.00		$32,030.00		$35,750.00
		Bid	As corrected		$36,000.00		$28,690.00		$32,030.00		$35,750.00

DEPARTMENT OF

PUBLIC WORKS

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STREET DIVISION	293-2250
WASTEWATER DIVISION	293-2261
ENGINEERING DIVISION	293-2255

MEMORANDUM

TO: Michael L. Guttman, City Administrator

FROM: Robert E. Flatter, P.E., Director of Public Works

DATE: January 15, 2018

RE: 2018 Brush Collection Program

On Thursday, January 4, 2018, under "Unfinished Business", the Infrastructure Committee continued its discussion about the 2018 Brush Collection Program. At said meeting, the Committee asked staff to compile a program bid history for review (see attached "Brush Collection Program – Fiscal Year Summary/Overview" for Fiscal Years 2003 thru 2017). This information will be shared with the Infrastructure Committee on Thursday, February 1, 2018.

Initial discussions occurred on December 7, 2017 with staff seeking direction from the Infrastructure Committee on how it would like to proceed with the 2018 Brush Collection Program: (1) should staff meet with Kramer Tree Specialist, Inc. (Kramer) and negotiate a new contract or prepare plans and specifications for a public bid in February/March 2018? , and (2) is the Committee interested in staff obtaining a multi-year contract or a single-year contract?

At the December 7th meeting, Committee indicated that it would be interested in a multi-year contract, and it would like staff to have discussions with Kramer regarding pricing before deciding whether to go to bid.

On January 4, 2018, staff shared the following information with Committee (see attached):

1. A list of annual brush collection revenues for 2014 thru 2017; and,

2. A copy of the Fiscal Year 2018 Public Works – Forestry budget document sheet which identified the Proposed 2018 Brush Pickup budget, and the Projected 2019 and 2020 Brush Pickup budget; and,

3. A copy of the 2015 Monthly Brush Collection Services bid tab.

4. Kramer Tree Specialist, Inc. proposed $87,500.00 for FY2018, $88,200.00 for FY2019, and $92,400.00 for FY2020.

Committee reviewed and discussed the above referenced information and then requested staff to assemble a larger bid history for its review.

On January 8, 2018 Kramer contacted staff and offered a willingness to alter its previous price proposal. This information will be shared with the Infrastructure Committee on Thursday, February 1, 2018.

In addition, on Monday, January 15, 2018, I spoke with Nick Willis of Trees "R" Us, Inc. of Wauconda, Illinois, about their ability to provide service and meet City expectations if the 2018 Brush Collection Program were bid. Mr. Willis indicated that Trees "R" Us is predominantly focused on brush collection; providing brush collection services for several municipalities including the Village of Glen Ellyn, the City of Naperville, and the Village of Hoffman Estates. Trees "R" Us also provides disaster relief, storm and hurricane assistance to FEMA. Like Kramer, Trees "R" Us uses multiple grapple trucks and trailers to collect and haul away brush. Trees "R" Us typically will collect anything placed in the parkway for collection, unless it becomes evident that a contractor is taking advantage of the program.

REF:ref
Att-

ANNUAL BRUSH COLLECTION REVENUES

Fiscal Year		Revenues
2017	Estimated	$76,600.00
2016	Actual	$77,576.00
2015	Actual	$79,808.00
2014	Actual	$75,375.00

PUBLIC WORKS
Forestry

01-09-22

Expense Item		Actual 2016	Budgeted 2017	Estimated 2017	Proposed 2018	Projected 2019	Projected 2020
CONTRACTUAL:							
4200 Legal Notices		-	100	-	100	100	100
4214 Brush Pickup		62,841	64,700	64,700	80,000	88,000	96,800
4225 Other Contractual Services		3,988	15,000	6,000	10,000	10,000	10,000
	Sub-Total	**$66,829**	**$79,800**	**$70,700**	**$90,100**	**$98,100**	**$106,900**
COMMODITIES:							
4604 Tools and Equipment		1,656	4,000	4,000	4,000	2,000	2,000
	Sub-Total	**$1,656**	**$4,000**	**$4,000**	**$4,000**	**$2,000**	**$2,000**
	Total	**$68,486**	**$83,800**	**$74,700**	**$94,100**	**$100,100**	**$108,900**

City of West Chicago

Tabulation of Bids

2015 Monthly Brush Collection Services

Date: February 26, 2015 @ 11:30 A.M.
Opened by: Tim Wilcox
Recorded by: Michelle Baldino

ITEMS		Units	Quantity	Kramer Tree Specialists 300 Charles Court West Chicago, IL 60185 5% Bid Bond Unit Price		Total	Trees "R" Us, Inc. P.O. Box 6014 Wauconda, IL 60084 5% Bid Bond Unit Price		Total	Arborworks LLC 1202N 75th Street Downers Grove, IL 60516 Cashier's Check 		Total
1	2015 Price Per Month	LS	7.0	$10,857.14		$75,999.98	$9,400.00		$65,800.00	$8,750.00		$61,250.00
2	2016 Price Per Month	LS	7.0	$11,071.43	1.97%	$77,500.01	$9,800.00	4.26%	$68,600.00	$8,975.00	2.57%	$62,825.00
3	2017 Price Per Month	LS	7.0	$11,285.72	1.94%	$79,000.04	$10,295.00	5.05%	$72,065.00	$9,235.00	2.90%	$64,645.00
Total As Read						$232,500.03			$206,465.00			$188,720.00
Total As Corrected						$232,500.03			$206,465.00			$188,720.00

BRUSH COLLECTION PROGRAM - FISCAL YEAR SUMMARY/OVERVIEW

Fiscal Year	# Bids Received	Kramer Tree Specialist, Inc.	Winkler's Tree Service, Inc.	American Ground Cover, LLC	Trees "R" Us, Inc.	Arborworks, LLC	Percentage Contract Change
2003	Contract Extension #1	$50,750.00					
2004	Contract Extension #2	$52,990.00					4.41%
2005	Contract Extension #3	$52,990.00					0.00%
2006	2	$50,700.00	$71,376.00				-4.32%
2007	Contract Extension #1	$59,150.00					16.67%
2008	3	$60,900.00	$80,472.00	$58,065.00			-1.83%
2009	Waiver of Bid - 3 Year Contract	$63,000.00					8.50%
2010	Year 2 of 3 Year Contract	$63,000.00					0.00%
2011	Year 3 of 3 Year Contract	$63,000.00					0.00%
2012	Waiver of Bid - 3 Year Contract	$63,000.00					0.00%
2013	Year 2 of 3 Year Contract	$66,325.00					5.28%
2014	Year 3 of 3 Year Contract	$69,650.00					5.01%
2015	3	$75,999.98			$65,800.00	$61,250.00	-12.06%
2016	Year 2 of 3 Year Contract	$77,500.01			$68,600.00	$62,825.00	2.57%
2017	Year 3 of 3 Year Contract	$79,000.04			$72,065.00	$64,645.00*	2.90%

* Kramer Tree Specialist, Inc. completed 2017 Brush Collection Program as a sub-contractor to Aborworks, LLC.

DEPARTMENT OF

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ENGINEERING DIVISION 293-2255

MEMORANDUM

TO: Michael L. Guttman, City Administrator

FROM: Robert E. Flatter, P.E., Director of Public Works

DATE: January 24, 2018

RE: Alternative Cost Analysis for Proposed Salt Storage Facility – 1300 W. Hawthorne Lane

In an effort to respond to cost concerns raised by members of the Infrastructure Committee, and to provide members with construction alternatives for consideration, City staff has worked directly with Advanced Storage Technology, Inc. (AST) to evaluate Hi-Arch Gambrel (Barn Style) salt storage facility options, sizes, and costs, and with Christopher B. Burke Engineering, Ltd. (CBBEL) to evaluate alternative site improvement concept plans and costs. Construction of a new salt storage facility has been previously discussed with the Infrastructure Committee on May 4, 2017, August 10, 2017, and September 7, 2017. This Memorandum provides additional information for consideration and discussion.

Salt Storage Facility/Building Alternatives

With the soil remediation efforts moving forward at 119 W. Washington, Public Works will be losing the temporary salt storage shed (approximate 1,500 ton capacity) and an equipment storage building (approximately 6,500 square feet). The equipment storage building is mainly used to store snow plows and salt spreaders in the summer months, and paving and mowing equipment during the winter months, along with pulverized topsoil, traffic control equipment, and miscellaneous items. Prior to the City acquiring the equipment storage building, equipment and material was stored at 135 W. Grandlake Boulevard (Street Division Garage). Due to limited space at the Street Division Garage, during the spring, summer and fall months, snow plow equipment (i.e., trucks, plows and salt spreaders) would be stored outside. During winter months paving equipment was stored outside to make room for snow plow equipment. Traffic control equipment now owned by the City (i.e., arrow boards and message boards) was purchased in 2009 and has always been stored at 119 W. Washington Street. If salt supply was

low during the summer months, pulverized topsoil would be stored inside the small salt dome at the Street Division. If there was no room in the shed for topsoil storage, crews would have to pick up topsoil when available and as needed as storing topsoil outside under tarps was attempted but did not work well.

The most critical issue is the salt storage, as the EPA will not allow salt to be permanently stored outside. Part IV.B.6.c of the City's Municipal Separate Storm Sewer Systems (MS4) Permit (NPDES Permit No. ILR400466), issued by the Illinois Environmental Protection Agency on February 10, 2016 and expires on February 28, 2021, states "Deicing material must be stored in a permanent or temporary storage structure or seasonal tarping must be utilized. If no permanent structures are owned or operated by the Permittee, new permanent deicing material storage structures shall be constructed within two years of the effective date of this permit." There is a small salt dome at the Street Division which only stores about 500 tons. Staff desires to construct a Hi-Arch Gambrel (barn style) salt storage facility/building (similar to the salt storage facility constructed at Winfield Township Highway Department at 30W575 W. Roosevelt Road). On average since 2000, the City uses approximately 2,600 tons of snow and ice melting (deicing) material per winter season (combination of rock salt and Thawrox), ranging from a minimum of approximately 1,400 tons during the 2000-2001 winter season and a maximum of approximately 6,200 tons during the 2013-2014 winter season. For 2007-2008 thru 2010-2011 the City used an average of approximately 3,400 tons of deicing material per winter season. 2011-2012 and 2012-2013 were light snow fall years in which only approximately 1,500 tons of deicing material was used per winter season. Please refer to the attached Snowfall Statistics spreadsheet for a 31-year winter season history.

Estimating salt usage needs for any winter season is difficult. Staff relies on historical averages with consideration given to how much surplus is on hand at the end of each winter season. Each year in early spring City staff must submit its desired rock salt procurement quantities for the next winter season's bid. Historically, staff uses the 2,600 ton average as a maximum annual rock salt purchase and 1,500 tons as a maximum annual Thawrox purchase, for a maximum annual total purchase of deicing material of 4,100 tons. Given the maximum purchase quantities referenced above, the City must purchase a minimum of 1,600 tons of rock salt and 1,200 tons of Thawrox annually, for a total minimum purchase of 2,800 tons of deicing material.

Winter snowfall forecasts are unpredictable, delivery of deicing material during the winter season can be just as unpredictable, and pricing annually fluctuates based on previous winter conditions, supply, and mining operations for rock salt. Therefore, to help ensure adequate supply of deicing material is always on-hand and to be prepared for the worst case situation (which the City experienced during the 2013-2014 winter season when demand was high and supply was unavailable, which then resulted in price gouging in 2014-2015), staff desires to construct a salt storage facility capable of storing approximately 6,000 tons of material. This would provide staff with the ability to store one year's maximum annual total purchase allotment of 4,100 tons, with the extra space being used initially to store a combination of other materials (i.e., sand, black dirt, etc.) as necessary. It is also important to have sufficient storage space in the event that new deicing material purchases are required following a mild winter that resulted in a surplus of deicing materials already in storage. Additionally, as the City continues to grow, the extra space will eventually be used to store additional deicing material.

The building foot print for 6,100 tons of deicing material is approximately 80' x 104'. The minimum size salt storage facility recommended by staff would be one that could store 4,100

tons; 2,900 tons would be the absolute minimum. Staff also desires to have a building with a concrete wall foundation, two overhead door entranceways (one on each side of building) to access the material(s), and enclosed truck/equipment storage bays on each side the building. Staff has been working with Advanced Storage Technology, Inc., to obtain budgetary numbers for various building configurations.

With several options and cost to be considered, the building cost could range between $320,000.00 (absolute minimum 2,900 ton building with wood wall foundation, one overhead entranceway door, and without enclosed truck storage bays) to $1,084,200 (6,200 ton building with concrete wall foundation, two overhead entranceway doors, and with twelve enclosed truck storage bays (six per side)). The attached spreadsheet provides costs and options associated with Hi-Arch Gambrel salt storage buildings capable of storing 2,900 tons to 6,200 tons of snow and ice melting material.

The Salt Institute – Salt Storage Handbook

The Salt Institute updated its Salt Storage Handbook "Practical Recommendations for Storing and Handling Deicing Salt" in 2015 (see attached). Salt storage guidelines and recommendations offered by The Salt Institute include:

- A one-year supply of salt should be properly stored to prevent shortages. Storage capacity for 100% of your average winter's needs can help eliminate the need for delivery during critical storm periods and will ensure that salt is available when needed.
- Never reduce last winter's figure simply because you hope next winter will be milder.
- Make realistic estimates based on average needs over the previous five or ten-year period.
- Understand the supply impact from the previous winter weather. Harsh, long winters deplete storage and affect salt demand for the following winter.
- Serious consideration should be given to the possibility of unreasonably cold temperatures, blizzard conditions, prolonged cold spells, and unusually large amounts of snow. All of these conditions, though unpredictable, will affect your use of salt and impact logistics factors.
- Be sure to take into account new mileage added to your road or street system.
- Take salt deliveries in the summer or fall. It ensures a ready supply. Salt cannot be transported up the Mississippi River, once the waterways are frozen and winter closes most Great Lake ports.

Site Improvement Alternatives

With the construction of a salt storage facility, certain site improvements must also be constructed (i.e., pavement to access the facility and load trucks, lighting, electricity, storm sewer and drainage systems, security fencing, etc.). 1300 W. Hawthorne Lane is the proposed location for a future Public Works campus, which would combine multiple Public Works facilities, equipment, personnel and operations into one location. To help determine the best location for a salt storage facility so it would not later hinder the construction of a Public Works facility, CBBEL was tasked with developing site improvement concept plans and costs estimates for the total site build-out as a Public Works campus. Once the best location for a salt storage

facility was determined, alternative site improvement concept plans and costs estimates were developed only for improvements related to and necessary to construct the salt storage facility.

Four total site build-out alternative concept plans were developed (see attached plans entitled ALT 1 thru ALT 4). Based on these concept plans, the best layout for a future Public Works campus would be ALT 1, which would locate the salt storage facility in the southern portion of the property.

Along with consideration of ALT 1, three additional alternative site improvement concept plans and cost estimates were developed for construction of a salt storage facility only (see ALT 1A thru ALT 1C). Costs estimated for site improvements associated with each concept plan are:

- ALT 1 = ~$1,336,492.00 (maximizes paving around salt storage with two ingress/egress access points; one new connection onto the driveway for 1400 W. Hawthorne Lane, and the other utilizing the existing driveway onto Hawthorne Lane which needs to be reconstructed).

- ALT lA = ~$1,150,805.00 (minimal paving around salt storage with two ingress/egress access points; one new connection onto the driveway for 1400 W. Hawthorne Lane, and the other utilizing the existing driveway onto Hawthorne Lane which needs to be reconstructed).

- ALT lB = ~$1,044,262.00 (minimal paving around salt storage with a single ingress/egress access utilizing the existing driveway onto Hawthorne Lane which needs to be reconstructed).

- ALT 1C = ~$727,943.00 (minimal paving around salt storage with a new single ingress/egress access connection onto the driveway for 1400 W. Hawthorne Lane).

Additional Engineering and Architectural Services

Total anticipated additional engineering and architectural services costs are approximately $261,000.00:

- Cost to obtain Architectural building design plans and specifications from AST is approximately $16,000.00.

- CBBEL's estimate for Phase II Design Engineering Services, permits, and bid documents is approximately $145,000.00.

- Phase III Construction Oversight Services (estimated at $100,000.00).

Automatic Fire Alarm Detection System and Sprinkler System Required

Per the City's current building code, construction of a new salt storage facility, regardless of size and with or without enclosed truck/equipment storage bays on each side the building, will require that installation of an automatic fire alarm detection system, automatic sprinkler system,

and extension of at least one fire hydrant near the proposed building. Construction costs are estimated at $100,000.00.

Summary of Pricing (Estimate)

As indicated above, staff desires to construct a salt storage facility capable of storing approximately 6,000 tons of deicing material. The minimum size salt storage facility recommended by staff would be one that could store 4,100 tons; 2,900 tons would be the absolute minimum. Staff also desires to have a building with a concrete wall foundation, two overhead door entranceways (one on each side of building) to access the material(s), and enclosed truck/equipment storage bays on each side the building. Alternative pricing for multiple options is detailed on the attached spreadsheet and summarized below for the three sizes referenced above:

6,100 ton Salt Storage Facility

80'x104' Building with Wood Wall Foundation =	~$ 432,000.00
Add Concrete Wall Foundation =	~$ 213,200.00
Add Overhead Entranceway Door =	~$ 25,000.00
Add Overhead Entranceway Door =	~$ 25,000.00
Add Lean-To Truck/Equipment Storage Bays (5 per building side) =	~$ 108,000.00
Add Lean-To Truck/Equipment Storage Bays (5 per building side) =	~$ 108,000.00
Add Overhead Doors on Truck/Equipment Storage Bays (5 per building side) =	~$ 47,500.00
Add Overhead Doors on Truck/Equipment Storage Bays (5 per building side) =	~$ 47,500.00
Total Estimated Building Construction Cost =	~$ 1,006,200.00
ALT 1C Site Improvement Construction Cost (used lowest cost option) =	~$ 727,943.00
Additional Engineering and Architectural Services Cost =	~$ 261,000.00
Automatic Fire Alarm Detection System & Automatic Sprinkler System =	~$ 100,000.00
Total Estimated Construction Cost =	~$ 2,095,143.00

4,100 ton Salt Storage Facility

60'x104' Building with Wood Wall Foundation =	~$ 355,000.00
Add Concrete Wall Foundation =	~$ 187,200.00
Add Overhead Entranceway Door =	~$ 25,000.00
Add Overhead Entranceway Door =	~$ 25,000.00
Add Lean-To Truck/Equipment Storage Bays (5 per building side) =	~$ 108,000.00
Add Lean-To Truck/Equipment Storage Bays (5 per building side) =	~$ 108,000.00
Add Overhead Doors on Truck/Equipment Storage Bays (5 per building side) =	~$ 47,500.00
Add Overhead Doors on Truck/Equipment Storage Bays (5 per building side) =	~$ 47,500.00
Total Estimated Building Construction Cost =	~$ 903,200.00
ALT 1C Site Improvement Construction Cost (used lowest cost option) =	~$ 727,943.00
Additional Engineering and Architectural Services Cost =	~$ 261,000.00
Automatic Fire Alarm Detection System & Automatic Sprinkler System =	~$ 100,000.00
Total Estimated Construction Cost =	~$ 1,992,143.00

2,900 ton Salt Storage Facility

60'x80' Building with Wood Wall Foundation =	~$	295,000.00
Add Concrete Wall Foundation =	~$	156,000.00
Add Overhead Entranceway Door =	~$	25,000.00
Add Overhead Entranceway Door =	~$	25,000.00
Add Lean-To Truck/Equipment Storage Bays (4 per building side) =	~$	86,400.00
Add Lean-To Truck/Equipment Storage Bays (4 per building side) =	~$	86,400.00
Add Overhead Doors on Truck/Equipment Storage Bays (4 per building side) =	~$	38,000.00
Add Overhead Doors on Truck/Equipment Storage Bays (4 per building side) =	~$	38,000.00
Total Estimated Building Construction Cost =	~$	749,800.00

ALT 1C Site Improvement Construction Cost (used lowest cost option) =	~$	727,943.00
Additional Engineering and Architectural Services Cost =	~$	261,000.00
Automatic Fire Alarm Detection System & Automatic Sprinkler System =	~$	100,000.00
Total Estimated Construction Cost =	~$	1,838,743.00

NOTE: Items shown in red above could be eliminated, constructed in phases, or added at a later date, but staff estimates that costs will increase by at least 30% due to additional work that would be necessary to alter an existing building or site and estimates an additional 3% annually for inflation.

Staff will seek direction from the Infrastructure Committee at the February 1, 2018, committee meeting.

SNOWFALL STATISTICS
WINTER SEASONS 1987 - 2017
As of 03/14/2017

YEAR	TOTAL "	# CALL - OUTS	2" OR LESS	3 - 4 "	5 - 6 "	7" OR MORE	LARGEST	Estimated Salt Usage Total Tons	Tons/Inch Snowfall	Tons/Call Out
1986-87	14.5	10	10	0	0	0	2"	620	42.76	62.00
1987-88	45.0	7	1	2	1	3	12"	600	13.33	85.71
1988-89	39.0	22	17	4	0	1	8"	760	19.49	34.55
1989-90	36.5	21	18	1	0	2	10"	1100	30.14	52.38
1990-91	43.0	30	25	4	0	1	8"	1400	32.56	46.67
1991-92	29.5	19	16	1	2	0	6"	916	31.05	48.21
1992-93	47.0	32	26	3	3	0	6"	1378	29.32	43.06
1993-94	49.0	31	27	2	0	2	10"	1347	27.49	43.45
1994-95	29.0	19	17	1	0	1	7"	849	29.28	44.68
1995-96	38.0	36	32	3	1	0	5"	1332	35.05	37.00
1996-97	52.5	33	26	4	3	0	6"	1701	32.40	51.55
1997-98	42.0	24	20	3	0	1	7"	1099	26.17	45.79
1998-99	55.5	21	15	3	1	2	21.5"	1440	25.95	68.57
1999-00	34.0	19	15	1	2	1	9"	1740	51.18	91.58
2000-01	44.0	32	27	2	2	1	12"	1955	44.43	61.09
2001-02	29.5	16	13	1	0	2	10"	1397	47.36	87.31
2002-03	33.5	31	29	1	1	0	6"	2160	64.48	69.68
2003-04	24.5	17	13	2	2	0	5.5"	1800	73.47	105.88
2004-05	41.0	15	12	1	0	2	16.5"	2200	53.66	146.67
2005-06	30.5	15	12	1	0	2	9"	2000	65.57	133.33
2006-07	39.5	16	11	0	1	4	11"	2400	60.76	150.00
2007-08	69.5	33	23	4	2	4	9"	3800	54.68	115.15
2008-09	63.5	25	14	6	4	1	11"	3400	53.54	136.00
2009-10	48.0	23	17	2	2	2	12"	3200	66.67	139.13
2010-11	55.1	25	19	4	0	2	20.6"	3200	58.08	128.00
2011-12	25.7	12	10	0	0	2	9"	1540	60.04	128.33
2012-13	30.5	18	15	1	1	1	9.1"	1500	49.18	83.33
2013-14	86.9	42	29	10	2	1	7"	6187	71.20	147.31
2014-15	44.6	23	19	2	1	1	19.26	3180.5	71.31	138.28
2015-16	28.7	24	20	2	1	1	6.5	2517	87.70	104.88
2016-17	27.1	15	10	4	1	0	6.5	2209	81.51	147.27
TOTALS*	1276.6	706	558	75	33	40		60927.5		

31 YEAR AVERAGES/PERCENTAGES

AVG. SNOWFALL / YEAR	41.18	
AVG. # CALL - OUTS / YEAR	22.77	
AVG. SNOWFALL / CALL - OUT	1.81	
LARGEST SNOWFALL	21.5"	(JAN. '99)
SECOND LARGEST SNOWFALL	20.6"	(FEB. 2011)

SNOWFALL DEPTH / CALL - OUT =

2" OR LESS -	79%
3 - 4" -	11%
5 - 6" -	5%
6" OR GREATER	6%

Average tons of salt used per year since year 2000: 2626.2

The Hi-Arch Gambrel™

The smart year-round solution for salt storage– and so much more

AST
ADVANCED STORAGE TECHNOLOGY, INC.

Undercover Operation

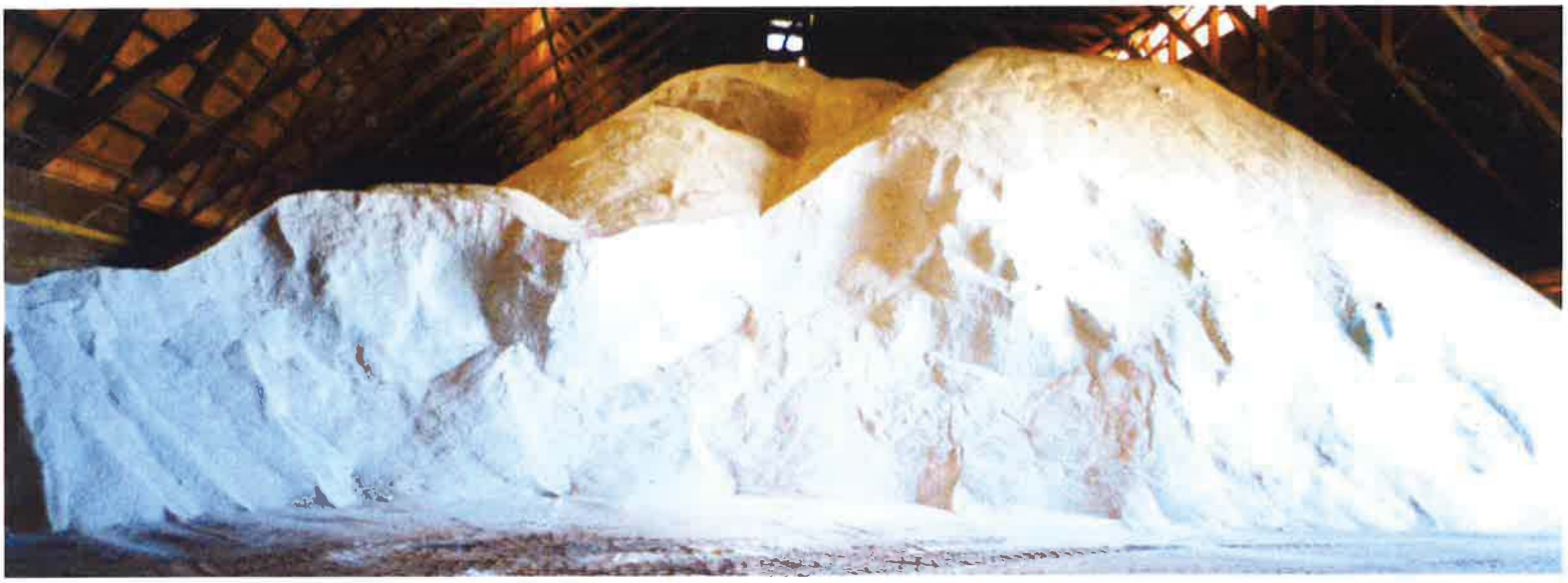
Since 1980, the Hi-Arch Gambrel™ has proven to be the smart solution for hundreds of municipalities, counties, and states across the U.S.

The Hi-Arch Gambrel features an interior clearance of 30' or more, extending the full length of the building. **As a result, tractor-trailers can dump salt directly under cover, and mixing and loading operations can be done inside too.** This not only protects the environment, but enables crews to work more safely and efficiently, saving both time and money.

Generous headroom maximizes the building's capacity. Ample lighting and ventilation also make it an ideal summer work area. A lean-to can be attached to add even more function and versatility to the structure.

Our building design has been analyzed and approved by numerous engineering departments, including many state Departments of Transportation. In fact, many of our clients are so satisfied with the Hi-Arch Gambrel's structural and fiscal performance that they have become repeat customers.

The Hi-Arch Gambrel gives you more for your money, because it's more than salt storage—it's a year-round, multi-purpose public works facility!



Each community and its storage needs are unique. The Hi-Arch Gambrel's versatile design can be tailored to store one or more piles of salt, mix or other materials, and to fit your site and budget requirements. A wide range of sizes can accommodate quantities from a few hundred tons to many thousands of tons.

After discussing your storage needs for salt and other materials, we can recommend sizes and layouts to meet your specific operational requirements.

Protects the Environment

Undercover operation improves efficiency and keeps you in compliance with environmental regulations. Inside dumping and operations:

- Eliminate outdoor salt piles
- Prevent weather exposure
- Prevent runoff and decrease pollution liability

Maximizes Your Capacity

The Hi-Arch Gambrel's 30-foot-plus vertical clearance and rectangular shape allow you to fill the structure to capacity without the need for costly conveyors. Twelve foot (12') high crib walls provide ample headroom, and front-end loaders can build the pile height toward the center of the building at the natural angle of repose of the material.

With the Hi-Arch Gambrel, you can store more material per square foot than other structures, so it takes up less space on your site—and that means lower site work and paving costs.

Inside Dumping

Strong & Many Features

High Strength—Low Maintenance

The Hi-Arch Gambrel stands up to real-life working conditions. The crib wall panels are internally reinforced to withstand operational impact from equipment, as well as to support the weight of stored material. Salt will not harm the wall structurally, and the exterior can be painted or left natural. And while the wood wall is more economical, a concrete wall can be substituted if that would best meet the needs of your particular facility.

Our permanent, durable roof system consists of asphalt shingles or metal panels supported by a plywood deck over sturdy wood trusses.

Aesthetics

Materials and finishes can be chosen to harmonize with surroundings and other buildings nearby. You can have a shingle or metal roof, decorative elements such as cupolas, dormer windows and shutters, standard or custom siding, and colors of your choice.

The Lean-To—a popular and versatile option

A lean-to can be located on any side or end wall. When unenclosed, it serves as a basic and inexpensive way to shelter valuable equipment and supplies. When fully or partially enclosed, it can be customized for weathertight secure storage, a maintenance area or workshop—even office space. The lean-to can be built at the same time as the main structure or added at a future date.

Options

Vents and Skylights

The Hi-Arch Gambrel has full-length ridge and eave vents that provide ample passive ventilation; mechanical fans are not needed. Translucent skylight panels extend the length of the roof on both sides to provide plentiful natural lighting during daylight hours.

Overhead Doors

For added security or protection from the weather, an electrically operated overhead door can be installed in the main entranceway, with a manual exit door nearby.

Side Entrance

A side entrance offers an ideal design for storing multiple products. The side entrance can be off-centered in order to accommodate piles of various size while still providing a covered area for mixing and loading. Multiple entrances can also be provided.

Concrete Wall

If you prefer, a concrete wall can be substituted for the reinforced wood panel system.

Multi-functional

Save Money

The Hi-Arch Gambrel:

- Prevents wasteful and costly runoff of salt
- Prevents double handling by your crews
- Prevents lumps and crusts which lead to clogged spreaders, downtime, and delays in serving your taxpayers
- Increases operational efficiency and reduces overtime and payroll costs
- Eliminates the need for conveyors which are expensive to purchase, operate, and maintain
- Prevents possible legal and environmental costs that result from salt runoff

The Hi-Arch Gambrel can help you save money on salt purchases, since many vendors give discounts for larger orders and early-season deliveries. This results in an even faster payback on your new building!

Improve Your Working Environment

- Delivery, mixing, and loading inside means your crews operate in dry, safe conditions regardless of the weather
- Salt and other materials stay dry and easy to work with
- Mixing can be done in advance, so your crews don't have to spend time mixing outdoors during a storm
- Inside operation reduces noise from loaders and other vehicles
- Both natural and artificial light sources facilitate operations and conserve energy
- Ridge and eave vents provide excellent passive ventilation and eliminate the need for fans

Small Building Design

For storage needs of less than 500 tons, we have developed a design for smaller structures. Please let us know if you would like further details on this option.

Economical & Efficient

Knowledgeable

We'll work with you

Our knowledgeable team can assist you throughout the planning process. We'll help analyze your needs and recommend the appropriate size and features for your operations– and your budget. We can work with your department and any other officials or consultants involved in your project.

To help you make the most informed decision, we can provide information including:

- Sizes, capacities, features, and budget prices
- How the Hi-Arch Gambrel compares to other types of storage structures
- Wall and foundation options
- Issues relating to salt storage sites
- Services we can provide
- Customer references

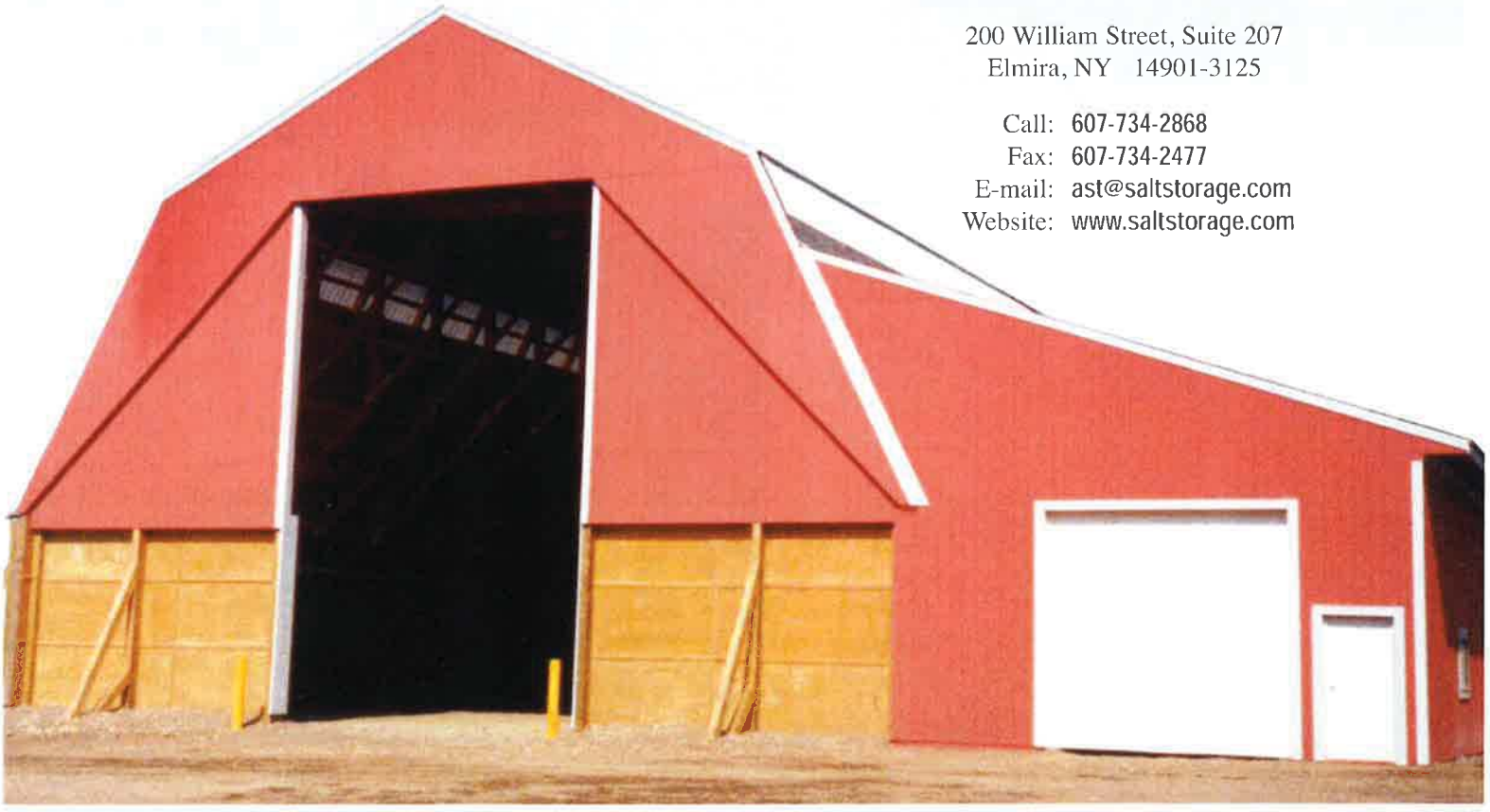
Let's get started!

Just tell us how you work, and we'll design a building that will work for you for years to come.

AST
ADVANCED STORAGE TECHNOLOGY, INC.

200 William Street, Suite 207
Elmira, NY 14901-3125

Call: 607-734-2868
Fax: 607-734-2477
E-mail: ast@saltstorage.com
Website: www.saltstorage.com



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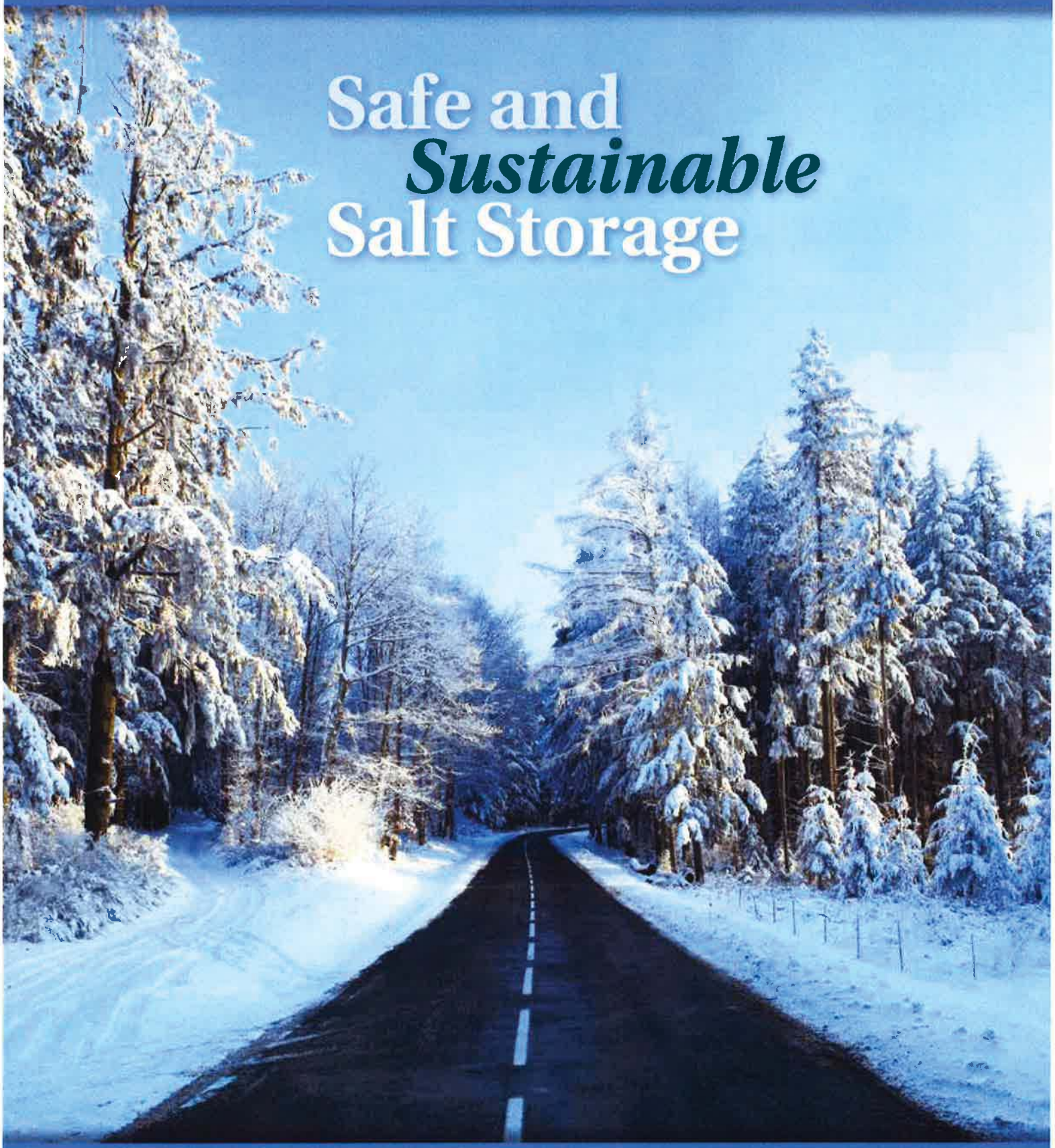
HI-ARCH GAMBREL SALT STORAGE FACILITY									ADDITIONAL STORAGE OPTIONS (LEAN-TO AND/OR ENCLOSED TRUCK BAYS)								
Storage Capacity (Tons)	Building Size	Building Size (Sq. Ft.)	Perimeter of Building (Lin. Ft.) Minus Entranceways (20 Lin. Ft. Each)	Approximate Cost of Hi-Arch Gambrel Salt Storage Building with Wood Wall Foundation	Approximate Cost Per Square Foot	ADD: Concrete Wall Foundation ($650.00/Lin. Ft.)	ADD: Overhead Entranceway Doors ($25,000.00 Each)	Approximate Total Construction Cost of Building with Concrete Wall Foundation and Overhead Entranceway Doors (Without Additional Storage Options)	Maximum Number of Truck Bays Per Side (20' wide x 40' long)	Approximate Cost To Construct Lean-To Truck Bays Per Side (20'Wx40'L Each @ $27.00/Sq. Ft.)	Approximate Cost to Include Overhead Doors on Truck Bays Per Side ($9,500.00 Each)	Approximate Cost to Construct Enclosed Truck Bays, with Overhead Doors, Per Side ($31,100.00 Each)	Number of Sides	Approximate Total Construction Cost for Enclosed Truck Bays on Both Sides of Building	**Approximate Total Construction Cost of Salt Storage Facility with Concrete Wall Foundation, Overhead Entranceway Doors, and Enclosed Truck Bays (Both Sides)**	**Approximate Total Construction Cost Per Square Foot of Building**	**Approximate Total Construction Cost Per Tons of Salt Storage**
2900	60'x80'	4800	240	$295,000.00	$61.46	$156,000.00	$50,000.00	$501,000.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$749,800.00**	**$156.21**	**$258.55**
3300	60'x88'	5280	256	$315,000.00	$59.66	$166,400.00	$50,000.00	$531,400.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$780,200.00**	**$147.77**	**$236.42**
3700	70'x80'	5600	260	$330,000.00	$58.93	$169,000.00	$50,000.00	$548,000.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$797,800.00**	**$142.46**	**$215.62**
3700	60'x96'	5760	272	$335,000.00	$58.16	$176,800.00	$50,000.00	$561,800.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$810,600.00**	**$140.73**	**$219.08**
4100	60'x104'	6240	288	$355,000.00	$56.89	$187,200.00	$50,000.00	$592,200.00	5	$108,000.00	$47,500.00	$155,500.00	2	$311,000.00	**$903,200.00**	**$144.74**	**$220.29**
4200	70'x88'	6160	276	$352,000.00	$57.14	$179,400.00	$50,000.00	$581,400.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$830,200.00**	**$134.77**	**$197.67**
4500	60'x112'	6720	304	$375,000.00	$55.80	$197,600.00	$50,000.00	$622,600.00	5	$108,000.00	$47,500.00	$155,500.00	2	$311,000.00	**$933,600.00**	**$138.93**	**$207.47**
4700	70'x96'	6720	292	$374,000.00	$55.65	$189,800.00	$50,000.00	$613,800.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$862,600.00**	**$128.36**	**$183.53**
4900	60'x120'	7200	320	$395,000.00	$54.86	$208,000.00	$50,000.00	$653,000.00	6	$129,600.00	$57,000.00	$186,600.00	2	$373,200.00	**$1,026,200.00**	**$142.53**	**$209.43**
4900	80'x88'	7040	296	$384,000.00	$54.55	$192,400.00	$50,000.00	$626,400.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$875,200.00**	**$124.32**	**$178.61**
5200	70'x104'	7384	308	$396,000.00	$53.63	$200,200.00	$50,000.00	$646,200.00	5	$108,000.00	$47,500.00	$155,500.00	2	$311,000.00	**$957,200.00**	**$129.63**	**$184.08**
5300	60'x128'	7680	336	$415,000.00	$54.04	$218,400.00	$50,000.00	$683,400.00	6	$129,600.00	$57,000.00	$186,600.00	2	$373,200.00	**$1,056,600.00**	**$137.58**	**$199.36**
5500	80'x96'	7680	312	$408,000.00	$53.13	$202,800.00	$50,000.00	$660,800.00	4	$86,400.00	$38,000.00	$124,400.00	2	$248,800.00	**$909,600.00**	**$118.44**	**$165.38**
5700	60'x136'	8160	352	$435,000.00	$53.31	$228,800.00	$50,000.00	$713,800.00	6	$129,600.00	$57,000.00	$186,600.00	2	$373,200.00	**$1,087,000.00**	**$133.21**	**$190.70**
5700	70'x112'	7840	324	$418,000.00	$53.32	$210,600.00	$50,000.00	$678,600.00	5	$108,000.00	$47,500.00	$155,500.00	2	$311,000.00	**$989,600.00**	**$126.22**	**$173.61**
6100	80'x104'	8320	328	$432,000.00	$51.92	$213,200.00	$50,000.00	$695,200.00	5	$108,000.00	$47,500.00	$155,500.00	2	$311,000.00	**$1,006,200.00**	**$120.94**	**$164.95**
6200	70'x120'	8400	340	$440,000.00	$52.38	$221,000.00	$50,000.00	$711,000.00	6	$129,600.00	$57,000.00	$186,600.00	2	$373,200.00	**$1,084,200.00**	**$129.07**	**$174.87**

SALT STORAGE HANDBOOK

Safe and *Sustainable* Salt Storage



SALTINSTITUTE.ORG


SALT

Salt Storage Handbook

Practical Recommendations for Storing and Handling Deicing Salt

*Dedicated to the people who provide safety and mobility on roads in winter — **the snowfighters***

PUBLISHED BY THE SALT INSTITUTE: The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition. See saltinstitute.org and safewinterroads.org for more information.

Contents

Foreword

Clear winter roads protect lives and commerce. Road salting and effective plowing can reduce injury crashes by up to 88%. And a one-day major snowstorm that shuts down roads can cost a state between $300 and $700 million in direct and indirect costs.

Salt is a strategic winter resource that has been used for decades as a major weapon in combating ice and snow. Today nearly all agencies responsible for winter maintenance in the United States and Canada use salt as one of the major tools to protect lives and commerce.

Salt is the ideal deicing material because:

- ✳ It is effective
- ✳ It is readily available
- ✳ It is inexpensive (Deicing pays for itself within 25 minutes after salt is spread)
- ✳ It is easy to store and handle
- ✳ It is easy to spread
- ✳ It is non-toxic
- ✳ It is environmentally friendly when used and stored properly

Most deicing salt users are making every effort to employ effective strategies to ensure protection of the environment through proper storage and application practices, something we call sensible or sustainable salting.

Good salt storage facilities, with adequate capacity, guarantee sufficient salt is available to maintain safety and mobility for motorists, emergency vehicles, and commercial vehicles. Because salt is so vital, proper storage must be provided to protect it from the elements and to protect the environment. It is recommended that a one-year supply of salt is properly stored to prevent shortages, which will affect safety and commerce.

This Sustainable Salt Storage Handbook is provided by the Salt Institute as a resource to the agencies that protect citizens every day. It is provided in conjunction with the Salt Institute's Safe and Sustainable Snowfighting Award program that recognizes agencies that demonstrate effective strategies in salt storage and snowfighting. ✳

Why Bulk Storage?

Why should a public works agency use proper bulk salt storage facilities?

There are three answers - economy, availability and convenience.

Bulk salt is the most economical deicing material available. Initial cost is low. Handling and storage are simple. Spreading is fast and easy.

Salt never loses its ice melting power no matter how long it is stored or how old it is. Each year thousands of tons of salt are stored and carried over to be used the next year. It is just as effective as though freshly mined or harvested. Neither is there any loss to moisture from the air if salt is stored properly. Salt does not absorb moisture until the humidity exceeds 75 percent. Moisture that is absorbed will later evaporate, but there may be a thin crusting on the surface of the stockpile that is easily broken up.

Salt, however, can be lost to precipitation. Stockpiles, whether large or small, should never be left exposed to the elements - rain or snow. Storage should always be done on impermeable pads, either in a building or covered with one of the many types of temporary covering materials, such as tarpaulin, polyethylene, polyurethane, polypropylene or Hypalon. These materials are also available with reinforcement for added strength. Proper storage inside a building or under cover will also prevent possible detrimental effects on the environment. When salt is stored outside, runoff must be properly controlled.

Why Store Salt Properly?

Properly stored salt will:

- Prevent formation of lumpy salt that is difficult to handle with loaders and to move through spreaders,
- Eliminate the possibility of contaminating streams, wells or groundwater with salt runoff,
- Eliminate the loss of salt by runoff and dissolving by precipitation.

Anticaking Additives. The best way to prevent or minimize caking is to store salt under cover. Most salt producers add anticaking agents. However, if left exposed to weather, anticaking agents can be washed from the outer layer of salt.

Crushers. Avoid the necessity to use crushers to get rid of lumps in salt by storing salt under cover where anticaking agents will not be washed out and crusting will be minimal. Crushers are not always readily available and they can be costly.

Adequate bulk storage assures enough salt to fight winter storms, without the problem of arranging emergency shipments throughout the winter months.

How Much is Needed?

Order enough. Ideally, there should be storage room for at least 100% of the estimated average winter's salt requirements.

It is wise to take early delivery of winter supplies and store the material until it is needed. Suppliers do their best to maintain deliveries and service salt users from strategically located stockpiles. However, replenishment of salt stockpiles becomes difficult during heavy demand periods, such as during back-to-back winter storms. It is always best to keep your sheds full to eliminate large backlogs of orders at stockpiles, speeding deliveries.

How Much Salt Will Be Needed This Winter?

Estimating future salt requirements is tough. Few public works officials ever hit the figure right on the nose. Here are a few guidelines for estimating future salt needs:

1. Never reduce last winter's figure simply because you hope next winter will be milder. Make realistic estimates based on average needs over the previous five or ten-year period.
2. Understand the supply impact from the previous winter weather. Harsh, long winters deplete storage and affect salt demand for the following winter.
3. Be sure to take into account new mileage added to your road or street system. Don't overlook new subdivision streets, Interstate or express highways and routes acquired from other political subdivisions.
4. Improve winter maintenance operations. Going to straight salt, including applying liquid brine or pre-wet solids, or adding more salt routes can substantially influence salt requirements while providing a higher level of service.

Serious consideration should be given to the possibility of unseasonably cold temperatures, blizzard conditions, prolonged cold spells and unusually large amounts of snow. All of these conditions, though unpredictable, will affect your use of salt.

Use the chart below to figure approximate salt needs for your area.

TABLE 1: SALT REQUIRED PER SEASON

SHORT TONS/METRIC TONS

Based on 4 applications per storm Per 2-lane Mi/Km

Two Lane Highway on Bare Pavement

Number of Storms	Mi / Km	100 / 161	200 / 322	300 / 483	400 / 644	500 / 804	600 / 965	700 / 1126
4		400	800	1200	1600	2000	2400	2800
		363	724	1089	1452	1814	2177	2540
6		600	1200	1800	2400	3000	3600	4200
		544	1089	1633	2177	2722	3266	3810
8		800	1600	2400	3200	4000	4800	5600
		726	1452	2177	2903	3629	4355	5080
10		1000	2000	3000	4000	5000	6000	7000
		907	1814	2722	3629	4536	5443	6350
12		1200	2400	3600	4800	6000	7200	8400
		1089	2177	3266	4355	5443	6532	7621
14		1400	2800	4200	5600	7000	8400	9800
		1270	2540	3810	5080	6350	7621	8346
16		1600	3200	4800	6400	8000	9600	11200
		1452	2903	4355	5806	7258	8709	9253
18		1800	3600	5400	7200	9000	10800	12600
		1633	3266	4899	6532	8165	9798	10524
20		2000	4000	6000	8000	10000	12000	14000
		1814	3629	5443	7258	9072	10886	12700

Order Salt Early

Plan your salt program early. Summer is best. Remember that your purchasing process can impose waiting periods between the time bid notices are advertised and a supplier is selected. Start your procurement process to allow sufficient time to take pre-season delivery.

Work with your salt supplier to take delivery in the summer or fall, taking advantage of logistics factors in your supplier's supply chain. Early delivery is generally better. It ensures a ready supply and allows your supplier to prepare a suitable stock point in your area. Salt cannot be transported up the Mississippi River, for example, once the waterways are frozen and winter closes most Great Lake ports.

Should in-season re-supply be required, re-order before on-hand inventories are depleted. Check inventory levels frequently and always before a forecasted storm. Agencies that plan ahead and have abundant storage capacity have an advantage.

Select the Right Site

The most critical step in providing good storage is selecting the storage site. S-A-L-T-E-D is the key word in picking the right spot.

Safety - Always make safety for workers and the general public a prime concern at a storage site. Equipment operators need good visibility in all directions. Access roads should not open directly into heavily traveled routes. Post signs to warn motorists that trucks enter and leave the area. Make sure the area is secure, preferably fenced, to prevent entrance by unauthorized persons. Children can be attracted by salt piles, which could be dangerous for them. It is also essential to secure the area in such a way as to provide safety for the surrounding environment.

If stored under tarps the tarps must be removed from loading and unloading area during activity to enable workers to see the pile and maneuver safely.

Make it safe!

Accessibility - Storage sites should permit easy access by trucks and other equipment entering and leaving these areas during storms, when visibility is low. Plan accordingly.

The storage area must be large enough for front-end loaders to maneuver freely, safely and expediently. If stored in a building, make sure the doors and openings are large enough to prevent interference with loading and unloading. Provide easy accessibility for delivery trucks, keeping in mind the prevailing wind and weather pattern.

Keep it accessible!

Legality - You must comply with local zoning requirements, as well as local, state and federal regulations governing environmental discharge concerns.

Keep it legal!

Tidiness - Make storage facilities blend with local surroundings when possible, especially in residential areas. They should be well kept, with no junk or scrap material piled around that would give an impression of sloppiness or waste and allow the possibility of getting foreign objects in spreaders.

"Live" fences offer an attractive alternative to chain link or wood.

Salt spilled during delivery or loading must be cleaned up and returned to the storage structure as soon as possible.

Be a good neighbor. Keep it tidy!

Economics - Locate and distribute storage facilities so that empty trucks don't have to "dead-head" long distances to reload. This reduces operating costs and speeds up spreading operations.

Permanent covered storage is a good method. Unprotected piles waste salt and could be harmful to the environment.

Keep it economical!

Drainage - Locate all storage structures to provide good drainage away from the stockpile. Pads should have a slope of 1/4 inch per foot away from the center. Pads, aprons and other adjacent work areas should be capable of supporting the stockpile and equipment.

Ensure that your storage area does not accidentally drain into a freshwater reservoir, well or groundwater supply. If needed, curbs can be installed around the storage area to direct drainage or run-off.

All drainage should be properly contained. The brine collected can be reapplied to the stockpile during dry seasons or applied to spreader loads prior to street applications.

Before disposing of brine, contact state and local environmental or natural resources agencies for proper procedures.

Control and/or collect all drainage!

How Much Space Will It Occupy?

There is a limit to how much salt you can store in a given area. From certain facts about salt's physical characteristics, we can determine in advance how much space a known amount will occupy.

When deicing salt falls freely into a pile, it forms a cone with sides that slope at an angle of 32 degrees, salt's natural angle of repose. Other types and gradations of salt have slightly different angles of repose but are within one or two degrees.

The density of deicing salt ranges from 72 pounds per cubic foot loose to 84 pounds compacted. When calculating storage space requirements, use the figure of 80 pounds per cubic foot (equivalent to 1281.4 kg/m^3).

When using 80 pounds per cubic food, a cubic yard of salt weighs 2,160 pounds. Thus, a tone of salt would require 25 cubic feet of storage space (equivalent to 21.06 m^3/metric ton of salt).

All calculations in this publication are based on a density for salt of 80 pounds per cubic foot.

Space requirements in Stockpiles. It is possible to calculate the area requirements of any cone-shaped salt stockpile, since the slope of the pile is known.

Table 2 lists characteristics of conical salt piles containing varying amounts of salt. For example, look at the column for 1,000 tons of salt and read across to the right. This much salt, stored in a cone –shaped pile, will occupy a space of 67'1" in diameter, or 3,540 square feet and the length of its slope from ground to peak 40 feet. Volume of the pile would be 25,000 cubic feet. It would have an exposed surface area of 4,180 feet (important if you want to cover the pile and needed to know how much polyethylene, canvas or other covering material to order).

It is also possible to calculate the dimensions required for salt stored in a windrow shape with conical ends. Table 3 shows how much salt may be stored per running foot in windrows of various heights. Width requirements are also shown. For example, 2.4 tons of salt may be stored per running foot of a windrow-shaped pile with a base 19'4" wide and a height of six feet.

TABLE 2: STORING SALT IN CONICAL PILES

Salt Short Tons metric tons	Diameter of Pile ft m	Length of Space Occupied by Pile ft2 m2	Height of Pile ft m	Slope from Ground to Peak ft M	Volume of Pile In ft3 m3	Exposed Surface Area ft2 m2
24	19.33	295	6.0	11	600	339
21.8	5.89	27.41	1.83	3.35	17.00	31.49
50	24.67	479	8.0	15	1,250	565
45.4	7.52	44.50	2,44	4.57	35.38	52.49
80	28.92	655	9.0	17	2,000	773
72.6	8.81	60.85	2.74	5.18	56.60	71.81
100	31.17	765	10.0	18	2,500	904
90.7	9.50	71.07	3.05	5.49	70.75	83.98
200	39.33	1,213	12.5	23	5,000	143.2
181.4	11.99	112.69	3,81	7.01	141.50	133.3
300	45.00	1,595	14.0	27	7,500	1,877
272.2	13.72	148.18	4.27	8.23	212.25	174.37
400	49.42	1,916	15.5	29	10,000	2,260
362.9	15.06	178.00	4.72	8.84	283.00	209.95
500	53.33	2,240	17.0	32	12,500	2,640
453.6	16.25	208.10	5.18	9.75	353.75	245.26
600	56.67	2,530	18.0	34	15,000	2,980
544.3	17.27	235.04	5.49	10.36	424.50	276.84
700	59.58	2,790	18.5	35	17,500	3,290
635.0	18.16	259.19	5.64	10.67	495.25	305.64
800	62.33	3,050	19.5	37.8	20,000	3,610
725.8	19.00	283.35	5.94	11.28	566.00	335.37
900	64.83	3,310	20.5	38	22,500	3,900
816.5	19.76	307.50	6.25	11.53	636.75	362.31
1,000	67.08	3,540	21.0	40	25,000	4,180
907.2	20.45	328.87	6.40	12.19	707.50	383.32
2,000	84.50	5,620	26.5	50	50,000	6,630
1,814.4	25.76	522.3	8.08	15.24	1,415.00	615.93
3,000	96.83	7,380	30.5	57	75,000	8,710
2,721.6	29.51	685.60	9.30	17.37	2,122.50	809.6
4,000	106.50	8,880	33.5	63	100,000	10,470
3,628.8	32.46	824.95	10.21	19.20	2,830.00	972.66
5,000	115.00	10,370	36.0	68	125,000	12,230
4,536.0	35. 06	963.37	10.97	20.73	3,537.50	1,136.17
6,000	122.00	11,700	38.5	72	150,000	13,810
5,443.2	37.19	1,086.93	11.73	21.95	4,245.00	1,282.95
7,000	128.33	12,960	40.5	76	175,000	15,290
6,350.4	39.11	1,203.98	12.34	23.16	4,952.5 0	1,420.44
8,000	134.17	14,130	42.0	779	200,000	16,680
7,257.6	40.90	1,312.68	12.80	24.05	5,660.00	1,549.57
9,000	139.83	15,400	44.0	83	225,000	18,170
8,164.8	42.62	1,430.66	13.41	25.30	6,367.50	1,687.99
10,000	144.67	16,410	45.5	85	250,000	19,370
9,072.0	44.10	1,524.49	13.87	25.91	7,075.00	17,911.47

TABLE 3: STORING SALT IN WINDROWED PILES

Salt in Each Running Foot/Meter of Windrow

short tons metric tons	Width ft m	Exposed Surface Height ft m	Volume ft3 m3	Area ft2 m2
2.4	19.3	6.0	59	23
2.18	5.89	1.83	1.67	2.14
3.8	24.7	8.0	96	29
3.45	7.52	2.44	2.72	2.69
5.2	28.9	9.0	131	34
4.72	8.81	2.74	3.71	3.16
6.3	31.1	10.0	158	37
5.72	9.50	3.05	4.47	3.44
9.7	39.3	12.5	243	46
8.80	11.99	3.81	6.88	4.27
12.7	45.0	14.0	318	53
11.52	13.72	4.27	9.00	4.92
15.3	49.4	15.5	383	58
13.88	15.06	4.72	10.84	5.39
17.9	53.3	17.0	447	63
16.24	16.25	5.18	12.65	5.85
20.2	56.67	18.0	505	67
18.33	17.27	5.49	14.30	6.22
22.3	59.58	18.5	557	70
20.23	18.16	5.64	15.76	6.50
24.4	62.3	19.5	610	74
22.14	19.00	5.94	17.26	6.87
26.3	64.83	20.5	657	77
23.86	19.76	6.25	18.60	7.15
28.3	67.1	21.0	708	79
25.67	20.45	6.40	20.04	7.34
44.8	84.5	26.5	1,120	100
40.64	25.76	8.08	31.70	9.29
58.8	96.83	30.5	1,470	114
53.34	29.51	9.30	41.60	10.59
771.2	106.50	33.5	1,780	126
64.59	32.46	10.21	50.37	11.71
83.2	115.00	36.0	2,080	136
75.48	35.05	10.97	58.86	12.63
93.6	122.0	38.5	2,340	144
84.91	37.19	11.73	66.22	13.38
103.6	128.33	40.5	2,590	151
93.99	39.11	12.34	73.30	14.03
113.2	134.2	42.0	2,830	158
102.70	40.91	12.80	80.09	14.68
122.8	139.8	44.0	3,070	165
111.40	42.62	13.41	86.89	15.33
131.6	144.67	45.5	3,290	171
119.39	44.10	13.67	93.11	15.89

Table 3 gives the capacity only for the windrow section of the pile. Figure the dimensions of the cone-shaped end sections from Table 2.

Space requirements in buildings. To figure how much space will be required to store salt in a bin or building divide the weight in pounds of salt to be stored by 80 to obtain the number of cubic feet required and deduct the amount of space lost due to the slope of the pile in the front of the building.

The amount of storage space that cannot be used due to salt's "angle of repose" will depend upon the height of the pile and the width of the building. Her are some typical calculations:

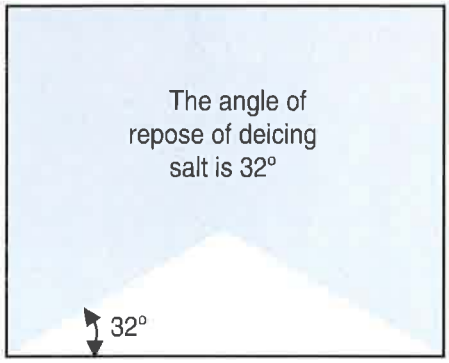
TABLE 4

Height of Pile ft m	Width of Bay ft m	Deduct This Amount short tons metric tons
8	12	24.4
2.44	3.66	22.14
10	12	38.2
3.05	3.66	34.66
12	12	54.9
3.66	3.66	49.81
15	12	85.8
4.57	3.66	77.84
20	12	152.6
6.10	3.66	138.44

H x H x W x 0.0318 = Lost Tonnage due to Angle of Repose

Thus, storage capacity of a building 30 ft wide and 40 ft deep, with salt piled ten ft high, would be 384 tons.

$$\frac{30 \times 40 \times 10 \times 80}{2000} - (10 \times 10 \times 30 \times 0.0318) = 384 \text{ Tons}$$



Put It On A Pad

Permanent, covered storage is recommended, particularly for small piles that are not actively managed. It is also acceptable to store salt in outdoor stockpiles on bituminous or concrete pads. This low-cost method provides maximum storage space and easy access. Whether stored inside or outside, salt always should be on a pad. If outdoor storage is used, it must be properly covered.

The pad site should be located away from wells, reservoirs and groundwater supplies, whenever possible. If pads are constructed of concrete, they must be high quality, air-entrained and treated with sealants, asphaltic-type coatings, or other treatments to keep salt out and prevent spalling. Total thickness of surface and base for asphalt pads will vary, depending upon the condition of the subgrade and weight to be supported. Any asphalt surfacing material used by highway departments is satisfactory.

Slope pads to let surface water drain away. Let local conditions control the direction of slope to avoid excessive grading. Minimum slope is one to two percent. For good drainage, install ditches, pipes and tile where necessary. In some cases, it may be necessary to install pipes, tiles or asphalt berms to channel water to a collection point, preferably a specially designed sump area.

Pads may later be framed on three sides to form a bin, or storage buildings may be erected over existing pads.

Put It Under Cover

Salt stored in bins or on pads outdoors may be covered with a variety of materials, including:

- Polyethylene
- Polypropylene
- Hypalon
- Polyurethane foam
- Water-resistant canvas
- Any other suitable waterproof cover (All of the above may be reinforced for added strength).

To join flexible coverings, lap and sew together with a two-inch standing seam, using a sewing machine suitable for such purpose. This gives a relatively waterproof and durable seam for most of these coverings. Taping of sewn seams improves waterproofing.

Industrial adhesive tapes may also be used to join coverings, but sewing is preferable.

Old tires (which are unacceptable in some places) or sand bags lashed together with rope or cable and placed uniformly over the flexible cover provide a suitable tie-down weighting method. Also available for tying covers are poly-cord nets. Be sure to weight down the base of the cover to keep wind from peeling covers off salt piles. Timbers or sand may be used.

A good method for covering smaller piles of deicing salt is the ground level storage shed or building. Storage structure size will vary with individual needs. There are as many types of storage buildings as there are ideas. Many agencies have developed their own particular style. Most buildings, of course, are let for bid, but there are also many that are built with spare or used materials and the agency's own labor.

Various pre-fabricated buildings are available. If building your own, storage buildings may be constructed of pressure treated timbers, assorted lumber, old bridge timbers and decking, concrete blocks, corrugated sheet metal or a variety of other materials on hand. Use treated posts and timbers in pole-type buildings. Make sure all hardware is galvanized. Tie corner posts of storage buildings together with underground galvanized cables with turnbuckles.

Concrete block buildings should be treated inside with a suitable sealant or coated with asphaltic material. In case of open ends, cover should be supplied for exposed salt.

A good, properly drained pad is just as important when salt is stored in a building as when stored on an open pad.

Doors on buildings must be high and wide enough to permit easy access by front-end loaders and delivery trucks. Door openings should be a minimum of 20 feet wide. Hinge doors to allow fastening in the "open" position so that high winds won't hinder operations. Buildings can be designed with doors at both ends.

Make sure any overhang in front of the building does not complicate truck unloading or loading.

Areas around the building must be well lighted. Inside of buildings, place lights to the side and high to keep from covering wiring or light fixtures with salt when the building is full to avoid corrosion damage.

Painting the inside of the storage facility with light-colored or white paint will enhance light reflectance, provide maximum visibility and may be a very worthwhile expense.

Build it strong

Wind and snow are enemies of storage buildings. For adequate building design, figure on a snow loading of 25 pounds or more per square foot of roof and winds of 80 miles per hour.

Think how often you have seen snow piled two to four feet deep on roofs, and windstorms with gusts of at least 80 mph. And remember that wind blowing through open sides or wide doors can cause pressure buildup inside the building, adding to stresses.

Provide building bracing and roof and wall anchorage to withstand internal wind pressure.

The following design considerations should be taken into account to allow for effects of wind and snow:

1. Location and Arrangement - Trees and other barriers may help shield a building against strong winds and snow, but putting a building too near a tree line may cause snow to accumulate around the building.
2. Foundation and Anchorage - Buildings tend to move with the wind; strong winds can lift a roof or collapse a wall. Buildings must be anchored securely to resist these pushing and lifting forces. Common mistakes are failing to anchor sills securely to foundations and using poles that are too small, too far apart or not embedded deeply enough.

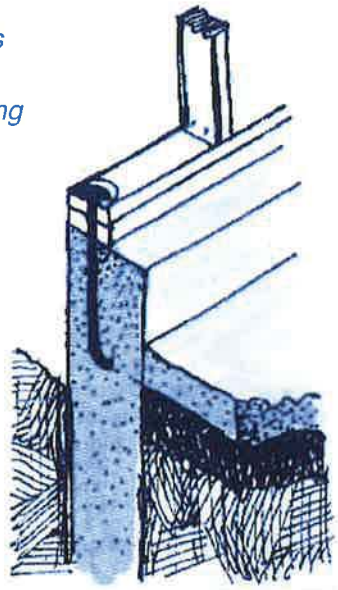
A good idea is to embed sound, pressure-treated poles four feet or more into undisturbed soil or set in concrete. Use closer pole spacings, heavier poles and deeper embedment for very high pole buildings.

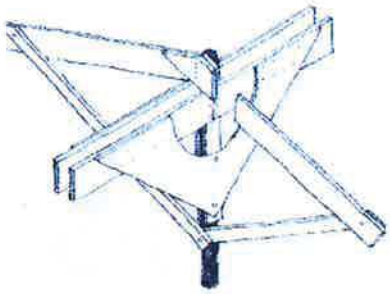
3. Construction practices - Poor construction causes many building failures. Knee bracing may be skimpy, building crossties poorly located, joints poorly fastened or framing members too small.

Whole roof and wall sections may blow off as a unit because a building literally comes apart at the seams. Common failures occur when rafters give way at plate lines, building corners become detached, or purlin and nailing girts are pulled loose from their supports. Framing members may not support their full load because of splice failure, because too few or too small nails were used, or because toe-nailing was used instead of a joint connector device.

To anchor sills, use 1/2-inch anchor bolts 16 inches long. 12-inches deep in 6- or 8-inch poured concrete foundation. Space not over 5 feet. Use 1 3/4-inch round washers; two 2 x 4- or two 2 x 6-inch members for sill.

Allow adequate tie-down for fastening rafters to purlins. This is typical bracing. Rafters and purlin sizes will vary with building sizes and pole spacing during construction.





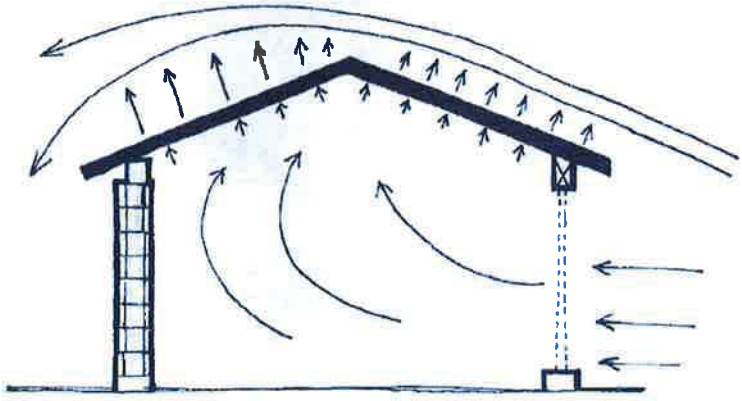


Diagram shows effect of wind blowing into open doors of a salt storage building.

Exterior bracing or earthen support may be required to prevent loaders from pushing the walls out. The salt alone creates some pressure on the walls, but the loader adds to the pressure when forcing its way into the pile. Another way to lessen pressure on outside walls is to build an interior bulkhead.

From the floor up, the pressure wall framing should be covered with 2" x 12" boards, which protect the supports from damage by loader buckets. Outside shed walls should be tongue-and-groove car siding. The roof should be of half-inch plywood topped with 90 pound roll roofing mineral surface.

Vehicle exhaust fumes can become noxious or hazardous if the storage facility is not properly ventilated. Sufficient ventilation must be provided to permit operation of a front-end loader and possibly a spreader truck in the case of large under-roof storage facilities. Forced ventilation should be installed in any building with a door opening smaller than the total width of the structure.

Receiving Salt

Shape the pile properly. For covered outside storage on a pad, the stockpile should be windrowed with well-sloped sides so all water will drain off and away from the pile. Ease of re-covering during the course of the winter should be considered in determining the height and overall size of the pile.

For in-building storage facilities, the most common method of filling is by dumping the salt directly in front of the building and pushing it inside with front-end loaders. Conveyors are sometimes used. Slingers, short conveyor belts, capable of throwing the salt some distance are used by some trucking firms. Use of either of these types of equipment requires sufficient volume in order to justify the cost of use. Where conveyors are installed in buildings, support structures and loadings should be carefully evaluated to avoid structural overloading and possible damage or failure. Taller structures (17 plus ft.) are now being built that will allow trucks to empty their load inside the building.

Delivery Tips

No matter how you store salt, it will likely be delivered to the site by truck. There are several ways to speed delivery.

Allow enough room for maneuvering. The average length of large trailer trucks that deliver deicing salt is 48 feet. Some are 55 feet long.

Room for turning and backing should be at least twice the length of the longest delivery truck entering the site.

When dumping, trailer beds may rise 30 feet above ground level. Allow for this when planning the front of storage buildings and when locating power lines and lights.

Provide enough support for heavy equipment. Large trailer trucks weigh up to 80,000 pounds when fully loaded. Total thickness of the pads and base in storage areas served by large loaders and trucks will vary, depending upon the condition of the subgrade.

Help truckers find the spot. A hard-to-find storage site may slow salt delivery. Place signs indicating locations of salt storage points and furnish maps and directions to truckers.

Don't keep truckers waiting. If a storage facility is properly designed, a truckload of bulk salt can be unloaded in three or four minutes. But truckers often stand idle waiting for someone to authorize delivery. These delays can be costly.

Generally, shipments cannot be unloaded unless a delivery ticket is signed. Make sure someone is available to accept and authorize deliveries.

Post names and telephone numbers of persons responsible for receipt of deliveries at storage areas.

Watch what you get. Salt is tested by suppliers for shipping weight. It is supplied in accordance with ASTM specification D-632, which is shown on pages 15-16.
If additional tests are necessary, try to make them quickly, using standardized equipment and procedures.

All trucks should be tarped with a secure cover during transit to prevent sifting, loss of salt and to keep salt dry.

The same trucks that deliver salt may haul other materials. Such foreign objects may damage spreaders and could occasionally get into salt.

Play it safe. Maintenance personnel should stay clear of the rear of trucks at all times. Night deliveries require special precautions. Clearly mark entrances to the storage site. Make sure yards and inside of storage facilities are adequately lighted. Place lights and wiring out of reach of raised truck beds and loaders.

Work Safely

Not only is Safety the #1 listed concern in our S-A-L-T-E-D summary, worker safety merits additional suggestions to support a safe work environment.

Communicate

Open and forthright channels of communication need to be established and maintained between employees and supervisors, and between employees. Employees must be encouraged to take responsibility for their own safety and participate in all efforts to improve the overall safety of the facility. Employees must be able to report to management any unsafe or questionable environmental condition without fear of reprisal, and must be encouraged to make recommendations to correct and improve those concerns. Employees must be provided with opportunities to attend safety meetings and task training to improve their knowledge, and encouraged to participate in the facility's safety program. Management must act as a role model by adhering to all environmental, safety, and health rules and all regulatory requirements governing the site.

General Safety

Salt storage facility employees need to adhere to general industrial safety rules. These include:

- Inspect mobile equipment for hazards and determine safe operating condition before use.
- Do not operate equipment or perform new tasks until properly trained by a qualified person.
- Wear appropriate personal protective equipment to protect against the hazards that exist in the work area. Wear seat belts when operating mobile equipment.
- Always "lock, tag and test" any equipment before you attempt to repair or troubleshoot.
- Follow required work practices and permit systems for electrical repairs or confined space entry.
- Immediately report all unsafe acts or conditions to a supervisor or manager. Immediately report any work related incident, injury or illness to your supervisor.
- Practice good housekeeping by keeping assigned work areas clean and orderly.
- Do not smoke in and around lubricant storage sites or refueling vehicles.
- Salt Stockpile Safety applies whether stockpile is inside or outside a building
- Never approach the vertical face of a stockpile on foot or in a vehicle closer than the vertical dimension of the pile; it might collapse and cover you in an avalanche.
- Never park next to a stockpile or next to loaders or other equipment working a stockpile.
- Never position yourself between the face of a stockpile and an immovable object (such as a loader or other vehicle).
- When working on top of a stockpile, never approach the crest closer than 15 feet.
- Always ensure that you have proper footing when accessing the top of a stockpile, and always be alert for sinkholes or other openings in the surface of the pile.
- Tarped stockpiles must be partially and strategically uncovered during loading and unloading to enable workers to see the pile face and maneuver safely.

Belt Conveyor and Screw Conveyor Safety

- Employees must be especially careful when operating and working around conveyors - especially when in close proximity to head and tail pulley, idler pulleys, and take-up pulleys.
- Conveyors must be equipped with emergency stop devices or pull cords. These emergency stop devices and pull cords must be checked regularly to ensure they are in working order.

Electrical Safety

- Conveyors must never be operated unless all guards are in place and securely fastened. Screw conveyors must never be operated unless top covers are in place and secured.
- Employees must never walk on top of a screw conveyor. Employees must never step onto or ride an operating conveyor belt.
- Before making repairs to a conveyor, it must always be de-energized and then locked, tagged and tested to ensure that it will not start unexpectedly. Employees must never attempt to apply belt dressing, or to lubricate an operating conveyor, unless protected by guards and a remote system has been installed to facilitate these procedures.
- Only employees who are properly trained should be allowed to work on electrical equipment.
- Employees must be alert for electrical hazards and make an immediate report to their supervisor when electrical hazards are identified.
- Always treat de-energized electrical equipment and conductors as energized until lockout/tagout, grounding, and testing procedures are implemented to verify a zero energy state.
- Determine the reason for fuse and breaker trips before resetting circuits.

Summary

The proper storage of salt is extremely important. Protection of salt and the surrounding environment, and ease of handling salt, are necessary and can be ensured through proper storage of salt either under roof or by covering outside stockpiles.

Street and highway maintenance agencies should make a continuous effort to provide good salt storage. Good storage also must include proper maintenance of facilities and good housekeeping practices.

Storage capacity for 100% of your average winter's needs can help eliminate the need for delivery during critical storm periods and will ensure that salt is available when needed.

Good planning is essential to good storage and proper storage is a vital part of Sustainable Snowfighting.

English/Metric Conversion Chart

METRIC TO ENGLISH

Multiply When You Know	English by	to Find	Symbol
millimeters	0.0394	inches	in
centimeters	0.394	inches	in
meters	3.281	feet	ft
meters	1.0936	yards	yd
kilometers	0.6214	miles	mi
square centimeters	0.1550	square inches	in^2
square meters	10.7639	square feet	ft^2
square meters	1.1959	square yards	yd^2
hectare	2.4711	acres	
square kilometers	0.3861	square miles	mi^2
cubic centimeters	0.0611	cubic inches	in^3
cubic meters	35.3147	cubic feet	ft^3
cubic meters	1.3078	cubic yards	yd^3
milliliters	0.0338	ounces (fluid)	oz
liters	2.1135	pints (fluid)	pt
liters	1.0567	quarts (fluid)	qt
liters	0.2641	gallons	gal
liters	1.8162	pints (dry)	pt
liters	0.9081	quarts (dry)	qt
cubic meters	28.3776	bushels	bu
grams	0.0352	avoirdupois ounces	avdp oz
kilograms	2.2046	avoirdupois pounds	avdp lb
metric tons (2204.6 lbs	1.1023	short tons (2000 lbs)	tn
metric tons	0.9842	long tons (2240 lbs)	t

(Celsius temperature x 1.8) + 32 = Fahrenheit temperature

ENGLISH TO METRIC

Multiply When You Know	Metric by	to Find	Symbol
inches	25.4	millimeters	mm
inches	2.54	centimeters	cm
feet	0.3048	meters	m
yards	0.9144	meters	m
miles	1.609	kilometers	km
fathoms	1.8	Meters	m
square inches	6.4516	square centimeters	cm^2
square feet	0.0929	square meters	m^2
square yards	0.8361	square meters	m^2
acres	0.4047	hectares	ha
square miles	2.5899	square kilometers	km^2
cubic inches	16.3871	cubic centimeters	cm^3
cubic feet	0.0283	cubic meters	m^3
cubic yards	00.7645	cubic meters	m^3
ounces (fluid)	29.5737	milliliters	mL
pints (fluid)	0.4732	liters	L
quarts (fluid)	0.9463	liters	L
gallons	3.7853	liters	L
pints (dry)	0.5506	liters	L
quarts (dry)	1.1012	liters	L
bushels	0.0352	cubic meters	m^3
bushels	35.2381	liters	L
avoirdupois ounces	28.3495	grams	g
avoirdupois pounds	0.4536	kilograms	kg
short tons (2000 lbs)	0.9072	metric tons (2204.6 lbs)	mt
long tons (2240 lbs)	1.0160 t	metric tons	mt

(Fahrenheit temperature -32) x 0.5555 = Celsius temperature

Appendix/Salt Specification

When ordering, specify sodium chloride as ASTM Designation: D632 or AASHTO M143. Do not specify year so the current specification will automatically be followed.

AASHTO Designation M143 complies with ASTM D-632.

STANDARD SPECIFICATION FOR SODIUM CHLORIDE: ASTM DESIGNATION D632

This Standard is issued under the fixed designation D632; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (e) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers sodium chloride intended for use as a deicer and for road construction or maintenance purposes.

1.2 The values stated as SI units are to be regarded as the standard.

1.3 The following precautionary caveat pertains only to the test method portion, Section 9 of this specification: This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:

C 136 Method for Sieve Analysis of Fine and Coarse Aggregates2

E 11 Specification for Wire-Cloth Sieves for Testing Purposes2

E 534 Methods for Chemical Analysis of Sodium Chloride3

3. Classification

3.1 This specification covers sodium chloride obtained from natural deposits (rock salt) or produced by man (evaporated, solar, other) and recognizes two types and two grades as follows:

3.1.1 Type 1 - Used primarily as a pavement deicer or in aggregate stabilization.

3.1.1.1 Grade 1- Standard gradation (Note 1).

3.1.1.2 Grade 2 - Special gradation (Note 1).

3.1.2 Type 11- Used in aggregate stabilization or for purposes other than deicing.

Note Grade 1 provides a particle grading for general application, and found by latest research to be most effective for ice control and skid resistance under most conditions. Grade 2 is the grading typical of salt produced in the western U.S. and available in states of the Rocky Mountains Region and west which may be preferred by purchasers in that area.

4. Sodium Chloride Requirements

4.1 The sodium chloride shall conform to the following requirement as to chemical composition:

Sodium Chloride (NaCl), min %, 95.0

5. Physical Requirements

5.1 Gradation:

5.1.1 Type 1- The gradation of Type 1 sodium chloride, when tested by means of laboratory sieves, shall conform to the following requirements for particle size distribution:

	Weight % Passing	
Sieve Size	Grade 1	Grade 2
19.0 mm (3/4 in.)	–	100
12.5 mm (1/2 in.)	100	–
9.5 mm (3/8 in.)	95 to 100	–
4.75 mm (No. 4)	20 to 90	20 to 100
2.36 mm (No. 8)	10 to 60	10 to 60
600 mm (No. 30)	0 to 15	0 to 15

5.1.2 Type 11-The gradation of Type II sodium chloride shall conform to the grading requirements imposed or permitted by the purchaser under conditions of the intended use.

6. Permissible Variations

6.1 In the case of sodium chloride sampled after delivery to the purchaser, tolerances from the foregoing specified values shall be allowed as follows:

6.1.1 Gradation-5.0 percentage points on each sieve size, except the 12.5 mm (1/2 in.) and 9.5 mm (3/8 in.) for grade 1 and 19.0 mm (3/4 in.) for grade 2.

6.1.2 Chemical Composition 0.5 percentage point.

7. Condition

7.1 The sodium chloride shall arrive at the purchaser's delivery point in a free-flowing and usable condition.

8. Sampling

8.1 Not less than three sample increments shall be selected at random from the lot (Note 2). Each increment shall be obtained by scraping aside the top layer of material to a depth of at least 25 mm (1 in.) and taking a 500-g (approximately 1-lb) quantity of sodium chloride to a depth of at least 150 mm (6 in.). Sampling shall be done by means of a sampling thief or other method which will assure a representative cross section of the material. The sample increments shall be thoroughly mixed to constitute a composite sample representative of the lot.

Note 2: A lot may be an amount agreed upon between purchaser and supplier at the time of purchase.

9. Test Methods

9.1 *Chemical Test*-Test for compliance with the requirements for chemical composition shall be in accordance with the following methods:

9.1.1 *Routine Control* -The "Rapid Method" provided in Annex A1 may be used for routine control and approval.

9.1.2 *Referee Testing*-In case of controversy, determine analysis in accordance with Methods E534.

9.2 Gradation shall be determined by Method C136.

10. Inspection

10.1 The purchaser or his representative shall be provided free entry and necessary facilities at the production plant or storage area if he elects to sample sodium chloride at the source.

11. Rejection and Rehearing

11.1 The sodium chloride shall be rejected if it fails to conform to any of the requirements of this specification.

11.2 In the case of failure to meet the require¬ments on the basis of an initial sample of a lot represented, two additional samples shall be taken from the lot and tested. If both additional samples meet the requirements, the lot shall be accepted.

12. Packaging and Marketing

12.1 The sodium chloride shall be delivered in bags or other container acceptable to the purchaser, or in bulk lots. The name of the producer and the net weight shall be legibly marked on each bag or container, or, in the case of bulk lots, on the shipping or delivery report.

13. Keywords

13.1 salt; snow and ice removal; sodium chloride; stabilization; winter maintenance.

[1] This specification is under the jurisdiction of ASTM Committee D-4 on Road and Paving Materials and is the direct responsibility of Subcommittee DO4.31 on Calcium, Sodium Chlorides and Other Deicers.

[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 11.01.

[4] *Annual Book of ASTM Standards*, Vol 14.02.

[5] *Annual Book of ASTM Standards*, Vol. 14.04.

[6] *Annual Book of ASTM Standards*, Vol. 15.05.

[7] *Reagent Chemicals*, American Chemical Society, Washington, DC. For suggestions on testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia* and the *National Formulary*, U.S. Pharmacopcial Convention, Inc., (USPC), Rockville, MD.

[8] Supporting data have been filed at ASTM Headquarters, Request RR: D04. 1016.

[9] These numbers represent respectively, the (ls %) and (d2s %) limits, as described in Practice C670.

ANNEX

(Mandatory Information)

A1 RAPID METHOD OF ANALYSIS FOR SODIUM CHLORIDE

A1.1 Scope

A1.1.1 This annex covers a rapid method for chemical analysis of sodium chloride.

A1.2 Significance and Use

A1.2.1 The procedure for chemical analysis in this annex determines the total amount of chlorides present in the sample and expresses that value as sodium chloride.

A1.2.2 This rapid method of analysis does not distinguish between sodium chloride and other evaporite chloride compounds with ice-melting capabilities. Typical rock salt and solar salt sometimes contains small amounts of $CaCl_2$, $MgCl_2$, and KCl, depending on the source of the material. When this rapid method is used on continuing shipments from a known source, it will provide a fast, essentially accurate determination of the sodium chloride content of the material furnished. Thus the need for testing by the referee method, Test Method E 534 is reduced.

A1.3 Apparatus

A1.3.1 *Glassware*-Standard weighing bottles, volumetric flasks (conforming to Specification E 288, Class B- or better), and burets (conforming to Specification E 287, Class B- or better).

A1.3.2 *Balance*, having a capacity of at least 20 g, accurate and readable to 0.01 g.

A1.4 Reagents

A1.4.1 *Purity of Reagents*-Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where such specifications are available.7 Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

A1.4.2 *Purity of Water*-Unless otherwise indicated, references to water shall be understood to mean reagent water as defined by Types I-IV of Specification D 1193.

A1 .4.3 *Calcium Carbonate ($CaCO_3$)*-low chloride, powder.

A1.4.4 *Nitric Acid (HNO_3)*-dilute (HNO_3:H_2O, 1:4 by volume).

A1.4.5 *Potassium Chromate (K_2CrO_4) Solution*-(50 g K_2CrO_4/L).

A1.4.6 *Silver Nitrate Solution*-0.05 N $AgNO_3$.

A1.4.7 *Sodium Chloride (NaCl).*

A!.5 Procedure

A1.5.1 Thoroughly mix the composite sample obtained under 8.1, and reduce by quartering or by means of a sample splitter to approximately 500 g. Pulverize the reduced sample to pass a 300 µm (no. 50) sieve.

A1.5.2 *Standardization*-Standardize the silver nitrate ($AgNO_3$) solution daily, using 10 g of reagent grade sodium chloride (NaCl) following the applicable procedure in A1.5.3.

A1.5.3 From the pulverized sodium chloride, obtain a test sample with a mass of 10.00 ± 0.01 g and place in a beaker with 250-mL distilled water. Add 10 mL of the diluted nitric acid solution (HNO_3, 1 + 4 by volume) and stir for 20 min at room temperature to put the salt in solution. Transfer the solution, including any insoluble material, to a 2-L volumetric flask, dilute to the mark with distilled water, and mix. With a pipet, draw off 25 mL of the solution and place in a white porcelain casserole. Add 0.5 g of calcium carbonate ($CaCO_3$) to neutralize the excess HNO_3, and adjust the pH to approximately 7. Add 3 mL of the potassium chromate (K_2CrO_4) solution as an indicator and titrate dropwise with the silver nitrate ($AgNO_3$) solution until a faint but distinct change in color occurs—a persistent yellowish brown endpoint (see Note A1.1), comparable to standardization. Estimate the titer from the buret to the second decimal place.

Note: A1.1—The stirred sample solution, after addition of potassium chromate (K_2CrO_4) and calcium carbonate ($CaCO_3$) is a creamy lemon-yellow color. Addition of the silver nitrate ($AgNO_3$) solution produces silver chloride, which begins to agglomerate as the titration progresses, and the lemon-yellow color will begin to have whitish opaque swirls of silver chloride. As the titration proceeds, the red color formed by addition of each drop begins to disappear more slowly. Continue the addition dropwise until a faint but distinct change in color occurs and the yellow-brown to faint reddish-brown color persists. The first stable presence of red silver chromate is the end point. If the endpoint is overstepped, a deep reddish-brown color occurs.

A1.6 *Calculate*-Calculate the total chlorides expressed as percent NaCl as follows:

$P = [(A/B) \times (C/D)] \times 100$ (A1.1) Where:

A = reagent grade NaCl used, g,

B = 0.05 N $AgNO_3$ solution required to titrate the reagent grade NaCl, mL,

C = 0.05 N $AgNO_3$ solution required to titrate the sample being tested, mL,

D = test sampling mass, g, and

P = total chlorides expressed as sodium chloride in the sample being tested, %.

A1.6.1 If moisture is apparent in the sample, dry a duplicate 10-g sample of the pulverized salt at 105° C and correct the mass of the sample accordingly.

A1.7.1 Precision and Bias

A1.7.1 *Precision* [8] –An interlaboratory study was conducted and an analysis was made that included three materials ranging from approximately 92 to 99 % NaCl. Ten laboratories were included in the study.

A1.7.2 *Single-Operator Precision* (NaCl composition 95.0 % and greater)—The single-operator standard deviation of a single test result for average NaCl composition 95.0 % and greater has been found to be 0.248.9 Therefore, results of two properly conducted tests by the same operator on the same material with the same equipment and under the same conditions should not differ by more than 0.70 %.[9]

A1.7.3 *Multilaboratory Precision* (NaCl composition 95.0 % and greater)—The multilaboratory standard deviation of a single test result for average NaCl composition greater than 95.0 % has been found to be 0.633 %.[9] Therefore, results of two properly conducted tests in different laboratories on the same material should not differ by more than 1.79 %.[9]

A1.7.4 *Single Operator Precision* (NaCl composition 95.0 % and greater than 90.0 %)— The single-operator coefficient of variation of a single test result for average NaCl composition less than 95.0 % and greater than 90.0 % has been found to be 0.427 %.[9] Therefore, results of two properly conducted tests by the same operator on the same material with the same equipment and under the same conditions should not differ by more than 1.21 %.[9]

A1.7.5 *Multilaboratory Precision* (NaCl composition less than 95.0 % and greater than 90.0 %)—The multilaboratory standard deviation of a single test result for average NaCl composition less than 95.0 % and greater than 90.0 % has been found to be 0.711 %.[9] Therefore, results of two properly conducted tests in different laboratories on the same material should not differ by more than 2.00 %.[9]

A1.7.6 *Bias*—No justifiable statement can be made on the bias of this test method because the data are not available.

Considerations for Large Stockpiles

The logistics process whereby salt is delivered to road agencies requires that large stockpiles be established at major transshipment locations. This section addresses steps that can be taken to minimize contaminated storm water run-off and help ensure the sustainability of such stockpiles.

The large quantities of salt stored at such locations, and the fact that such locations may not be used solely for salt storage, means that permanent structures (i.e. buildings that provide complete cover) may not be a feasible solution for such stockpiles. Although permanent buildings may not be feasible, steps can still be taken to minimize loss of salt through storm water run-off. The following list presents a number of suggested actions that can be taken to minimize chloride runoff, thereby helping to ensure that these stockpiles are sustainable (i.e. that they balance the environmental, economic, and societal needs with respect to road salt).

- Stockpiles should either be placed indoors or covered with tarps as soon as practical given weather conditions. Stockpiles should remain covered with a tarp except for the portion where salt is being added or removed.
- Stockpiles should be placed on impermeable pads that allow storm water to drain away from the covered salt to be appropriately managed.
- Pads should be sized so as to allow not only salt storage but handling of the salt as it is transshipped from one mode of transportation (e.g. river barge) to another (e.g. truck for delivery to agency stockpiles). This means space must be provided for maneuvering by loading and unloading vehicles and equipment.
- Pads should be constructed in such a way that water cannot easily run onto the pad. This can be accomplished by use of some sort of curbing around the edge of the pad, for example.
- Pads and stockpiles should be constructed in such a way that when salt is not being loaded into or unloaded from the stockpile, the stockpile can be safely covered with a tarp (or a system of tarps). Note that since the purpose of such stockpiles is to enable transshipment of salt from one transportation mode to another, it is necessary that when such actions are being performed parts of the stockpile (where transshipment is occurring) will not be covered with a tarp. Trying to either load salt onto the stockpile or unload it from a stockpile underneath a tarp would be very dangerous and should not be attempted.
- Plans should be developed and followed to manage any salt contaminated run-off from the storage site, in keeping with an appropriate Storm Water Pollution Prevention Plan (SWPPP) developed for the site[1].

[1] SWPPPs are intended to be site specific documents that detail management practices implemented at a given geographic location to ensure that contaminated storm water runoff from the site is appropriately handled. Methods of handling the storm water runoff include (but are not limited to) utilization of berms, ditches, pipes (appropriately sized to handle a 100 year 24 hour storm event) and bioswales. Other solutions may of course be used in a plan to the degree that they are appropriate for a given location.

Publications Available
from the
Salt Institute

Refer to saltinstitute.org for further details and other literature

Snowfighter's Handbook

Manual for winter maintenance. Includes pre-winter planning, equipment scheduling and maintenance, special plowing and spreading problems and environmental considerations.

[Note: available on line in PDF format].

ABOUT THE SALT INSTITUTE: The Salt Institute is a North American based non-profit trade association dedicated to advancing the many benefits of salt, particularly to ensure winter roadway safety, quality water and healthy nutrition. See saltinstitute.org or call 703-549-4648.

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SALT

SALT STORAGE HANDBOOK

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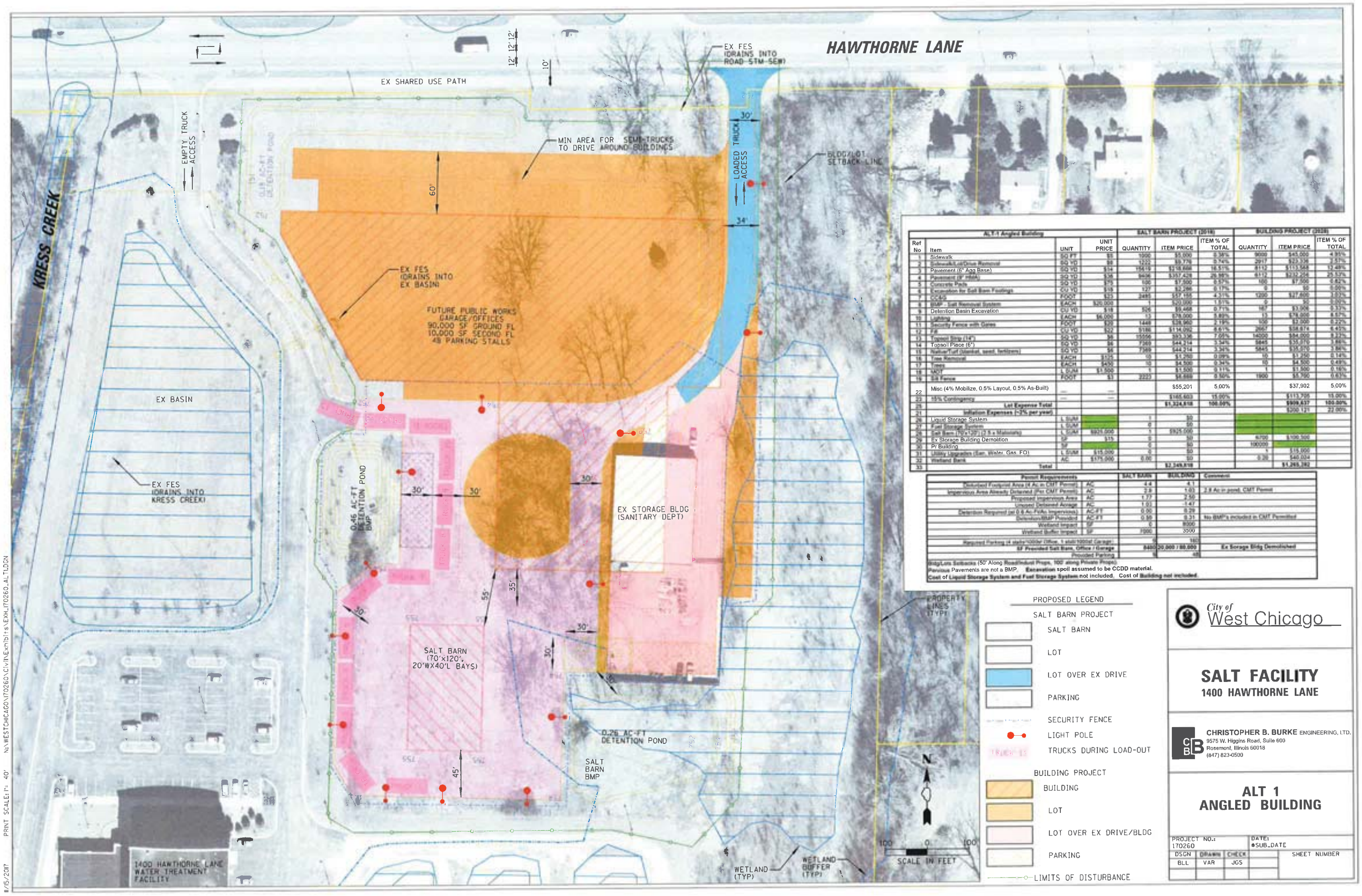

ALT-1 Angled Building				SALT BARN PROJECT (2018)			BUILDING PROJECT (2028)		
Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
1	Sidewalk	SQ FT	$5	1000	$5,000	0.38%	9000	$45,000	4.95%
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	1222	$9,776	0.74%	2917	$23,336	2.57%
3	Pavement (6" Agg Base)	SQ YD	$14	15619	$218,666	16.51%	8112	$113,568	12.48%
4	Pavement (8" HMA)	SQ YD	$38	9406	$357,428	26.98%	6112	$232,256	25.53%
5	Concrete Pads	SQ YD	$75	100	$7,500	0.57%	100	$7,500	0.82%
6	Excavation for Salt Barn Footings	CU YD	$18	127	$2,286	0.17%	0	$0	0.00%
7	CC&G	FOOT	$23	2485	$57,155	4.31%	1200	$27,600	3.03%
8	BMP - Salt Removal System	EACH	$20,000	1	$20,000	1.51%	0	$0	0.00%
9	Detention Basin Excavation	CU YD	$18	526	$9,468	0.71%	167	$3,006	0.33%
10	Lighting	EACH	$6,000	13	$78,000	5.89%	13	$78,000	8.57%
11	Security Fence with Gates	FOOT	$20	1448	$28,960	2.19%	100	$2,000	0.22%
12	Fill	CU YD	$22	5186	$114,092	8.61%	2667	$58,674	6.45%
13	Topsoil Strip (14")	SQ YD	$6	15556	$93,336	7.05%	14000	$84,000	9.23%
14	Topsoil Place (6")	SQ YD	$6	7369	$44,214	3.34%	5845	$35,070	3.86%
15	Native/Turf (blanket, seed, fertilizers)	SQ YD	$6	7369	$44,214	3.34%	5845	$35,070	3.86%
16	Tree Removal	EACH	$125	10	$1,250	0.09%	10	$1,250	0.14%
17	Trees	EACH	$450	10	$4,500	0.34%	10	$4,500	0.49%
18	MOT	L SUM	$1,500	1	$1,500	0.11%	1	$1,500	0.16%
19	Silt Fence	FOOT	$3	2223	$6,669	0.50%	1900	$5,700	0.63%
22	Misc (4% Mobilize, 0.5% Layout, 0.5% As-Built)	—	—		$55,201	5.00%		$37,902	5.00%
23	15% Contingency	—	—		$165,603	15.00%		$113,705	15.00%
25	Lot Expense Total				$1,324,818	100.00%		$909,637	100.00%
21	Inflation Expenses (~2% per year)							$200,121	22.00%
26	Liquid Storage System	L SUM		1	$0				
27	Fuel Storage System	L SUM		0	$0				
28	Salt Barn (70'x120') (2.5 x Materials)	L SUM	$925,000	1	$925,000				
29	Ex Storage Building Demolition	SF	$15	0	$0		6700	$100,500	
30	Pr Building	SF		0	$0		100000		
31	Utility Upgrades (San, Water, Gas, FO)	L SUM	$15,000	0	$0		1	$15,000	
32	Wetland Bank	AC	$175,000	0.00	$0		0.26	$40,024	
33	Total				$2,349,818			$1,265,282	

Permit Requirements		SALT BARN	BUILDING	Comment
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	4.4	4.1	
Impervious Area Already Detained (Per CMT Permit)	AC	2.8	1.03	2.8 Ac in pond, CMT Permit
Proposed Impervious Area	AC	1.77	2.50	
Unused Detained Acreage	AC	1.03	-1.47	
Detention Required (at 0.6 Ac-Ft/Ac Impervious)	AC-FT	0.00	0.29	
Detention/BMP Provided	AC-FT	0.56	0.31	No BMP's included in CMT Permitted
Wetland Impact	SF	0	8000	
Wetland Buffer Impact	SF	7000	3500	
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		9	180	
SF Provided Salt Barn, Office / Garage		8400	20,000 / 80,000	Ex Sorage Bldg Demolished
Provided Parking		9	48	

Bldg/Lots Setbacks (50' Along Road/Indust Props, 100' along Private Props)
Pervious Pavements are not a BMP. Excavation spoil assumed to be CCDD material.
Cost of Liquid Storage System and Fuel Storage System not included. Cost of Building not included.

PROPOSED LEGEND

SALT BARN PROJECT
- SALT BARN
- LOT
- LOT OVER EX DRIVE
- PARKING
- SECURITY FENCE
- LIGHT POLE
- TRUCKS DURING LOAD-OUT

BUILDING PROJECT
- BUILDING
- LOT
- LOT OVER EX DRIVE/BLDG
- PARKING
- LIMITS OF DISTURBANCE

City of West Chicago

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ALT 1
ANGLED BUILDING

PROJECT NO.: 170260	DATE: *SUB_DATE	
DSGN: BLL	DRAWN: VAR	CHECK: JGS
SHEET NUMBER		

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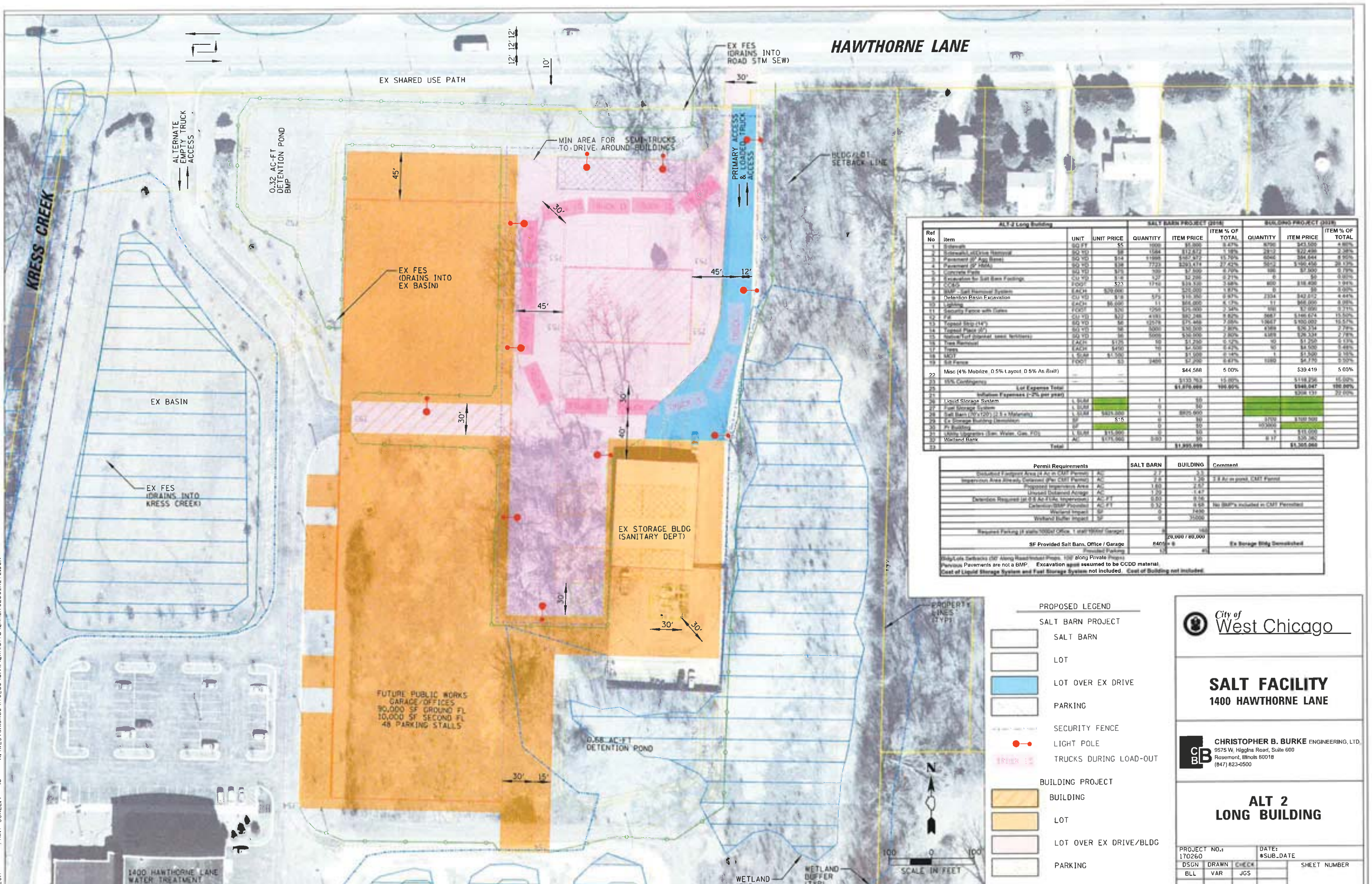

ALT-2 Long Building				SALT BARN PROJECT (2018)			BUILDING PROJECT (2028)		
Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
1	Sidewalk	SQ FT	$5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	Sidewalk/Lot/Drive Removal	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	Pavement (8" Agg Base)	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	Pavement (8" HMA)	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	Concrete Pads	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	Excavation for Salt Barn Footings	CU YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	CCDD	FOOT	$23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	BMP - Salt Removal System	EACH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	Detention Basin Excavation	CU YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	Lighting	EACH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	Security Fence with Gates	FOOT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	Fill	CU YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	Topsoil Strip (14")	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	Topsoil Place (2")	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	Native/Turf (blanket, seed, fertilizers)	SQ YD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	Tree Removal	EACH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	Trees	EACH	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	MOT	L SUM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	Silt Fence	FOOT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	Misc (4% Mobilize, 0.5% Layout, 0.5% As Built)	—	—		$44,588	5.00%		$39,419	5.00%
23	15% Contingency	—	—		[illegible]	15.00%		[illegible]	15.00%
25	Lot Expense Total				[illegible]	100.00%		[illegible]	100.00%
21	Inflation Expenses (~2% per year)							[illegible]	[illegible]
26	Liquid Storage System	L SUM		1	[illegible]				
27	Fuel Storage System	L SUM		0	[illegible]				
28	Salt Barn (70'x120') (2.5 x Materials)	L SUM	[illegible]	1	[illegible]				
29	Ex Storage Building Demolition	SF	$15	0	[illegible]		[illegible]	[illegible]	
30	PI Building	SF		0	[illegible]		[illegible]		
31	Utility Upgrades (San, Water, Gas, FO)	L SUM	[illegible]	0	[illegible]		1	[illegible]	
32	Wetland Bank	AC	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	
33	Total				[illegible]			[illegible]	

Permit Requirements		SALT BARN	BUILDING	Comment
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	[illegible]	[illegible]	
Impervious Area Already Detained (Per CMT Permit)	AC	[illegible]	[illegible]	[illegible]
Proposed Impervious Area	AC	[illegible]	[illegible]	
Unused Detained Acreage	AC	[illegible]	[illegible]	
Detention Required (at 0.5 Ac-Ft/Ac Impervious)	AC-FT	[illegible]	[illegible]	
Detention/BMP Provided	AC-FT	[illegible]	[illegible]	No BMP's included in CMT Permitted
Wetland Impact	SF	0	[illegible]	
Wetland Buffer Impact	SF	0	[illegible]	
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		[illegible]	[illegible]	
SF Provided Salt Barn, Office / Garage		[illegible]	20,000 / 80,000	Ex Storage Bldg Demolished
Provided Parking		[illegible]	[illegible]	

Bldg/Lots Setbacks (50' Along Road/Indust Props, 100' along Private Props)
Pervious Pavements are not a BMP. Excavation spoil assumed to be CCDD material.
Cost of Liquid Storage System and Fuel Storage System not included. Cost of Building not included.

City of West Chicago

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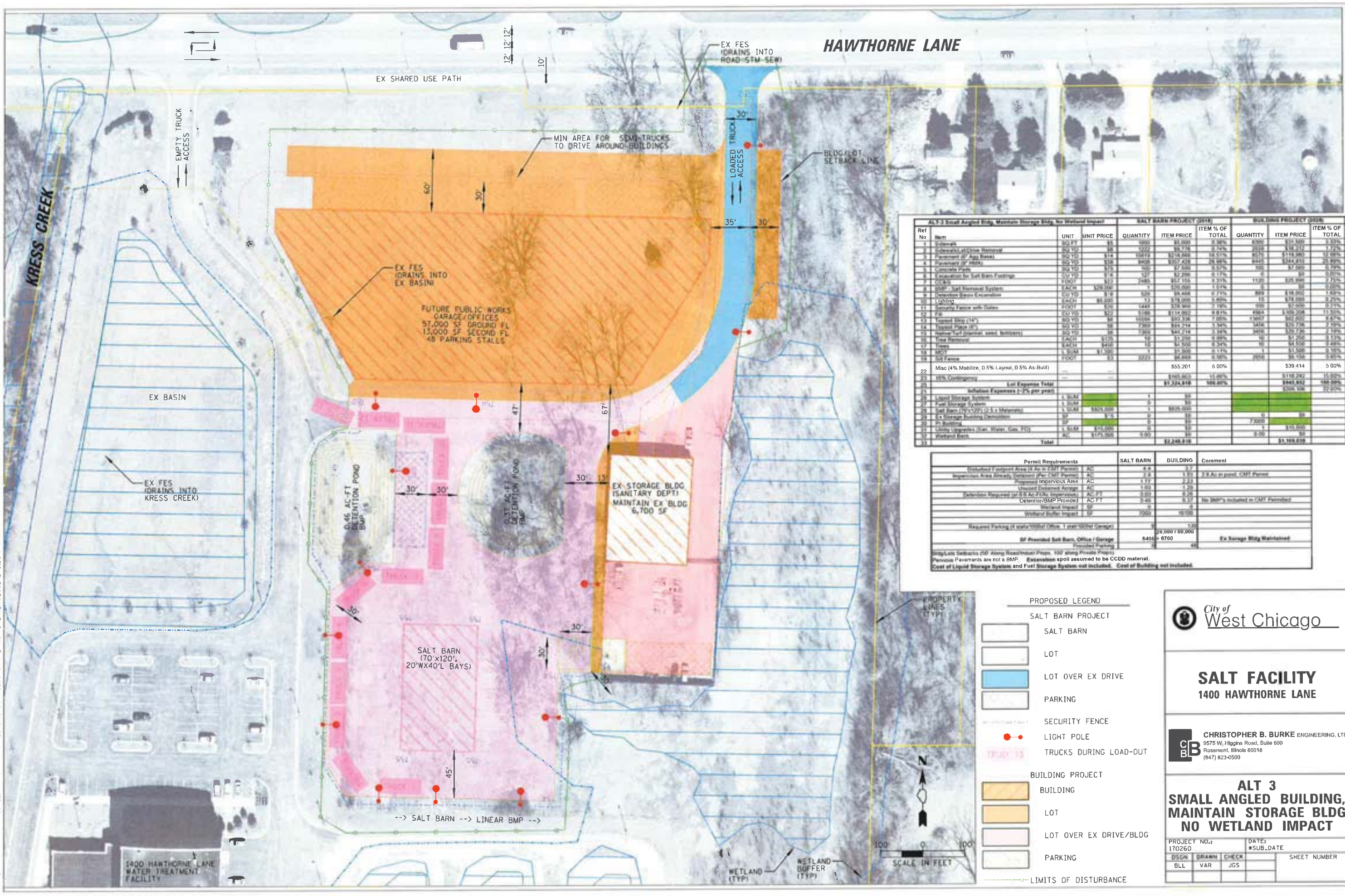
ALT 2 LONG BUILDING

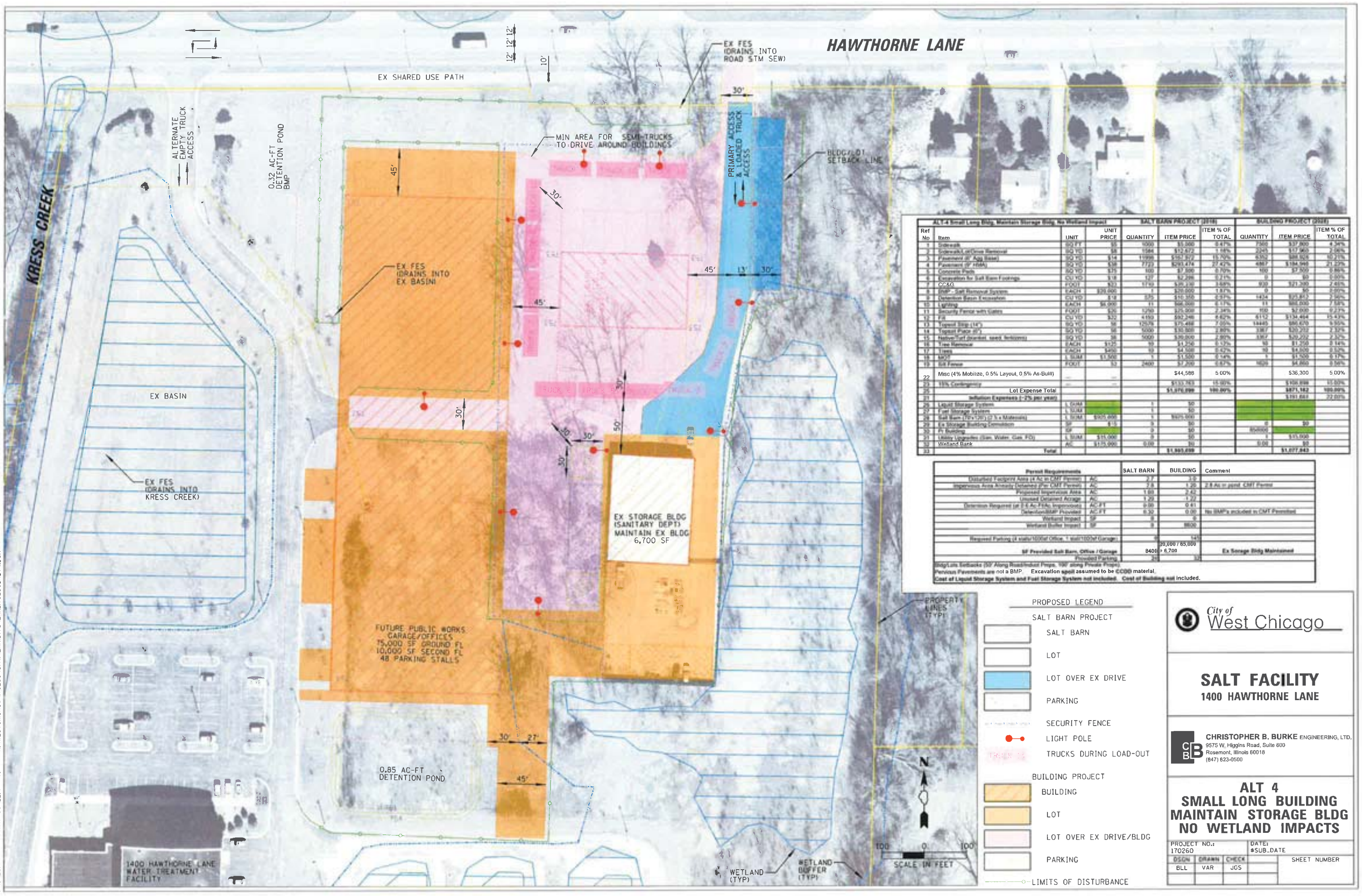
PROJECT NO.: 170260			DATE: #SUB_DATE	SHEET NUMBER
DSGN	DRAWN	CHECK		
BLL	VAR	JGS		



ALT-3 Small Angled Bldg, Maintain Storage Bldg, No Wetland Impact				SALT BARN PROJECT (2018)			BUILDING PROJECT (2028)		
Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
1	Sidewalk	SQ FT	$5	1000	$5,000	0.38%	6300	$31,500	3.33%
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	1222	$9,776	0.74%	2039	$16,312	1.72%
3	Pavement (6" Agg Base)	SQ YD	$14	15619	$218,666	16.51%	8570	$119,980	12.68%
4	Pavement (9" HMA)	SQ YD	$38	9406	$357,428	26.98%	6445	$244,910	25.89%
5	Concrete Path	SQ YD	$75	100	$7,500	0.57%	100	$7,500	0.79%
6	Excavation for Salt Barn Footings	CU YD	$16	127	$2,286	0.17%	0	$0	0.00%
7	CCBG	FOOT	$23	2485	$57,155	4.31%	1120	$25,760	2.72%
8	BMP - Salt Removal System	EACH	$20,000	1	$20,000	1.51%	0	$0	0.00%
9	Detention Basin Excavation	CU YD	$16	529	$9,466	0.71%	889	$16,002	1.69%
10	Lighting	EACH	$6,000	13	$78,000	5.89%	13	$78,000	8.25%
11	Security Fence with Gates	FOOT	$20	1448	$28,960	2.19%	100	$2,000	0.21%
12	Fill	CU YD	$22	5188	$114,052	8.61%	4964	$109,208	11.55%
13	Topsoil Strip (14")	SQ YD	$6	15556	$93,336	7.05%	13667	$82,002	8.67%
14	Topsoil Place (6")	SQ YD	$6	7369	$44,214	3.34%	3456	$20,736	2.19%
15	Native Turf (blanket, seed, fertilizer)	SQ YD	$6	7369	$44,214	3.34%	3456	$20,736	2.19%
16	Tree Removal	EACH	$125	10	$1,250	0.09%	10	$1,250	0.13%
17	Trees	EACH	$450	10	$4,500	0.34%	10	$4,500	0.48%
18	MOT	L SUM	$1,500	1	$1,500	0.11%	1	$1,500	0.16%
19	Silt Fence	FOOT	$3	2223	$6,669	0.50%	2050	$6,150	0.65%
22	Misc (4% Mobilize, 0.5% Layout, 0.5% As-Built)	—	—		$55,201	5.00%		$39,414	5.00%
23	15% Contingency	—	—		$165,603	15.00%		$118,242	15.00%
25	Lot Expense Total				$1,324,818	100.00%		$945,932	100.00%
21	Inflation Expenses (~2% per year)							$208,106	22.00%
26	Liquid Storage System	L SUM		1	$0				
27	Fuel Storage System	L SUM		0	$0				
28	Salt Barn (70'x120') (2.5 x Materials)	L SUM	$925,000	1	$925,000				
29	Ex Storage Building Demolition	SF	$15	0	$0		0	$0	
30	PI Building	SF		0	$0		73000		
31	Utility Upgrades (San, Water, Gas, PO)	L SUM	$15,000	0	$0		1	$15,000	
32	Wetland Bank	AC	$175,000	0.00	$0		0.00	$0	
33	Total				$2,249,818			$1,169,038	

Permit Requirements		SALT BARN	BUILDING	Comment
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	4.4	3.7	
Impervious Area Already Detained (Per CMT Permit)	AC	2.6	1.83	2.8 Ac in pond, CMT Permit
Proposed Impervious Area	AC	4.77	2.23	
Unused Detained Acreage	AC	1.63	1.20	
Detention Required (at 0.8 Ac-Ft/Ac Impervious)	AC-FT	3.03	0.26	
Detention/BMP Provided	AC-FT	3.46	0.17	No BMP's included in CMT Permitted
Wetland Impact	SF	0	0	
Wetland Buffer Impact	SF	7000	16100	
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		9	130	
SF Provided Salt Barn, Office / Garage		8400 + 6700	20,000 / 50,000	Ex Sorage Bldg Maintained
Provided Parking		9	48	

Bldg/Lots Setbacks (50' Along Road/Indust Props, 100' along Private Props)
Pervious Pavements are not a BMP. Excavation spoil assumed to be CCDD material.
Cost of Liquid Storage System and Fuel Storage System not included. Cost of Building not included.



ALT-4 Small Long Bldg, Maintain Storage Bldg, No Wetland Impact				SALT BARN PROJECT (2018)			BUILDING PROJECT (2028)		
Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
1	Sidewalk	SQ FT	$5	1000	$5,000	0.47%	7500	$37,500	4.34%
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	1584	$12,672	1.18%	2245	$17,960	2.06%
3	Pavement (8" Agg Base)	SQ YD	$14	11998	$167,972	15.70%	6352	$88,928	10.21%
4	Pavement (9" HMA)	SQ YD	$38	7723	$293,474	27.42%	4867	$184,946	21.23%
5	Concrete Pads	SQ YD	$75	100	$7,500	0.70%	100	$7,500	0.86%
6	Excavation for Salt Barn Footings	CU YD	$18	127	$2,286	0.21%	0	$0	0.00%
7	CC&G	FOOT	$23	1710	$39,330	3.68%	930	$21,390	2.45%
8	BMP - Salt Removal System	EACH	$20,000	1	$20,000	1.87%	0	$0	0.00%
9	Detention Basin Excavation	CU YD	$18	575	$10,350	0.97%	1434	$25,812	2.96%
10	Lighting	EACH	$6,000	11	$66,000	6.17%	11	$66,000	7.58%
11	Security Fence with Gates	FOOT	$20	1250	$25,000	2.34%	100	$2,000	0.23%
12	Fill	CU YD	$22	4193	$92,246	8.62%	6112	$134,464	15.43%
13	Topsoil Strip (14")	SQ YD	$6	12576	$75,456	7.05%	14445	$86,670	9.95%
14	Topsoil Place (6")	SQ YD	$6	5000	$30,000	2.80%	3367	$20,202	2.32%
15	Native/Turf (blanket, seed, fertilizer)	SQ YD	$6	5000	$30,000	2.80%	3367	$20,202	2.32%
16	Tree Removal	EACH	$125	10	$1,250	0.12%	10	$1,250	0.14%
17	Trees	EACH	$450	10	$4,500	0.42%	10	$4,500	0.52%
18	MOT	L SUM	$1,500	1	$1,500	0.14%	1	$1,500	0.17%
19	Silt Fence	FOOT	$3	2400	$7,200	0.67%	1620	$4,860	0.56%
22	Misc (4% Mobilize, 0.5% Layout, 0.5% As-Built)	—	—		$44,588	5.00%		$36,300	5.00%
23	15% Contingency	—	—		$133,763	15.00%		$108,898	15.00%
25	Lot Expense Total				$1,070,098	100.00%		$871,182	100.00%
21	Inflation Expenses (~2% per year)							$191,661	22.00%
26	Liquid Storage System	L SUM		1	$0				
27	Fuel Storage System	L SUM		1	$0				
28	Salt Barn (70'x120') (2 ½ x Materials)	L SUM	$925,000	1	$925,000				
29	Ex Storage Building Demolition	SF	$15	0	$0		0	$0	
30	PI Building	SF		0	$0		65000		
31	Utility Upgrades (San, Water, Gas, FO)	L SUM	$15,000	0	$0		1	$15,000	
32	Wetland Bank	AC	$175,000	0.00	$0		0.00	$0	
33	Total				$1,995,098			$1,077,843	

Permit Requirements		SALT BARN	BUILDING	Comment
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	2.7	3.0	
Impervious Area Already Detained (Per CMT Permit)	AC	2.8	1.20	2.8 Ac in pond CMT Permit
Proposed Impervious Area	AC	1.60	2.42	
Unused Detained Acreage	AC	1.20	-1.22	
Detention Required (at 0.6 Ac-Ft/Ac Impervious)	AC-FT	0.00	0.41	
Detention/BMP Provided	AC-FT	0.30	0.00	No BMP's included in CMT Permitted
Wetland Impact	SF	0	0	
Wetland Buffer Impact	SF	0	8600	
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		0	145	
SF Provided Salt Barn, Office / Garage		8400	20,000 / 65,000 + 6,700	Ex Sorage Bldg Maintained
Provided Parking		28	32	

Bldg/Lots Setbacks (50' Along Road/Induct Props, 100' along Private Props)
Pervious Pavements are not a BMP. Excavation spoil assumed to be CCDD material.
Cost of Liquid Storage System and Fuel Storage System not included. Cost of Building not included.

PROPOSED LEGEND

SALT BARN PROJECT
- SALT BARN
- LOT
- LOT OVER EX DRIVE
- PARKING
- SECURITY FENCE
- LIGHT POLE
- TRUCKS DURING LOAD-OUT

BUILDING PROJECT
- BUILDING
- LOT
- LOT OVER EX DRIVE/BLDG
- PARKING
- LIMITS OF DISTURBANCE

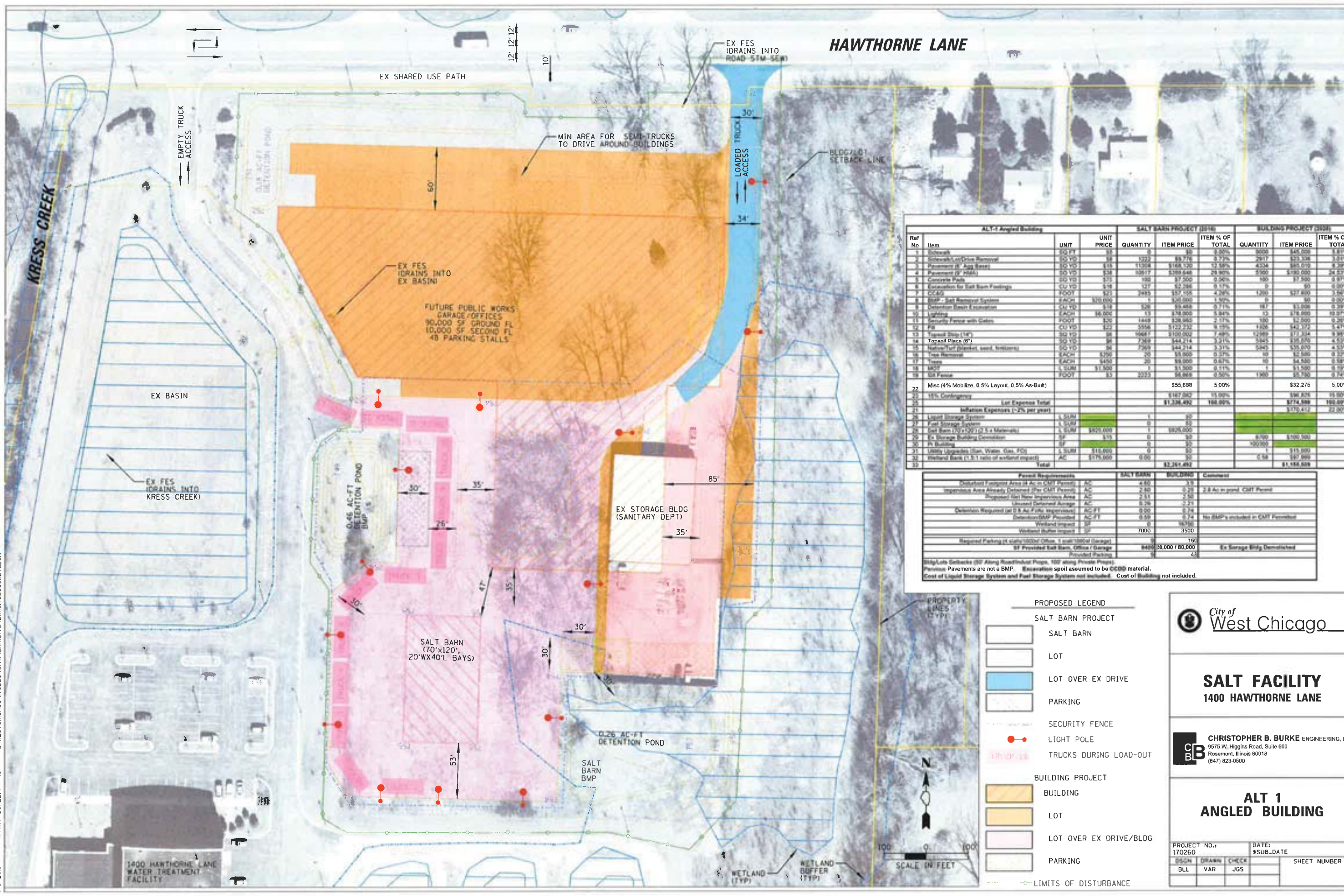
City of West Chicago

SALT FACILITY
1400 HAWTHORNE LANE

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500

ALT 4
SMALL LONG BUILDING MAINTAIN STORAGE BLDG NO WETLAND IMPACTS

PROJECT NO.: 170260			DATE: #SUB_DATE	SHEET NUMBER
DSGN	DRAWN	CHECK		
BLL	VAR	JGS		



Ref No	Item	UNIT	UNIT PRICE	SALT BARN PROJECT (2018) QUANTITY	ITEM PRICE	ITEM % OF TOTAL	BUILDING PROJECT (2028) QUANTITY	ITEM PRICE	ITEM % OF TOTAL
	ALT-1 Angled Building								
1	Sidewalk	SQ FT	$5	0	$0	0.00%	9000	$45,000	5.81%
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	1222	$9,776	0.73%	2917	$23,336	3.01%
3	Pavement (6" Agg Base)	SQ YD	$15	11208	$168,120	12.58%	4334	$65,010	8.39%
4	Pavement (9" HMA)	SQ YD	$38	10517	$399,646	29.90%	5000	$190,000	24.53%
5	Concrete Pads	SQ YD	$75	100	$7,500	0.56%	100	$7,500	0.97%
6	Excavation for Salt Barn Footings	CU YD	$18	127	$2,286	0.17%	0	$0	0.00%
7	CC&G	FOOT	$23	2485	$57,155	4.28%	1200	$27,600	3.56%
8	BMP - Salt Removal System	EACH	$20,000	1	$20,000	1.50%	0	$0	0.00%
9	Detention Basin Excavation	CU YD	$18	526	$9,468	0.71%	167	$3,006	0.39%
10	Lighting	EACH	$6,000	13	$78,000	5.84%	13	$78,000	10.07%
11	Security Fence with Gates	FOOT	$20	1448	$28,960	2.17%	100	$2,000	0.26%
12	Fill	CU YD	$22	5556	$122,232	9.15%	1926	$42,372	5.47%
13	Topsoil Strip (18")	SQ YD	$6	16667	$100,002	7.48%	12889	$77,334	9.98%
14	Topsoil Place (6")	SQ YD	$6	7369	$44,214	3.31%	5845	$35,070	4.53%
15	Native/Turf (blanket, seed, fertilizers)	SQ YD	$6	7369	$44,214	3.31%	5845	$35,070	4.53%
16	Tree Removal	EACH	$250	20	$5,000	0.37%	10	$2,500	0.32%
17	Trees	EACH	$450	20	$9,000	0.67%	10	$4,500	0.58%
18	MOT	L SUM	$1,500	1	$1,500	0.11%	1	$1,500	0.19%
19	Silt Fence	FOOT	$3	2223	$6,669	0.50%	1900	$5,700	0.74%
22	Misc (4% Mobilize 0.5% Layout 0.5% As-Built)				$55,688	5.00%		$32,275	5.00%
23	15% Contingency				$167,062	15.00%		$96,825	15.00%
25	Lot Expense Total				$1,336,492	100.00%		$774,598	100.00%
21	Inflation Expenses (~2% per year)							$170,412	22.00%
26	Liquid Storage System	L SUM		1	$0				
27	Fuel Storage System	L SUM		0	$0				
28	Salt Barn (70'x120') (2.5 x Materials)	L SUM	$925,000	1	$925,000				
29	Ex Storage Building Demolition	SF	$15	0	$0		6700	$100,500	
30	PI Building	SF		0	$0		100000		
31	Utility Upgrades (San, Water, Gas, FO)	L SUM	$15,000	0	$0		1	$15,000	
32	Wetland Bank (1.5:1 ratio of wetland impact)	AC	$175,000	0.00	$0		0.56	$97,999	
33	Total				$2,261,492			$1,158,509	

Permit Requirements		SALT BARN	BUILDING	Comment
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	4.60	3.9	
Impervious Area Already Detained (Per CMT Permit)	AC	2.80	0.29	2.8 Ac in pond, CMT Permit
Proposed Net New Impervious Area	AC	2.51	2.50	
Unused Detained Acreage	AC	0.29	-2.21	
Detention Required (at 0.6 Ac-Ft/Ac Impervious)	AC-FT	0.00	0.74	
Detention/BMP Provided	AC-FT	0.59	0.74	No BMP's included in CMT Permitted
Wetland Impact	SF	0	16750	
Wetland Buffer Impact	SF	7000	3500	
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		9	160	
SF Provided Salt Barn, Office / Garage		8400	20,000 / 80,000	Ex Sorage Bldg Demolished
Provided Parking		9	48	

Bldg/Lots Setbacks (50' Along Road/Indust Props, 100' along Private Props).
Pervious Pavements are not a BMP. Excavation spoil assumed to be CCDD material.
Cost of Liquid Storage System and Fuel Storage System not included. Cost of Building not included.

PROPOSED LEGEND

SALT BARN PROJECT
- SALT BARN
- LOT
- LOT OVER EX DRIVE
- PARKING
- SECURITY FENCE
- LIGHT POLE
- TRUCKS DURING LOAD-OUT

BUILDING PROJECT
- BUILDING
- LOT
- LOT OVER EX DRIVE/BLDG
- PARKING
- LIMITS OF DISTURBANCE

City of West Chicago

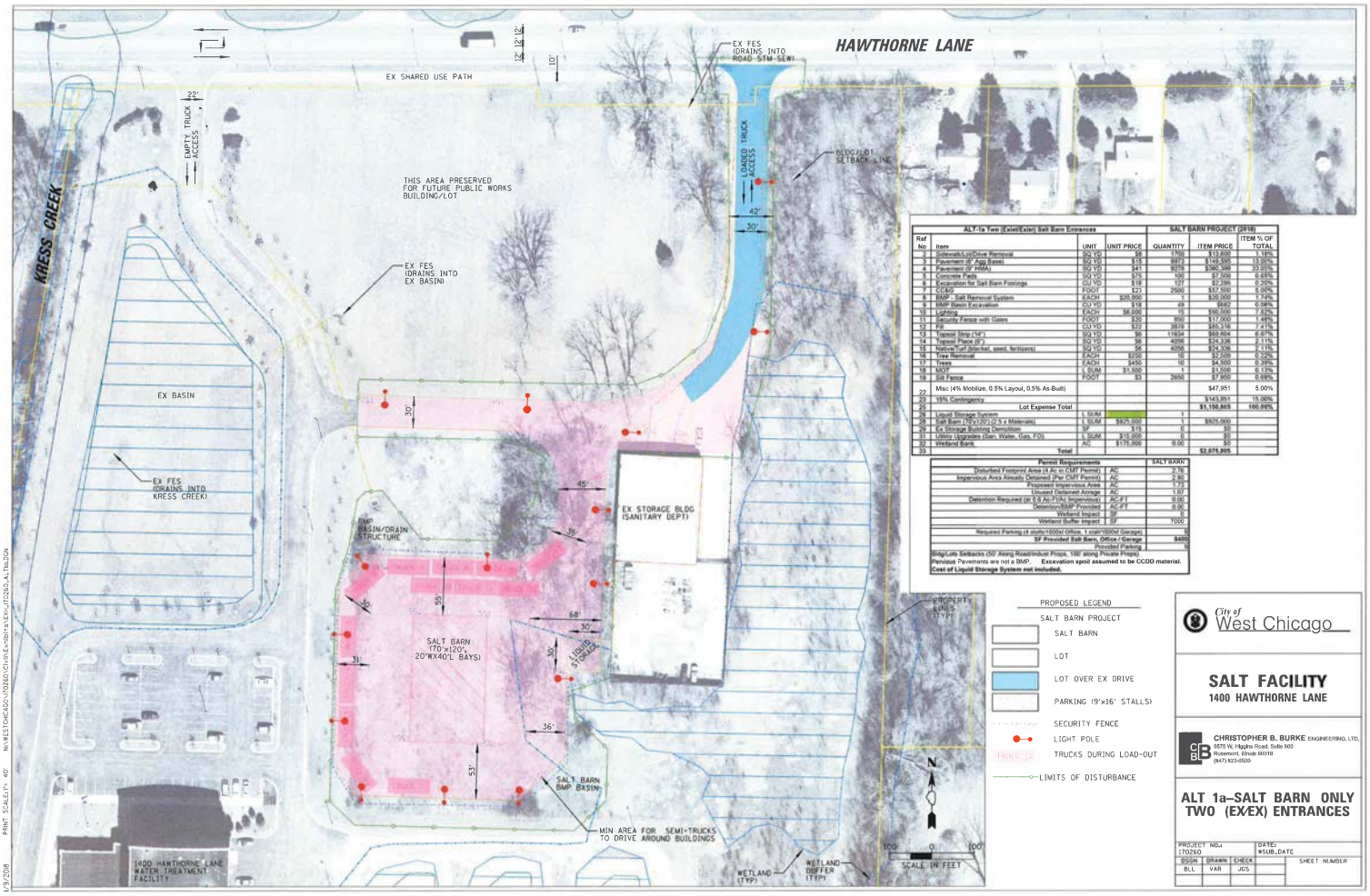
SALT FACILITY
1400 HAWTHORNE LANE

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500

ALT 1 ANGLED BUILDING

PROJECT NO.	DATE:		SHEET NUMBER
170260	$SUB_DATE		
DSGN	DRAWN	CHECK	
BLL	VAR	JGS	

PRINT SCALE: 1" = 40'   N:\WESTCHICAGO\170260\Civil\Exh\Dfts\EXH_170260_ALT1.DGN   1/9/2018



ALT-1a Two (Exist/Exist) Salt Barn Entrances			SALT BARN PROJECT (2018)		
Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	1700	$13,600	1.18%
3	Pavement (6" Agg Base)	SQ YD	$13	9972	$148,595	13.00%
4	Pavement (9" HMA)	SQ YD	$41	9278	$380,398	33.00%
5	Concrete Pads	SQ YD	$75	100	$7,500	0.65%
6	Excavation for Salt Barn Footings	CU YD	$18	127	$2,286	0.20%
7	CCBG	FOOT	$23	2500	$57,500	5.00%
8	BMP - Salt Removal System	EACH	$30,000	1	$30,000	1.74%
9	BMP Basin Excavation	CU YD	$18	49	$882	0.08%
10	Lighting	EACH	$6,000	13	$78,000	7.82%
11	Security Fence with Gates	FOOT	$10	890	$17,700	1.48%
12	Fill	CU YD	$22	3878	$85,316	7.41%
13	Topsoil Strip (14")	SQ YD	$6	11634	$69,804	6.67%
14	Topsoil Place (8")	SQ YD	$6	4056	$24,336	2.11%
15	Native Turf (blanket, seed, fertilizers)	SQ YD	$6	4056	$24,336	2.11%
16	Tree Removal	EACH	$250	10	$2,500	0.22%
17	Trees	EACH	$450	10	$4,500	0.39%
18	MOT	L SUM	$1,500	1	$1,500	0.13%
19	Silt Fence	FOOT	$3	2650	$7,950	0.69%
22	Misc (4% Mobilize, 0.5% Layout, 0.5% As-Built)				$47,951	5.00%
23	15% Contingency				$143,851	15.00%
25	Lot Expense Total				$1,150,805	100.00%
26	Liquid Storage System	L SUM		1		
28	Salt Barn (170'x120') (2.5 x Materials)	L SUM	$925,000	1	$925,000	
29	Ex Storage Building Demolition	SF	$15	0	$0	
31	Utility Upgraders (Gas, Water, Gas, FO)	L SUM	$75,000	0	$0	
32	Wetland Bank	AC	$175,000	0.00	$0	
33	Total				$2,075,805	

Permit Requirements		SALT BARN
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	2.76
Impervious Area Already Detained (Per CMT Permit)	AC	2.80
Proposed Impervious Area	AC	1.73
Unused Detained Acreage	AC	1.07
Detention Required (at 0.6 Ac-Ft/Ac Impervious)	AC-FT	0.00
Detention/BMP Provided	AC-FT	0.00
Wetland Impact	SF	0
Wetland Buffer Impact	SF	7000
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		5
SF Provided Salt Barn, Office / Garage		6400
Provided Parking		5

Bldg/Lots Setbacks (50' Along Road/Individual Props, 100' along Private Prop).
Pervious Pavements are not a BMP. Excavation spoil assumed to be CCDD material.
Cost of Liquid Storage System not included.

PROPOSED LEGEND

SALT BARN PROJECT

- SALT BARN
- LOT
- LOT OVER EX DRIVE
- PARKING (9'x16' STALLS)
- SECURITY FENCE
- LIGHT POLE
- TRUCKS DURING LOAD-OUT
- LIMITS OF DISTURBANCE

City of West Chicago

SALT FACILITY

1400 HAWTHORNE LANE

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500

ALT 1a–SALT BARN ONLY TWO (EX/EX) ENTRANCES

PROJECT NO.: 170760	DATE: #SUB_DATE			
DSGN	DRAWN	CHECK		SHEET NUMBER
BLL	VAR	JCS		

1/3/2018 PRINT SCALE: 1" = 40' N:\WEST CHICAGO\170760\CIVIL\ENGINEERING\ALT1\170760-ALT1A.DGN

ALT-1b One (Exist) Salt Barn Entrance				SALT BARN PROJECT (2018)		
Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	1700	$13,600	1.30%
3	Pavement (6" Agg Base)	SQ YD	$15	9107	$136,605	13.08%
4	Pavement (9" HMA)	SQ YD	$41	8523	$349,443	33.46%
5	Concrete Pads	SQ YD	$75	100	$7,500	0.72%
6	Excavation for Salt Barn Footings	CU YD	$18	127	$2,286	0.22%
7	CC&G	FOOT	$23	2100	$48,300	4.63%
8	BMP - Salt Removal System	EACH	$20,000	1	$20,000	1.92%
9	BMP Basin Excavation	CU YD	$18	49	$882	0.08%
10	Lighting	EACH	$6,000	13	$78,000	7.47%
11	Security Fence with Gates	FOOT	$20	850	$17,000	1.63%
12	Fill	CU YD	$22	3471	$76,362	7.31%
13	Topsoil Strip (14")	SQ YD	$6	10412	$62,472	5.98%
14	Topsoil Place (6")	SQ YD	$6	3589	$21,534	2.06%
15	Native/Turf (blanket, seed, fertilizers)	SQ YD	$6	3589	$21,534	2.06%
16	Tree Removal	EACH	$250	9	$2,250	0.22%
17	Trees	EACH	$450	9	$4,050	0.39%
18	MOT	L SUM	$1,500	1	$1,500	0.14%
19	Silt Fence	FOOT	$3	2300	$6,900	0.66%
22	Misc (4% Mobilize, 0.5% Layout, 0.5% As-Built)				$43,511	5.00%
23	15% Contingency				$130,533	15.00%
25	**Lot Expense Total**				**$1,044,262**	**100.00%**
26	Liquid Storage System	L SUM		1		
28	Salt Barn (70'x120') (2.5 x Materials)	L SUM	$925,000	1	$925,000	
29	Ex Storage Building Demolition	SF	$15	0	$0	
31	Utility Upgrades (San, Water, Gas, FO)	L SUM	$15,000	0	$0	
32	Wetland Bank	AC	$175,000	0.00	$0	
33	**Total**				**$1,969,262**	

Permit Requirements		SALT BARN
Disturbed Footprint Area (4 Ac in CMT Permit)	AC	2.76
Impervious Area Already Detained (Per CMT Permit)	AC	2.80
Proposed Impervious Area	AC	1.56
Unused Detained Acrage	AC	1.24
Detention Required (at 0.6 Ac-Ft/Ac Impervious)	AC-FT	0.00
Detention/BMP Provided	AC-FT	0.00
Wetland Impact	SF	0
Wetland Buffer Impact	SF	7000
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		9
SF Provided Salt Barn, Office / Garage		**8400**
Provided Parking		9

Bldg/Lots Setbacks (50' Along Road/Indust Props, 100' along Private Props)
Pervious Pavements are not a BMP. **Excavation spoil assumed to be CCDD material.**
Cost of Liquid Storage System not included.

PROPOSED LEGEND

SALT BARN PROJECT

- SALT BARN
- LOT
- LOT OVER EX DRIVE
- PARKING (9'x16' STALLS)
- SECURITY FENCE
- LIGHT POLE
- TRUCKS DURING LOAD-OUT
- LIMITS OF DISTURBANCE

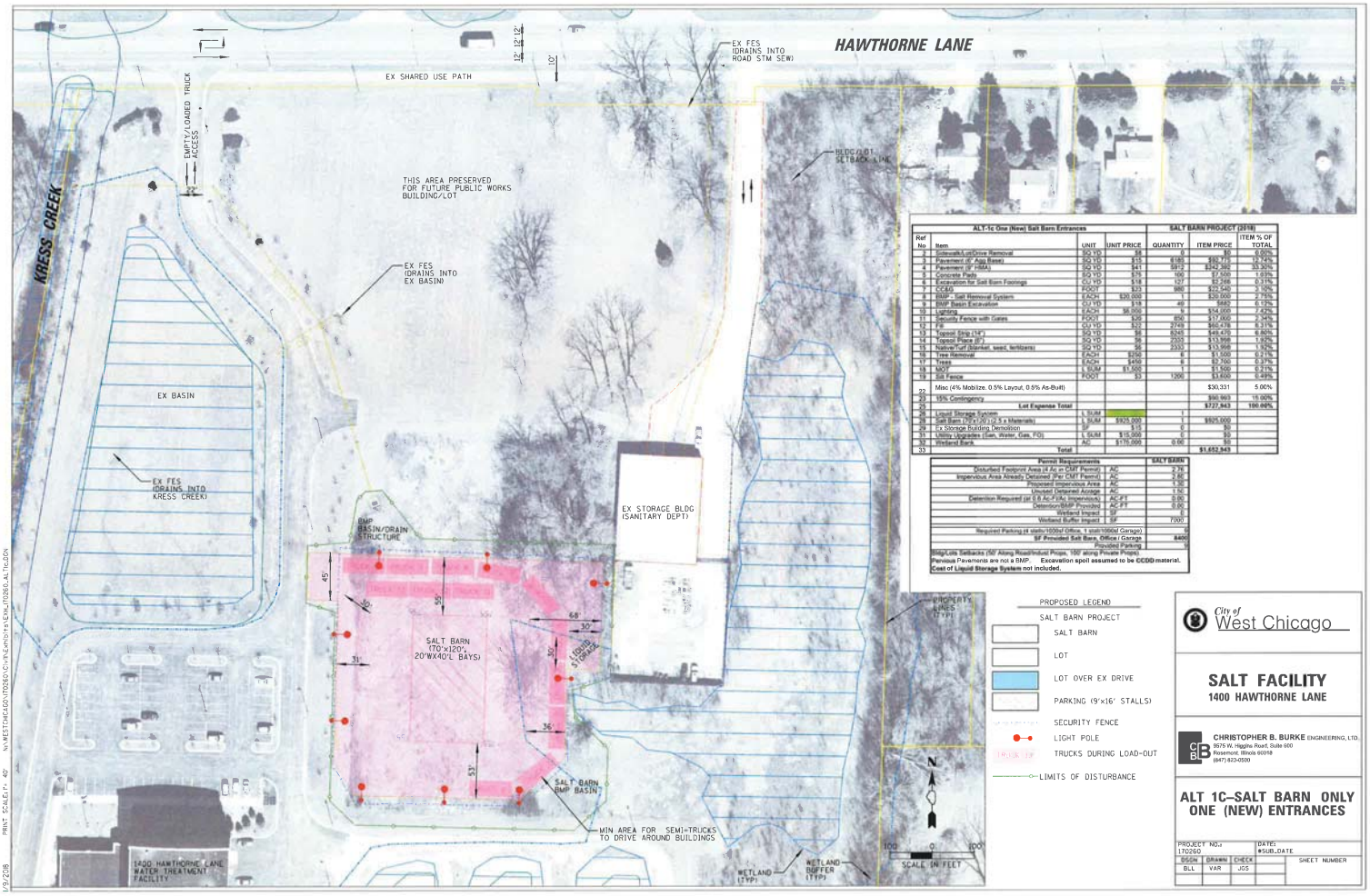
City of West Chicago

SALT FACILITY
1400 HAWTHORNE LANE

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500

ALT 1B–SALT BARN ONLY ONE (EX) ENTRANCES

PROJECT NO.: 170260			DATE: *SUB_DATE
DSGN	DRAWN	CHECK	SHEET NUMBER
BLL	VAR	JGS	



ALT-1c One (New) Salt Barn Entrances — **SALT BARN PROJECT (2018)**

Ref No	Item	UNIT	UNIT PRICE	QUANTITY	ITEM PRICE	ITEM % OF TOTAL
2	Sidewalk/Lot/Drive Removal	SQ YD	$8	0	$0	0.00%
3	Pavement (6" Agg Base)	SQ YD	$13	6180	$80,340	12.34%
4	Pavement (9" HMA)	SQ YD	$41	5912	$242,392	33.35%
5	Concrete Pads	SQ YD	$75	100	$7,500	1.03%
6	Excavation for Salt Barn Footings	CU YD	$18	127	$2,286	0.31%
7	CCA/G	FOOT	$23	980	$22,540	3.10%
8	BMP - Salt Removal System	EACH	$20,000	1	$20,000	2.75%
9	BMP Basin Excavation	CU YD	$18	40	$682	0.13%
10	Lighting	EACH	$8,000	1	$14,000	7.43%
11	Security Fence with Gates	FOOT	$20	850	$17,000	2.34%
12	Fill	CU YD	$22	2749	$60,478	8.31%
13	Topsoil Strip (14")	SQ YD	$6	6245	$49,470	6.80%
14	Topsoil Place (6")	SQ YD	$6	2333	$13,998	1.92%
15	Native/Turf (blanket, seed, fertilizers)	SQ YD	$6	2333	$13,998	1.92%
16	Tree Removal	EACH	$250	6	$1,500	0.21%
17	Trees	EACH	$450	6	$2,700	0.37%
18	MOT	LSUM	$1,500	1	$1,500	0.21%
19	Silt Fence	FOOT	$3	1200	$3,600	0.49%
20	Misc (4% Mobilize, 0.5% Layout, 0.5% As-Built)				$30,331	5.00%
23	15% Contingency				$90,993	15.00%
25	**Lot Expense Total**				**$727,843**	**100.00%**
26	Liquid Storage System	L SUM		1		
28	Salt Barn (70'x120'/12.5 x Materials)	L SUM	$925,000	1	$925,000	
29	Ex Storage Building Demolition	SF	$10	0	$0	
31	Utility Upgrades (Gas, Water, Gas, FO)	L SUM	$15,000	0	$0	
32	Wetland Bank	AC	$175,000	0.00	$0	
33	**Total**				**$1,652,843**	

Permit Requirements		SALT BARN
Disturbed Footprint Area (4 Ac on CMF Permit)	AC	2.76
Impervious Area Already Detained (Per CMF Permit)	AC	0.80
Proposed Impervious Area	AC	1.30
Unsited Detained Acreage	AC	1.50
Detention Required (at 0.6 Ac-Ft/Ac Impervious)	AC-FT	0.90
Detention/BMP Provided	AC-FT	0.90
Wetland Impact	SF	0
Wetland Buffer Impact	SF	7000
Required Parking (4 stalls/1000sf Office, 1 stall/1000sf Garage)		6
SF Provided Salt Barn, Office / Garage		8400
Provided Parking		10

Bldg/Lots Setbacks (50' Along Road/Individ Props, 100' along Private Prop)
Pervious Pavements are not a BMP. **Excavation spoil assumed to be CCDD material.**
Cost of Liquid Storage System not included.

PROPOSED LEGEND

SALT BARN PROJECT
- SALT BARN
- LOT
- LOT OVER EX DRIVE
- PARKING (9'x16' STALLS)
- SECURITY FENCE
- LIGHT POLE
- TRUCKS DURING LOAD-OUT
- LIMITS OF DISTURBANCE

City of West Chicago

SALT FACILITY
1400 HAWTHORNE LANE

CHRISTOPHER B. BURKE ENGINEERING, LTD.
9575 W. Higgins Road, Suite 600
Rosemont, Illinois 60018
(847) 823-0500

ALT 1C–SALT BARN ONLY ONE (NEW) ENTRANCES

PROJECT NO.: 170260 | DATE: #SUB_DATE

DSGN	DRAWN	CHECK		SHEET NUMBER
BLL	VAR	JGS		

1/9/208 PRNT SCALE:1" = 40' N:\WEST\CHICAGO\170260\Civil\Exhibits\CIVIL170260_ALT1c.DGN