PARKING DECK FEASIBILITY STUDY
SOUTH RUSSELL STREET LOCATION
PLYMOUTH, MA

Prepared for:

The Town of Plymouth and
The Plymouth Growth and Development Corporation

July 2016

SIMON DESIGN
ENGINEERING

VHB
Vanasse Hangen Brustlin, Inc.

DBVW
ARCHITECTS

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I. PROJECT TEAM

Architect:	DBVW Architects Martha Werenfels, AIA, Principal in Charge Ed Cifune, Associate Matthew Valero, Architectural Illustrator
Parking Garage Consultant:	Simon Design Engineering Alan Simon, Principal Darian Medeiros, Parking Planner
Civil Engineer:	Vanasse Hangen Brustlin John Stabach, Project Manager Karen Crawford, Sr. Project Designer

II. OVERVIEW

In order to address parking concerns in downtown Plymouth, DBVW Architects, along with Simon Design Engineering, was hired in May 2016 by the Town of Plymouth and the Plymouth Growth and Development Corporation to assess the feasibility of adding a parking deck at the location of an existing surface parking lot on the east side of South Russell Street adjacent to Burial Hill. DBVW Architects collaborated closely with Simon Design Engineering (SDE) as they are able to provide specific parking design expertise.

DBVW Architects is the architect for the new Town Hall project that is currently under construction across the street from the South Russell Street site. The Town Hall project includes reconfiguring an existing surface lot at the South Russell Street location, adding sub-surface infiltration for drainage, installing lighting, and extending an existing stone wall south along South Russell Street. As of the writing of this report, the lot has been regraded, the sub-surface infiltration system has been installed, and a base coat has been applied to the surface of the parking area. This work will need to be redone if a parking deck is constructed.

Vanasse Hangen Brustlin (VHB), who is the civil engineer for the Town Hall project, provided civil engineering consulting for this feasibility study.

1. Aerial view showing South Russell Street surface parking. Note excavation for new Town Hall to the northwest.

III. SITE ANALYSIS

In order to determine the most efficient use of the site to maximize parking for the Town of Plymouth, the team evaluated the existing conditions and site constrainst and studied different configurations for structured parking.

Appendix A of this report includes photographs of the site, both before the lot was re-graded and in its current condition. These photos also depict the historic context of the site, specifically Burial Hill to the north, south and east and South Russell Street to the west. The existing lot is separated from Burial Hill on three sides by a stone wall that varies in height from approximately two to three feet along its length. The condition and composition of the stone wall varies considerably at different locations. A small set of granite steps is present at approximately the center of the wall along the east boundary of the lot.

To the north of the site, a low stone wall also extends along South Russell Street to School Street. To the south of the site, two granite piers mark an entrance to Burial Hill and there is a historic brick powder keg further to the south. Historically, the proposed site and the area between the site and Main Street along the east side of South Russell Street contained residential structures. None of these structures remains.

The existing approximately 1,500 square foot underground infiltration is within the footprint of the proposed parking deck. This infiltration system has an elevation ranging from 87.9 (bottom) to 92.4 (top) and would need to be reconstructed at a lower elevation within the footprint of the parking deck in order to maintain function of the stormwater management system.

Geotechnical exploration conducted for the Town Hall project in July of 2014 adjacent to the proposed parking deck site generally indicated the presence of 8-10 feet of sand fill overlying stratified glacial deposits. Groundwater was encountered at depths in excess of 40 feet during the time of those geotechnical explorations. Based on the previous explorations, the relocation of the underground stormwater infiltration appears feasible. Additional geotechnical analysis will be required for the design of the parking deck foundation system and to confirm the feasibility of the relocation of the stormwater management system.

2. Stone wall along South Russell Street

3. Stone wall between surface lot and Burial Hill

IV. STAKEHOLDERS' INPUT

Due to the sensitive nature of the site, the project team met with stakeholders to discuss potential overall impacts of a parking deck on Burial Hill and the existing stone walls. The meeting was attended by the following:

Melissa Arrighi, Town Manager
Anthony Provenzano, Town Selectman
Leighton Price, President, Plymouth Growth and Development Corp.
John Burke, PGDC Project Manager
Desmond Egan, Parking Plymouth Operations Manager
Bill Keohan, Community Preservation Committee
Robert Fournier, Plymouth Historic District Commission
Ted Bubbins, Friends of Burial Hill
Evan Warner, STV, Owner's Representative for Town Hall project
Alan Simon, Simon Design Engineering
Darian Medeiros, Simon Design Engineering
Martha Werenfels, DBVW Architects
Ed Cifune, DBVW Architects

At this meeting, held on June 16, 2016, the inconsistent nature of the stone walls was discussed, as well as the impact of constructing a parking structure on the walls. DBVW Architects and SDE noted that in order to maximize parking, the new structure would be very close to portions of the stone walls. Due to the excavation that will be required for construction, the walls will have to be rebuilt unless the parking deck is pulled away from them and the number of parking spaces is significantly reduced.

The group agreed that Option A, as described in the next section of this report, was the best option and that the stone walls could be reconstructed if this option were to be pursued. Existing granite within the stone walls will be reused in the reconstructed walls to the greatest extent possible. Following the meeting, Robert Fornier met with Plymouth historian Jim Baker to obtain more information about the walls. Baker indicated that the walls may date back to the 1840s, however, they have probably been repaired and/or rebuilt many times over the years. Baker agreed with the team's strategy of rebuilding the existing walls and reusing as much granite as possible.

A set of granite steps exists at approximately the center of the stone wall on the east side of the existing parking lot. These steps should also be integrated into the new parking deck, if possible.

The stone wall along Burial Hill along South Russell Street, which is the most visible of the stone walls, will remain and will be extended up the hill in front of the proposed parking deck.

V. PARKING CONFIGURATIONS

Prior to construction of the new Town Hall, the South Russell Street parking lot was striped for 61 parking spaces. None of the spaces was designated for ADA parking. See Appendix B.

The reconfiguration of the surface parking lot that is underway with the construction of the new Town Hall will result in a total of 63 spaces, including one space that is designated for ADA van parking. See Appendix C. (The ADA spaces that are required for Town Hall are being accommodated in the lot that is directly adjacent to the new building.)

Simon Design Engineering (SDE), an engineering firm that specializes in the design of parking structures, developed three different configurations for structured parking on the South Russell Street site. The design team evaluated the different options and concluded that Option A was the most feasible for maximizing parking on the site within a reasonable budget. Option A provides a configuration that includes an efficient parking layout while having minimal impact on Burial Hill. Option A includes 152 spaces on two levels, six of which are ADA spaces.

The following is a summary of existing and proposed parking counts:

Previous Parking Lot	61 spaces
Town Hall Lot Under Construction	63 spaces
Proposed Parking Deck (Option A)	152 spaces

4. Existing condition of South Russell Street surface parking lot.

VI. PARKING ANALYSIS BY SIMON DESIGN ENGINEERING

Parking Geometrics:

Plymouth regulations prescribe design standards for off-street parking spaces to be not less than 10-feet wide by 18-feet long, serviced by 25-foot wide drive aisles for 90-degree parking configurations. However, 9-foot by 18-foot parking spaces are already in use for public parking throughout Plymouth. In addition, the new on-grade parking lot currently under construction on which the proposed structure is to be located utilizes 9-foot by 18-foot parking spaces with a minimum of 22-foot wide drive aisles. These parking space sizes are commonly considered generous and are often used in high-turnover parking situations, including shopping centers, and visitor parking. In order to yield the maximum number of spaces while considering the space size needed for the user type, 9-foot by 18-foot parking spaces with a minimum of 22-foot aisles were used for the purposes of this study.

Structured Parking Configurations:

The following parking design options consist of stand-alone parking structures not mixed with any other uses. The plans vary in the number of spaces, configuration, and extent of below-grade excavation. Selection of gate controls and specific revenue collection systems was not part of the study and are not depicted in the drawings. As each option is less than three stories and has a direct accessible means of egress from each level to grade, an elevator is not required. Stairs have been placed throughout the structures per the requirements set forth in building code. The parking levels are designed with 10-foot 6-inch floor to floor heights which allow for 3-feet of structure, standard 7-foot parking clearance, and construction tolerances.

The conceptual parking options assume the following design criteria:

1. Parking spaces will be approved at 9'-0"x18'-0" with minimum 22'-0" wide one-way aisles.
2. A variance to encroach within the five-foot rear and side yard setbacks can be obtained.
3. The typical parking structure framing is long-span with three-foot deep structure.

Option-A (Preferred):

The Option-A structure provides 152 spaces in a one-way 90-degree parking configuration on two parking levels (see Appendix E). The lower-level digs into the hill to the east and south while the upper-level generally follows the grade of the existing lot. Option-A is designed as an "open garage" in order to provide greater user-friendliness and cost-effectiveness. This is achieved by adding provisions for natural ventilation, which in turn allows for natural light and open stairs. In order to classify as an open structure, ventilation openings to below grade were added along South Russell Street, the north-east/southeast corners of the upper-level, and along the east face retaining wall of the lower-level.

Pedestrian access and egress to the structure is provided by means of two covered open stairs located in the northwest and southwest corners of the structure. The small set of granite steps located at the east bounding wall has been relocated to the south wall to maintain pedestrian access to Burial Hill.

The 90-degree parking layout provides for an efficient design. The upper and lower parking levels are accessed utilizing the sloped grade of South Russell Street. For the purposes of user friendliness, costs and ease of construc-tability, internal ramping was not provided. One-way traffic flow is utilized to guide drivers past all stalls, and because there are fewer decisions to be made there are fewer conflict points. An overhead bar will be added to the entrance to the upper level to restrict the size of vehicles. ADA guidelines call for six (6) accessible spaces where 151 to 200 spaces are provided for public use. These spaces have been located on the upper-level near the southwest stair.

The north and south ends of the structure follow the shape of the lot and abut or encroach on the existing stone walls. These walls will need to be reconstructed over the new retaining walls surrounding the lower-level to maintain fidelity to their original location.

Below is a brief summary of the pros and cons of the Option-A design.

Pros:
- Efficient layout at 329 sf/space
- Simple one-way traffic loop
- Flat plates with no ramping to impede vision, and constructability
- Level facade
- Generally maintains the grades of existing lot
- Naturally ventilated
- Open Stairs
- No dead ends

Cons:
- No future vertical expansion
- Requires reconstruction of existing stone walls and relocation of small granite stair
- If someone enters the lower level and is unable to find a parking space, they will need to drive around the block to re-enter the upper level

Option-B:

The Option-B structure provides 151 spaces in a two-way 90-degree parking configuration on a continuous ramped-helix (see Appendix E). Vehicular entry to the structure is located on the northwest corner of the lower-level off of South Russell Street. Circulation continues up a ramp in a counter-clockwise manner at a 5% slope for one and three-quarter revolutions and then dead-ends onto an extended ramp on the east side. The rise of the sloping ramps helps to reduce the amount of excavation required for the lower-level and results in a more open perimeter for natural ventilation. A stair is provided on the extended dead-end ramp to allow access to the egress stair on the northwest corner. This dead-end ramp was added in order to roughly yield the same number of spaces as Option-A. The ramp can be seen in elevation off of South Russell Street extending up and blocking some of the view of Burial Hill. If the extended ramp is removed this would result in a loss of roughly thirty spaces.

Like Option-A, 90-degree parking was used for an efficient design, however, it differs in that two-way flow is required to allow for vehicle exiting. A turn-around space was provided at the dead-end.

Like in the previous option, six accessible spaces are required, of which, four of these spaces are located on the lower-level near the northwest stair. The remaining two spaces are located on the upper-level around the southeast stair. The required van accessible space was located at the lower-level to minimize the amount of excavation need along the ramp due to the fourteen (14) inches of additional clearance required for van accessible spaces.
This ramped option was added to study the effects of a design that could allow for future vertical expansion.

Below is a summary of the pros and cons of this design.

Pros:
- Efficient layout at 319 sf/space
- Expandable for future parking
- Reduces excavation
- Naturally ventilated
- Open Stairs

Cons:
- Dead-end at the top
- Extended ramp-up blocks some of the view of Burial Hill
- Sloped floors obstruct user vision
- Sloped façade is not architecturally pleasing
- Requires reconstruction of existing stone walls

Option-C:

The Option-C structure provides 130 spaces over two (2) levels with a one-way 90-degree parking layout on the upper-level and a one-way angled parking layout on the lower-level (see Appendix E). The lower-level digs into the hill to the east and south while the upper-level follows the grade of the existing lot. This option was conceived in order to maintain the existing stone walls without disturbance by shrinking the basement level by offsetting the basement walls roughly fifteen (15) feet from the existing stone walls. The upper-level approximately follows the shape of the site as in Option-A and extends beyond the lower-level basement walls. Because Option-C maintains the existing grade, and the upper-level extends beyond the lower-level, access to the existing granite stair could remain in its current location. However, this also causes the lower-level to be enclosed and keeps it from meeting the "open garage" classification. Mechanical ventilation, sprinklers, and enclosed fire-rated stairs would be required for this option. This would result in higher construction, operational, and maintenance costs and due to its enclosed nature, the structure will be less user-friendly.

As in the previous options, egress stairs are provided on the northwest and southwest corners along South Russell Street. The ADA spaces are located around the southwest stair. Like Option-A internal ramping was not provided; the parking levels are accessed utilizing the sloped grade of South Russell Street. The upper- level utilizes one-way 90-degree parking while the lower-level utilizes one-way 60-dgree angled parking. The angled parking was used to shorten the east-west width of the garage allowing it to be pulled further away from the stone walls.

Pros:
- Simple one-way traffic loop
- Generally maintains grades of existing lot
- Preserves existing stone walls
- Preserves existing granite stair to Burial Hill

Cons:
- Least efficient
- Fewest number of spaces
- No future vertical expansion
- Additional costs for ventilation, sprinklers, operations, and maintenance
- Enclosed stairs increase security risks, and are less user-friendly

VII. ARCHITECTURAL DESIGN

Once a configuration for the parking deck was agreed upon, DBVW Architects developed renderings of what the deck might look like within the context of Burial Hill and the neighborhood. The following key considerations were important in determining the size, configuration, materials and architectural style of the proposed design:

- Respect historic context, particularly Burial Hill
- Create a pleasing experience along South Russell Street, including preservation of the stone wall along the street
- Minimize impact on historic houses on opposite side of South Russell Street
- Utilize the architectural "language" developed for the new Town Hall

Architectural renderings of the proposed parking deck appear on the following pages. The design features brick piers with granite caps along South Russell Street to relate to the brick and granite materials that are in employed in the design of the new Town Hall across the street. The decorative fence between the brick piers that encloses the parking deck matches the decorative fence that is being used along Russell Street. The open stairs at the northwest and southwest corners of the parking deck are covered by gabled roofs that mimic the scale and design of the two pavilions that house the public restrooms on the east side of Town Hall.

5. Parking deck from South Russell Street (looking southeast)

6. Parking deck from South Russell Street at night

7. Parking deck from top of South Russell Street (looking northeast)

8. View looking south along South Russell Street (with new Town Hall at right)

9. Parking deck from Burial Hill (looking west)

10. Parking deck from Russell Street (looking east)

VIII. OPINION OF PROBABLE COST BY SIMON DESIGN ENGINEERING

The following summarizes an Opinion of Probable Construction Cost for the preferred Option-A structure. Please note that SDE has developed the following opinion from extensive experience of unit costs gathered from regional construction of similar structures of size and complexity. Recognizing that SDE has no control over the cost of materials, equipment, labor, or an individual contractor's method of determining prices, we do not offer guarantees that the actual construction costs will not vary from this statement of opinion. The costs include 5% design contingency, builder's fee, insurance and escalation through end of the calendar year 2016. It is customary for construction materials and labor costs to rise at approximately 3-4% per year.

Soft Costs and Land Costs:
Soft costs may vary depending on the methodology of delivering the project. Soft costs generally would include full architectural and engineering services, soils report, site surveys, title reports, permits and inspections, testing, traffic impacts, construction management, cost estimating, and project management. No soft costs, land costs, or financing costs were included in the following cost estimates.

Base Construction Cost:

Parking Design:	Option A (Preferred)
Total Parking Spaces:	152
Total Area:	50,000 sf
Base Construction Cost:	$3,178,000
Base Cost/Space:	$20,908
Base Cost/SF:	$63.56

Inclusions:
1. General conditions, project management and supervision costs for a period of 24 weeks
2. Union labor during normal working hours
3. Reinstalled water retention system
4. Brick Spandrel Exterior Façade
5. Decorative Pedestrian Fall Protection
6. Covered Stairs
7. Reconstructed Stone Walls

Exclusions:
1. All soft costs for design, approvals, and project management
2. Bonds
3. Cost Escalation beyond Calendar year 2017
4. State Sales Taxes
5. Inspection fees
6. Construction-related testing services
7. Fire watch details
8. Environmental Engineering
9. Testing, removal, disposal or handling of hazardous materials
10. Removal or handling of unsuitable materials (Ledge, rock, organic, etc.)
11. Special dewatering costs
12. Site specific order of conditions
13. Utility company connection fees or back charges
14. Winter conditions
15. Landscaping
16. Power or Transformers
17. Parking revenue control equipment
18. Security Equipment

IX. NEXT STEPS

Ideally, the proposed parking deck will be constructed within the schedule of construction for the new Town Hall. The Town Hall is currently scheduled to be completed in October 2017. In order to be completed at approximately the same time, the following next steps are recommended and should occur as soon as possible.

A. Conduct geo-technical investigations including test pits to determine overall soil quality, ground water depth, presence or absence of ledge and/or other obstructions.
B. Conduct more detailed site survey.
C. Engage architect and engineer to develop construction documents.
D. Obtain any necessary relief and approvals from Town agencies.
E. Determine bidding and procurement requirements.

X. PROJECTED TIMELINE

The following time frame should be considered when making decisions to move forward in tandem with the ongoing construction of the new Town Hall.

Schematic Design (including site investigation):	2 months
Design Development (including approvals):	2-3 months
Construction Documents:	2-3 months
Procurement:	Not included
Construction: (if performed by current contractor)	6-8 months
TOTAL DURATION:	**12-16 months**

APPENDIX A

Site Photos

1. View of Burial Hill from intersection of South Russell and School Streets

2. View looking up South Russell Street

3. View of previous Burial Hill parking lot from top of South Russell Street

4. View of entrance to Burial Hill from top of South Russell Street

5. View of existing conditions looking northeast

6. View of existing conditions at northwest corner of site.

7. Existing stone wall along South Russell Street

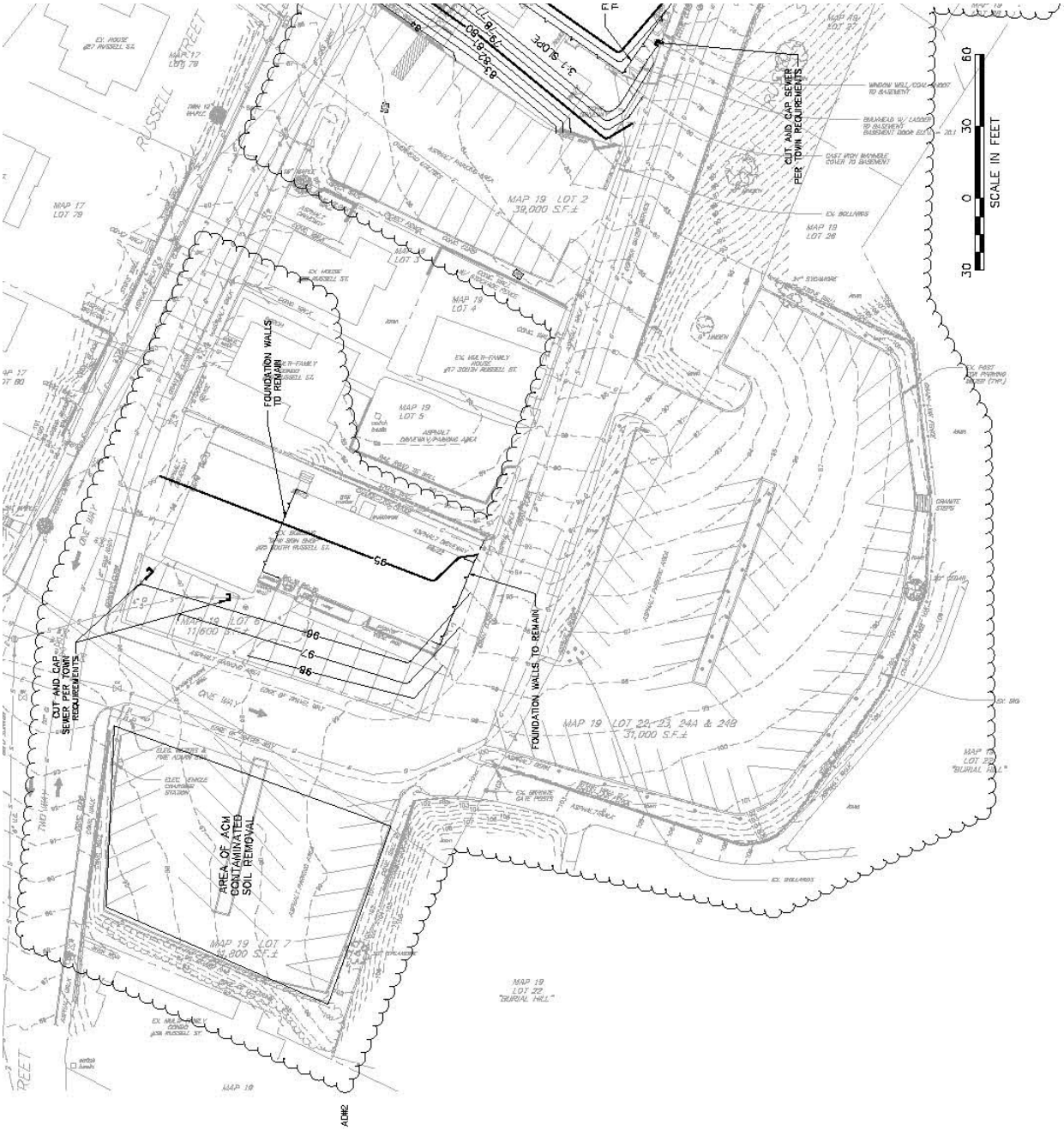
8. Existing stone wall at east edge of parking lot

9. Existing stone wall and steps at east side of parking lot

10. Stone wall at south edge of site

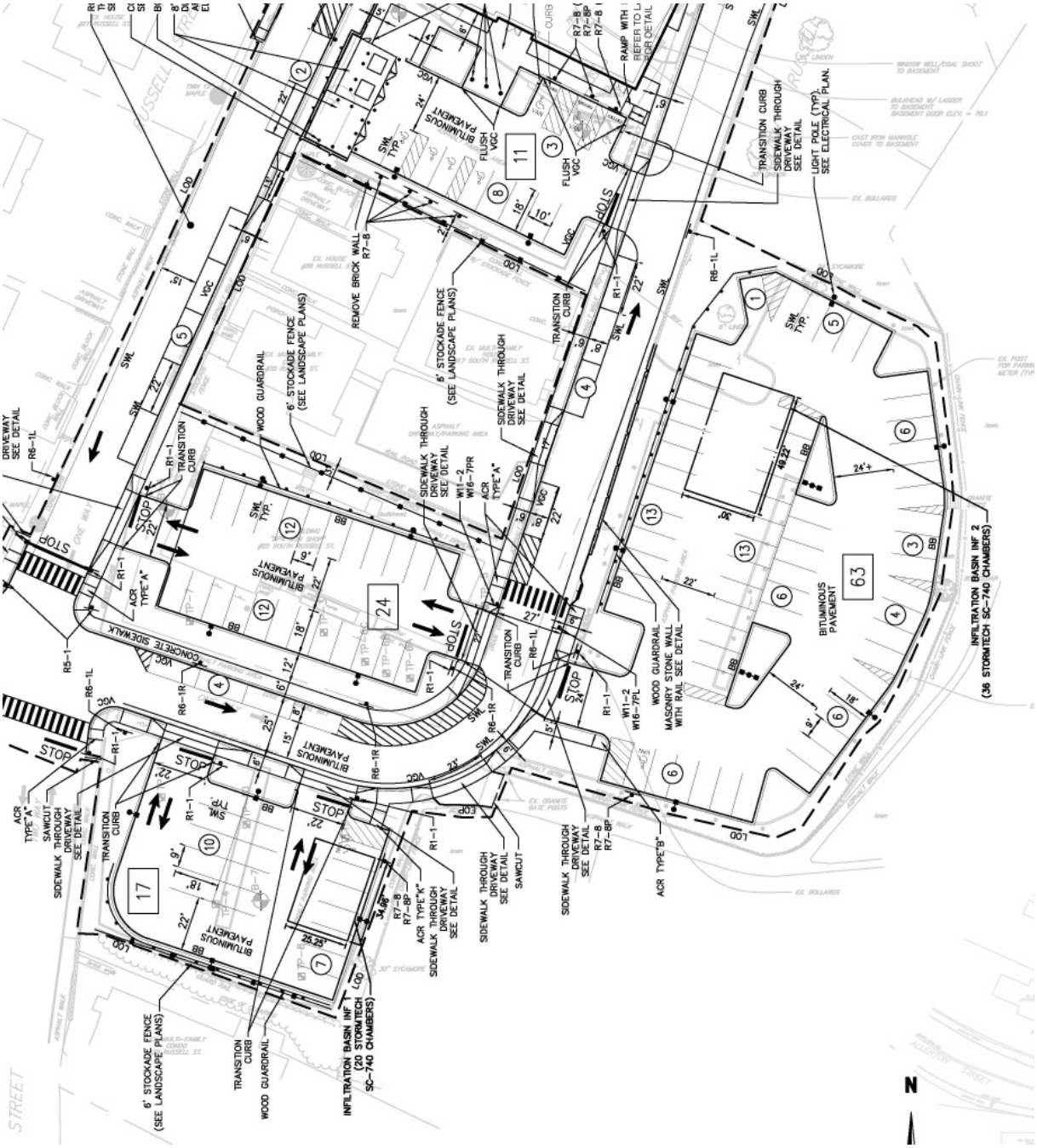
APPENDIX B

Pre-construction Site Plan



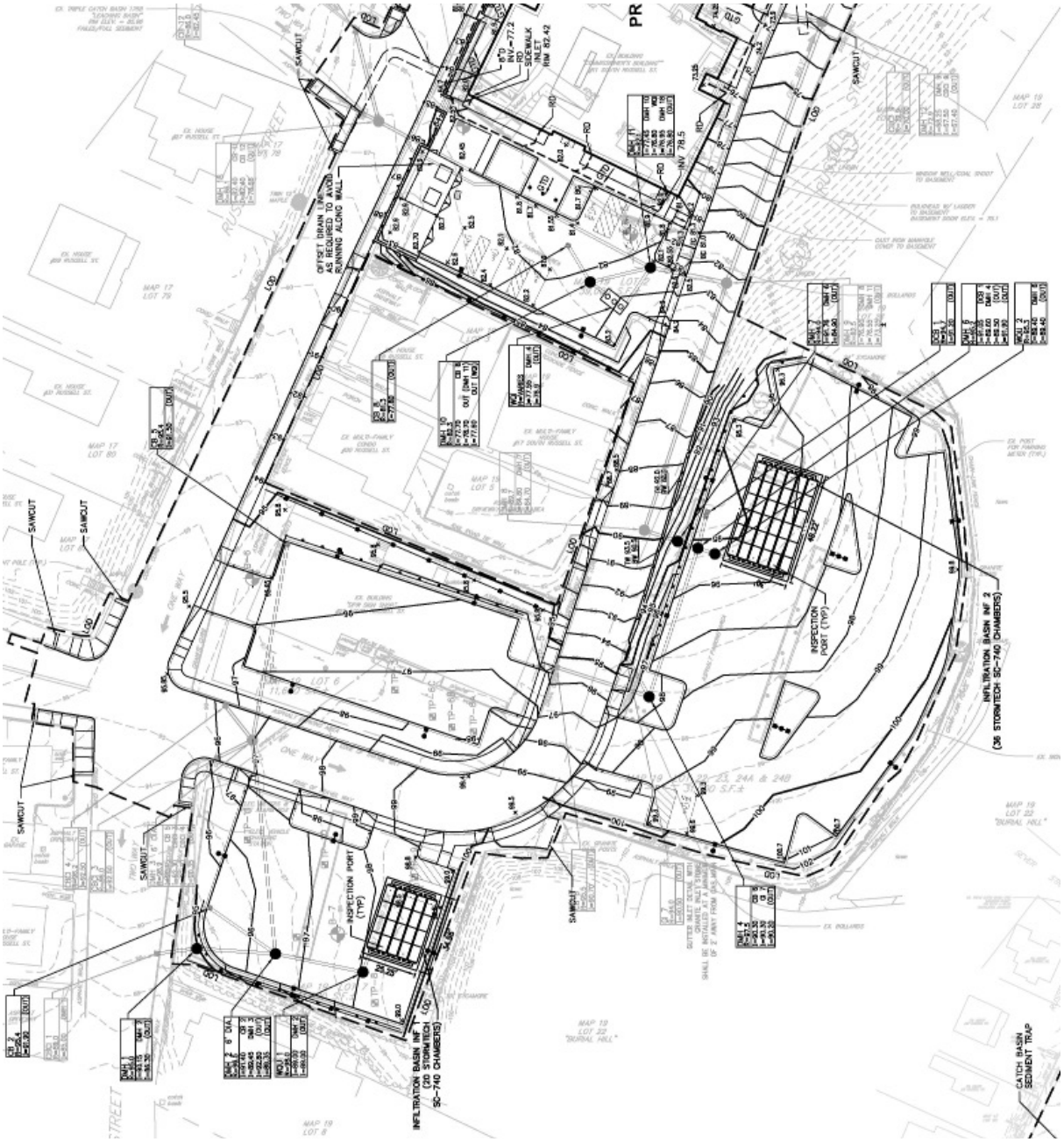
APPENDIX C

Existing Site Plan



APPENDIX D

Existing Drainage Plan



APPENDIX E

Breakout of Opinion of Probable Cost

PROJECT :	Russell Street Garage
LOCATION:	Plymouth, MA
DESCRIPTION:	2 Story OPEN Parking Garage

SIMON DESIGN ENGINEERING
42 Washington Street, Suite 300
Wellesley, Massachusetts 02481
Tel: 781.237.2226 ▪ Fax: 781.237.2272
info@sde-us.com ▪ www.sde-us.com

Est. Date: 08-Jul-16
Print Date : 08-Jul-16

DIVISION	DESCRIPTION		PROBABLE COST	Cars 152	SF 50,000	TOTAL PROBALE COST $/sf	
01100	GENERAL CONDITIONS		$135,000			$ 2.70	$135,000
01100	TEMPORARY CONSTRUCTION		$25,000			$ 0.50	$25,000
01150	PRECONSTRUCTION		$0			$ -	$0
02070	SHEET PILING		$325,000			$ 6.50	$325,000
02000	SITEWORK		$325,000			$ 6.50	$325,000
03000	CONCRETE & FORMWORK		$505,000			$ 10.10	$505,000
03450	PRECAST CONCRETE		$900,000			$ 18.00	$900,000
04000	MASONRY		$75,000			$ 1.50	$75,000
05000	STRUCTURAL STEEL		$100,000			$ 2.00	$100,000
05500	MISCELLANEOUS METALS		$100,000			$ 2.00	$100,000
06100	ROUGH CARPENTRY & JOBSITE LABOR		$50,000			$ 1.00	$50,000
06400	FINISH CARPENTRY		$0			$ -	$0
07200	FIREPROOFING		$0			$ -	$0
07270	FIRESTOPPING		$0			$ -	$0
07500	MOISTURE PROTECTION		$53,000			$ 1.06	$53,000
08000	DOORS & HARDWARE		$0			$ -	$0
08800	EXTERIOR CLADDING		$0			$ -	$0
09250	PLASTER & DRYWALL		$0			$ -	$0
09300	TILE		$0			$ -	$0
09500	ACOUSTICAL		$0			$ -	$0
09650	RESILIENT & CARPET		$0			$ -	$0
09800	SPECIAL COATINGS		$0			$ -	$0
09900	PAINTING		$14,000			$ 0.28	$14,000
10000	SPECIALTIES		$0			$ -	$0
11000	EQUIPMENT		$0			$ -	$0
12000	FURNISHINGS		$0			$ -	$0
13000	SPECIAL CONSTRUCTION		$7,000			$ 0.14	$7,000
14200	ELEVATORS		$0			$ -	$0
15300	FIRE PROTECTION		$32,000			$ 0.64	$32,000
15400	PLUMBING		$50,000			$ 2.03	$50,000
15500	H. V. A. C.		$0			$ -	$0
16000	ELECTRICAL		$158,000			$ 3.16	$158,000
	DIRECT CONSTRUCTION COST		**$2,854,000**			**$ 57.08**	**$2,854,000**
	CONTINGENCY	5.00%	$142,700			$ 2.85	$142,700
	BUILDERS FEE	5.00%	$149,800			$ 3.00	$149,800
	LIABILITY INSURANCE	1.00%	$31,500			$ 0.63	$31,500
	TOTAL BASE CONSTRUCTION COST		**$3,178,000**			**$ 63.56**	**$3,178,000**
	SOFT ARE COSTS NOT INCLUDED						

APPENDIX F

Parking Options

Option A (Preferred)

Option B

Option C