October 22, 2021

Mr. Wayne Chubb
Hobbs+Black Architects
100 North State Street
Ann Arbor, MI 48104

**RE:** ***200 Lake Street Wayzata – Feasibility Study for Subsurface Structure***

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Mr. Wayne Chubb,

Hobbs+Black Architects engaged Kimley-Horn and Associates to assist in providing design of the subsurface structure below the ground water for the new building at 200 Lake Street in the City of Wayzata. The purpose of this report is to serve as formal documentation of Kimley-Horn's recommendations for dewatering and waterproofing the subsurface structure.

Kimley-Horn had a phone conversation with the City of Wayzata's engineer, Mr. Michael Kelly, PE, on October 20, 2021. Based on the recent phone conversation with Mr. Kelly, we understand there to be three items the City would like included by the design team. These items are the following:

- #1: Temporary management of the ground water during construction
- #2: Permanent management of the ground water after completion of construction and over the life cycle of the building
- #3: Durability of the subsurface foundation structure below the ground water

## PROJECT DESCRIPTION

The project is located at 200 Lake Street E, Wayzata, MN. The site is being developed into an east and west building. Both buildings will have three levels above grade plus a subsurface structure connecting the two buildings, which is the focus of this report. The first floor, second floor, third floor and roof structure is anticipated to be concrete construction (either post-tensioned or precast).

## RECOMMENDATIONS

Kimley-Horn has extensive experience in designing subsurface structures that extend to and below the ground water level. Based on our analysis of the geotechnical report, architectural concept drawings, and standard design practice, Kimley-Horn has developed an outline for a reasonable approach to constructing this subsurface structure. Three design items for consideration are listed under separate headings followed by a bulleted list of recommendations. This report and the recommendations provided are not intended to be a final design; this shall be done at the construction document stage. Based upon our past project experience and expertise, we offer these recommendations.

### #1 Temporary Management of Ground Water

Kimley-Horn advises the Architect to consider the following recommendations during construction to manage the ground water.

- Temporary dewatering shall be provided by the contractor to allow for excavation below the ground water elevation.
  - Well points or boreholes along the perimeter of the excavation are suggested.
- As the site is dewatered, the ground water shall be collected into a portable holding tank and transported to a treatment facility where the ground water can be disposed.
- We advise that the ground water not be directed into the City's sanitary or storm systems. In the event testing proves the ground water is not contaminated with metals, diesel fuel, oil, or other contaminates, there may be a possibility to discharge into the storm system at a controlled rate.
- Consider that if enough ground water is extracted from the site, it may require a permit through the MN DNR. Their website lists 10,0000,000 gallons per year as the threshold.
- There is knowledge of contaminated soils on the site. These soils shall be remediated as part of the construction project. The ground water collected during construction shall be tested for contamination and be treated if contaminated.
- The temporary dewatering system shall remain in place until construction of the structure is completed since the dead weight of the structure will counteract the upwards buoyant force exerted by the ground water.
- Normal erosion control and BMP practices shall be used for the project. A flocculation tank shall be used to prevent sedimentation from leaving the site with the ground water.

### #2 Permanent Management of Ground Water

Kimley-Horn advises the Architect to consider the following recommendations and incorporate them into the final design of the building.

- A ***passive*** system shall be used to manage the ground water over the life cycle of the building (after construction is completed). The following is our recommendation for a ***passive*** ground water management system.
  - Soil borings and monitoring wells completed by NTI indicate that ground water is currently perched above a layer of clay. This clay layer shall be removed to allow for proper drainage of the soil strata. The recommendations of the geotechnical engineer shall be followed for removal of clay soils.
  - A drainage mat shall be installed at the exterior of the subsurface structure along the vertical surface of the foundation wall to help guide the ground water away from the subsurface foundation walls.
  - The design team shall specify a robust waterproofing system; see item #3 of this report.

**#3 Durability of the Subsurface Foundation Structure Below Ground Water**

Kimley-Horn advises the Architect to consider the following recommendations and incorporate them into the final design of the building. The passive ground water management system as described in item #2 will help to mitigate effects of ground water on the subsurface foundation structure. Kimley-Horn recommends the design team consider the subsurface foundation structure to be fully submerged in the ground water when completing the design (assuming the passive system described in item #2 is not in place to assist in guiding the water away from the building). This is conservative.

- The assumed ground water elevation to be used for design is important in the design of the subsurface foundation structure. The OHWL for Lake Minnetonka is 929.4 ft. In lieu of the OHWL elevation, Kimley-Horn recommends the design team uses the maximum lake elevation reported over a 100-year period. MN DNR lake elevation data, dating back to 1906, was studied by KH. The maximum lake elevation recorded was 931.11 ft. KH recommends that ground water elevation to be used for design be set to 931.11 ft.
- The ground water will exert a horizontal pressure on the subsurface foundation walls and a vertically upward buoyant pressure on the superstructure. These forces shall be considered in the design of the subsurface structure.
- Kimley-Horn has performed design-check calculations on the structure type proposed for the building. We have determined there is sufficient structure dead load to resist building buoyancy under the effects of ground water. The dead load only was used for this design-check.
- Kimley-Horn has performed a preliminary study on the strength of the subsurface foundation structure to resist these ground water pressures. We recommend the following subsurface foundation structure be utilized in design.
  - 2-foot-thick mat foundation with a double mat of steel reinforcement, which will support the interior concrete columns and the exterior concrete subsurface foundation walls.
    - A mat foundation design assumes that a shallow foundation is allowed. If a deep foundation system is required (which we understand may be the case for the east building), then the mat foundation thickness may be decreased by installing intermediate deep foundation elements between column locations to act as a tie-downs resisting the ground water buoyant force.
  - 20-inch-thick concrete foundation walls along the building perimeter with a double mat of steel reinforcement.
  - Steel reinforcement in contact with the ground water shall be epoxy coated.
  - Properly designed concrete mix for the subsurface foundation. We recommend the following concrete mix design requirements: fc' = 5,000 psi minimum strength, 4.5%-7.5% air entrainment, max water to cement ratio = 0.40, and a liquid crystalline admixture.
  - Slight adjustments may need to be made regarding column layout. Those details shall be sorted through during the design phase.
- Vertical surfaces below grade (subsurface foundation walls) shall be covered with a continuous robust waterproofing system. This waterproofing system shall include a hot fluid applied rubberized asphalt waterproofing membrane, fabric reinforcement, drainage panels, flashings, and a protective cover.

- The mat foundation system shall be waterproofed by fully wrapping its surfaces in bentonite waterproofing.
- Joints between waterproofing elements shall be sealed with a quality sealant.
- Durable water stops shall be used at concrete cold joint locations.
- Kimley-Horn has developed a waterproofing specification (071400) and joint sealant specification (079000) for design scenarios similar to this. If selected as the engineer of record, we will work with the Developer to include these specifications into the construction documents. A sample of these specifications are attached to this report as *Attachment #1 and Attachment #2*.
- Waterproofing systems shall carry a product and installation warranty of 5 years minimum.
- Inspections shall occur during installation of the waterproofing materials and joint sealants. Specifically, a flood test shall be performed per ASTM D5957.
- Special consideration shall be given to final design details, such as the following:
  - The sill height for openings in the foundation wall shall be greater than 2 feet above the 100-year maximum water elevation.
  - Points of entry to the subsurface structure shall daylight at an elevation above the 100-year maximum water elevation.

## SUMMARY

Thank you for the opportunity to assist you in this feasibility study. We are confident that there is an achievable solution to this engineering challenge and that we can deliver a successful project for the Architect, the Developer, and the City of Wayzata.

Please contact either Richard Kirchner or Michael Brandt should you have any questions.

Sincerely,

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I hereby certify that this report was prepared under me or my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Attachment #1: Sample from KH Specification 071400 Waterproofing
Attachment #2: Sample from KH Specification 079000 Joint Sealants

**SECTION 07 12 00**
**HOT FLUID APPLIED WATERPROOFING**

PART 1 GENERAL

1.1 SUMMARY

A. Section includes hot applied rubberized asphalt waterproofing, with fabric reinforcement; drainage panels and protective cover.

B. Section includes waterproofing of all horizontal surfaces on the plaza deck specified to receive waterproofing as well as vertical walls of all planters specified to receive waterproofing. The waterproofing system is expected to be continuous as indicated in drawings.

1.2 REFERENCES

A. ASTM International:
1. ASTM D4258 – Standard Practice for Surface Cleaning Concrete for Coating.
2. ASTM D4259 – Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application.
3. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
4. ASTM D4541 – Standard Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
5. ASTM D5957 – Standard Guide for Flood Testing Horizontal Waterproofing Installations.
6. ASTM D7877 – Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes

B. National Roofing Contractors Association:
1. NRCA - The NRCA Waterproofing and Dampproofing Manual.

*Attachment 1: Sample from KH Specification 071400 Waterproofing*

**SECTION 07 90 00**
**JOINT SEALANTS**

PART 1 GENERAL

1.1 SUMMARY

A. Section includes: Installation of sealant and backing materials within, around, under and between elements of the waterproofing, cladding, doors, sheet metal flashing, and joints between dissimilar materials and changes in plane.

1. Wall to floor joints (Type 1)
2. Sealant for sheet metal flashings and exposed above grade joints (Type 2)
3. Sheet metal laps (Type 3)

B. Refer to Section 07 12 00 – Hot Fluid Applied Waterproofing for flashing specifications that directly apply to the installation of the Hot Fluid Applied Waterproofing.

1.2 PERFORMANCE REQUIREMENTS

A. Provide joint sealants for exterior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

B. Compatibility and adhesion test reports from sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for

*Attachment 2: Sample from KH Specification 079000 Joint Sealants*