

VII. RELOCATION OF UNDERGROUND STORM RETAINAGE SYSTEM (UGS)

BACKGROUND:

Carderock Springs Elementary School has an underground storm water retainage system (UGS) to manage volumetric flow of water from its site to the public storm sewers. At the current location the UGS is located about 18 feet below one of the highest points on the site. This requires deep excavations that are more costly and take longer to dig. Also at its current location, it cuts off a very critical access point to the site and building during critical stages of the construction sequence.

This analysis will look to relocate the system to a lower location saving on installation costs. The primary benefits will come from greater site utilization. This will allow more crews to work on substructure components simultaneously at different parts of the building. This will help to accelerate the schedule. It is important that substructure and superstructure activities, such as the installation of footings, slabs on grade, and steel structure, be monitored closely since they are on the critical path and can affect the schedule duration many months later.

METHODOLOGY AND STEPS:

This analysis will first highlight the proposed relocation area of the site. Next it will analyze the cost difference between placing the system at different elevations of the site. It will then review areas of the schedule that can benefit from achieving access to 'area B' of the building earlier. Last a new site utilization plan will be created to take advantage of greater amounts of space.

RELOCATION OF UGS:

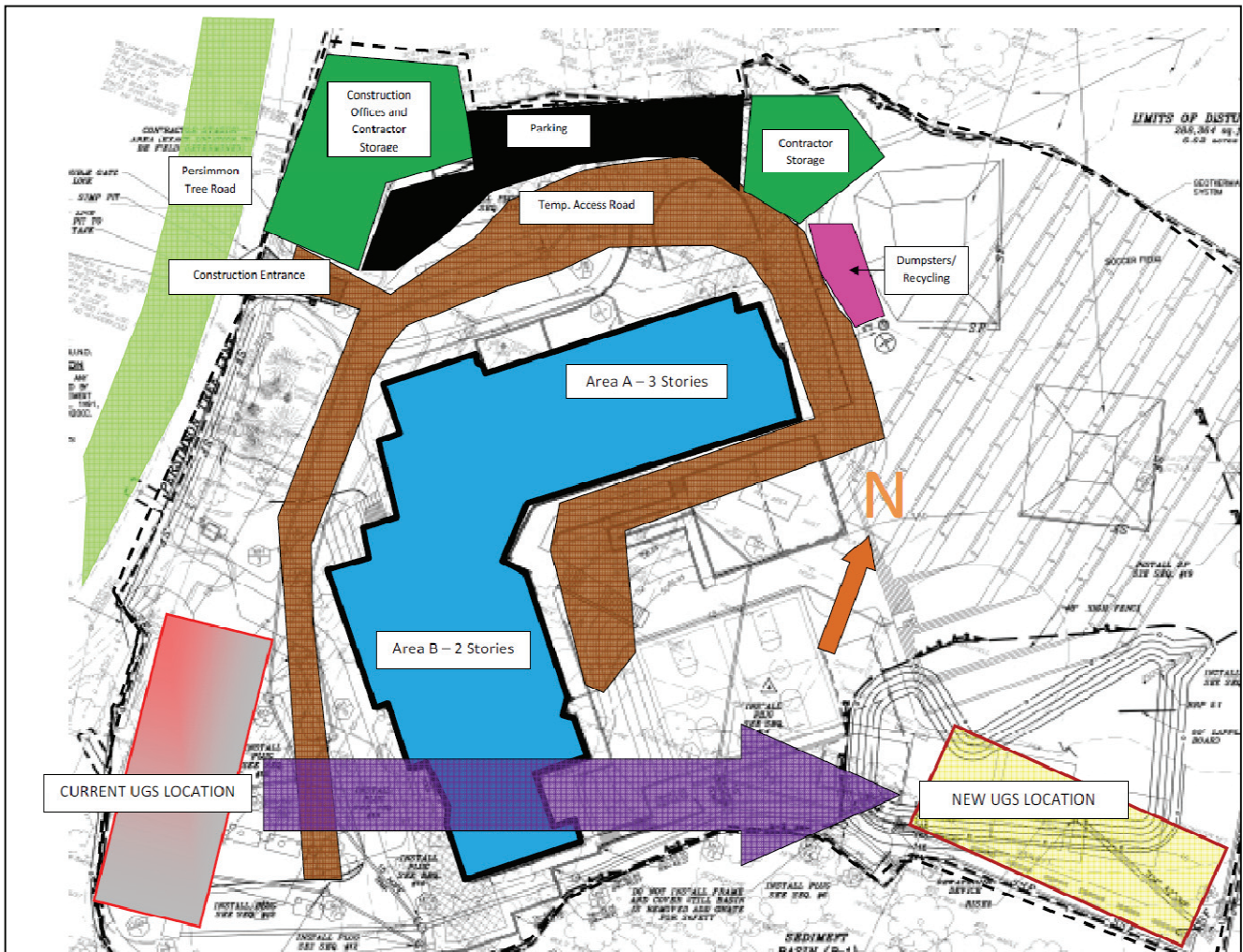


Figure 16 - Relocation of UGS Plan

The figure above shows the new location of the UGS. It will move from being very close to Area B of the building footprint to an unused corner of the site. This new location will be on the edge of the site conservation area where trees must be preserved. This new location will allow for a greater utilization of the site near Area B for material storage, parking, and material staging.

COST COMPARISON:

This comparison is being made by simply “lifting up” the system and moving it to a new location. This means that there will be no difference in the actual cost of the system as it is engineered. The following assumptions were made:

- The engineering of the system would not be affected by relocation
- The new location would not require any additional storm structures
- There are no unknown soil conditions in the area that could affect the structural support
- Identical crew sizes will be used at the new location
- RS Means 2010 was used to find cost and labor output or duration
- The excavation totals were calculated using 45 degree slopes on the excavation limits to adhere to safety regulations. This was common practice on this site. At times, trench boxes were also used to protect the workers.

Table 7 - Excavation Takeoff Summary

Location	Quantity	Description	Daily Output	Duration (8h work days)	Labor Hours	Unit	Mtrl.	Labor	Equip.	Total	Labor Total	Equip Total	TOTAL COST
ORIGINAL	7286	Excavating, bulk bank measure, 3 C.Y. capacity, backhoe, hydraulic, crawler mounted	2080	7.3	0.008	CY	\$ -	\$ 0.23	\$ 1.13	\$ 1.36	\$ 1,676	\$ 8,233	\$ 9,909
NEW	3643	Excavating, bulk bank measure, 3 C.Y. capacity, backhoe, hydraulic, crawler mounted	2080	3.6	0.008	CY	\$ -	\$ 0.23	\$ 1.13	\$ 1.36	\$ 838	\$ 4,117	\$ 4,954
DIFFERENCE											\$ 838	\$ 4,117	\$ 4,954

Cost Results:

- The difference between the excavations is about \$5,000.
- There is no savings in general conditions since relocating this work would take it off the critical path.

NEW SITE UTILIZATION PLAN:

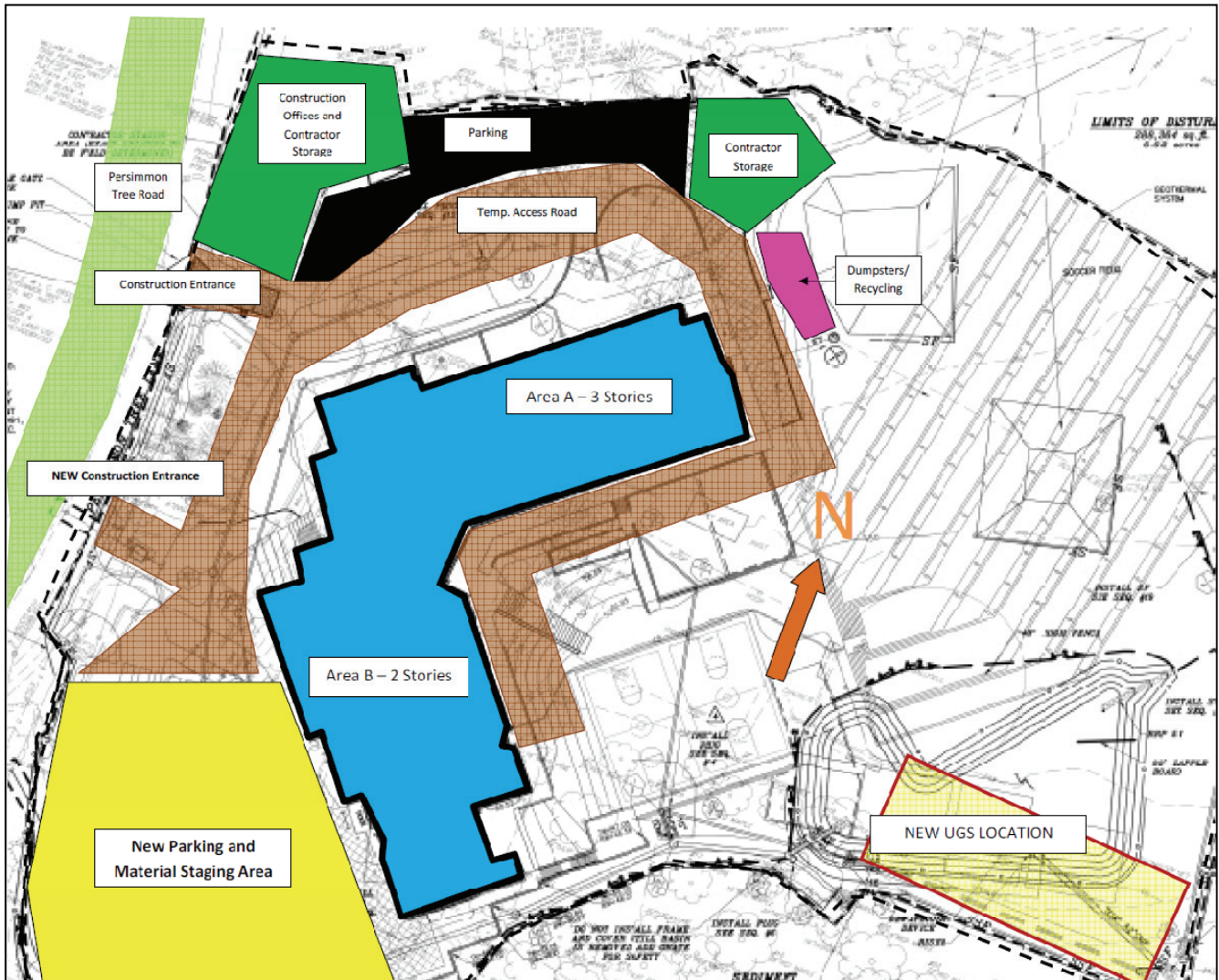


Figure 17 - UGS Relocation Site Utilization Plan

The new site plan opens up a generous area that was previously allocated only for the sitework contractor during the installation of the UGS. This area will also allow for more parking and material storage. During this phase, the masonry contractor began delivering CMU for foundation walls and exterior wall systems. Previously shipments had to equal only about 2-3 days work. With more storage they can receive larger deliveries saving them valuable time in material staging. The greatest benefit will be unrestricted access to Area B by the concrete contractor who will install foundations and slabs on grade. With access to this area they can add another crew and work in Area A and B simultaneously to do slab work and finish foundations. This will allow them to pour both areas at the same time which will them to save money. Concrete pours also take precedent on the site over deliveries and construction traffic. Pouring at the same time will limit restricted traffic patterns on site.

SCHEDULE ANALYSIS:

In order to accelerate the schedule in this scenario, additional crews will have to be used to work simultaneously in different areas. This will be possible since the restrictions that were on Area B will be lifted by relocating the UGS to the new location. The relocation will allow for other contractors such as the concrete contractor to get their equipment into the area to prepare the substructure and slabs. By doing so, and working simultaneously in two areas they can achieve a 20-30 work day schedule reduction.

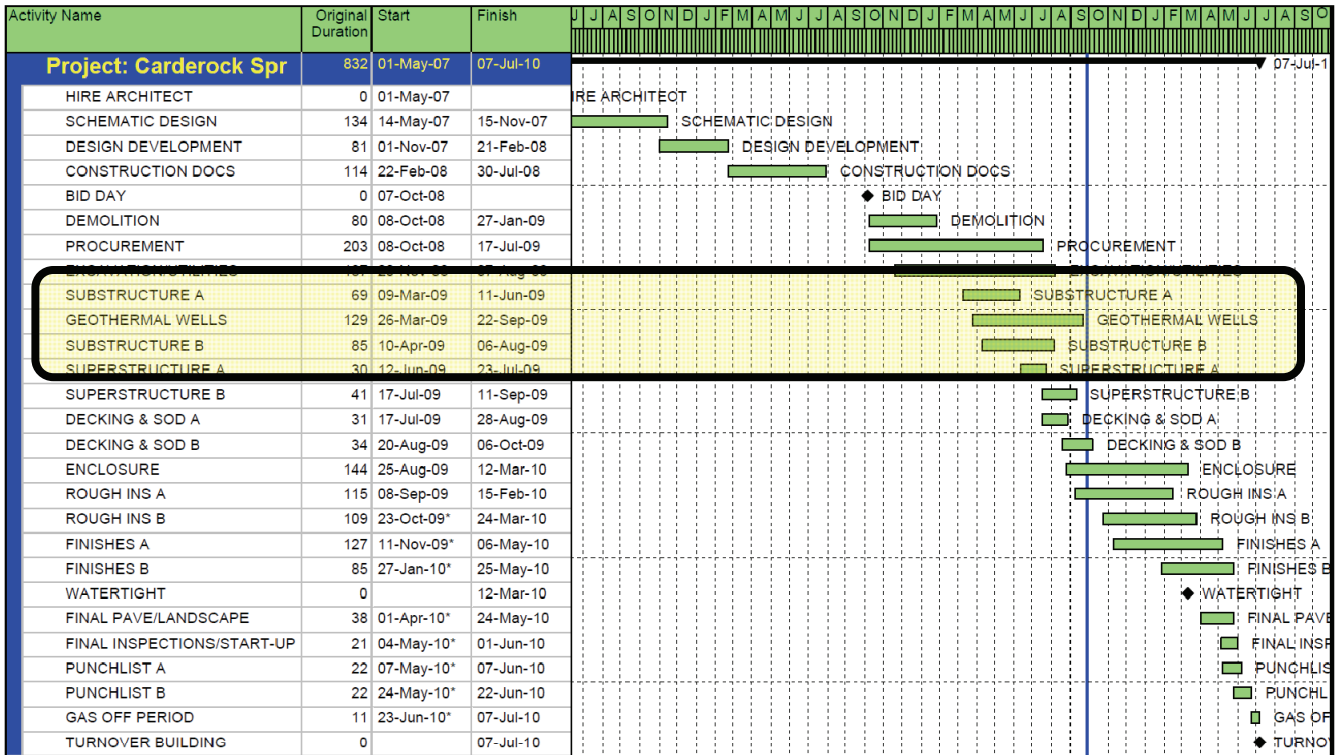


Figure 18 - UGS Schedule Analysis

The primary activities to be monitored during this period will be footings, underground rough-ins, poured concrete and CMU foundation walls, slab pours, and exterior CMU course patterns. Another important consideration in the success of this scenario will be the need for close coordination by the superintendent. It will be critical that close supervision and extensive quality control be utilized to prevent any problems from arising. It will be important to maintain a team atmosphere during this stage since multiple contractors will be working together to accelerate the schedule by a month. They will also have to be very diligent that all of their work is planned for and installed to the specification's quality and performance standards. By referencing the General Conditions estimate (pg. 21), saving a month of time correlates to a budget savings of about \$94,000. Also, starting from the beginning of demolition to building turnover, this acceleration represents a duration reduction of 9.1%.

CONCLUSION:

This analysis shows how building design greatly affects the construction process. By moving the UGS (with assumptions noted), it is shown how greater access to areas of the site can reveal opportunities for schedule acceleration. This translates to significant cost savings, especially in the general conditions. Although the difference in excavation costs is negligible, the CM Hess Construction + Engineering Services, could increase their margins on this project significantly by utilizing increased manpower from the trades on site.

In summary the results show that about \$94,000 can be saved in general conditions costs from a schedule reduction of about 9.1%. This makes this scenario extremely desirable if it could be applied to the project. The variables that could negatively impact the scenario include: supervising more trade members at the same time; coordinating larger deliveries of materials and concrete; maintaining quality control in multiple areas; and managing contractors' interactions in close working areas. This would require planning up front but could provide great benefits on the back end of the project by saving time and money.

SEE APPENDIX D FOR RS MEANS SUPPORT