Appendix II
Construction Logistics – Fjord Trail South
II-2: Construction Logistics Report (South)

ARUP SCAPE

Hudson Highlands Fjord Trail

Shoreline Trail | Schematic Design

Construction Logistics Report (South)

Reference: 295084-SLT-REP05-CLR(South)

00 | February 23, 2024

Job number 295084-00

Arup US, Inc.
77 Water Street
New York, NY 10005
USA
arup.com

Contents

Tables

Figures

Appendices

1. Introduction

The Hudson Highlands Fjord Trail is a proposed linear park in the Hudson Highlands, spanning 7.5 miles with a walkable and bikeable trail between the City of Beacon and Village of Cold Spring in New York State. The Shoreline Trail ("the Project" or "SLT") is a 2.5-mile accessible segment of the trail planned between Breakneck Bridge and Dockside Park, consisting of trail sections that are on structure and paths that are on grade.

© Scape Landscape Architecture DPC

Figure 1 – Shoreline Trail location map

The project is comprised of two sub-projects which will be constructed in two phases:

- Shoreline Trail (North) – from access point of Little Stony Point to the south abutment of Breakneck Bridge (BNB Abutment #6). This only includes the main trail through Little Stony Point and excludes all other improvements at that location. This will also include the Breakneck Lower Overlook and any landscaping elements around the south abutment, which were excluded from Breakneck Bridge.
- Shoreline Trail (South) – from the northern limit of Dockside Park to the access point of Little Stony Point.

Figure 2 – Shoreline Trail North/South Division

Hudson Highlands Fjord Trail, Inc. ("HHFT") was formed in January 2020 as an independently managed non-profit subsidiary organization of Scenic Hudson, Inc. HHFT will be responsible for operating and maintaining the entire trail, including the Shoreline Trail. HHFT and the New York State Office of Parks, Recreation and Historic Preservation ("OPRHP") are working in partnership to advance the project through environmental permitting, procurement, and construction.

HHFT has commissioned Arup US, Inc. ("Arup") to complete the schematic design of the Shoreline Trail. Scape Landscape Architecture DPC ("Scape") will serve as the lead design consultant and subconsultant to Arup. SLR Consulting Limited ("SLR") has been retained as the wetland ecologist and Manuel Miranda Practice ("MMP") for signage and wayfinding design.

About the Work ("AtW") are acting as owner's representative for HHFT and have been responsible for management and direction of Arup's services.

The scope is this report is to describe the design development, provide consideration of construction logistics for the on-grade sections of trail, and provide high-level schedules for construction of the trail.

2. Design Development

This section provides a description of the design schemes for the different sections of trail within Shoreline Trail (South).

2.1 On-Structure Trail

2.1.1 Foundations

- The base design is two 18 in. driven steel tube piles at each support.
- Pile lengths vary from 35 to 120 ft from pile cut off level. The typical spacing between supports is adopted as 20 ft, governed by equipment reach and capacities. A wall thickness of 0.625 in., which includes a sacrificial thickness of 0.2 in. for corrosion resistance, is used. The maximum distance between the mudline and pile cut off is 13 ft.

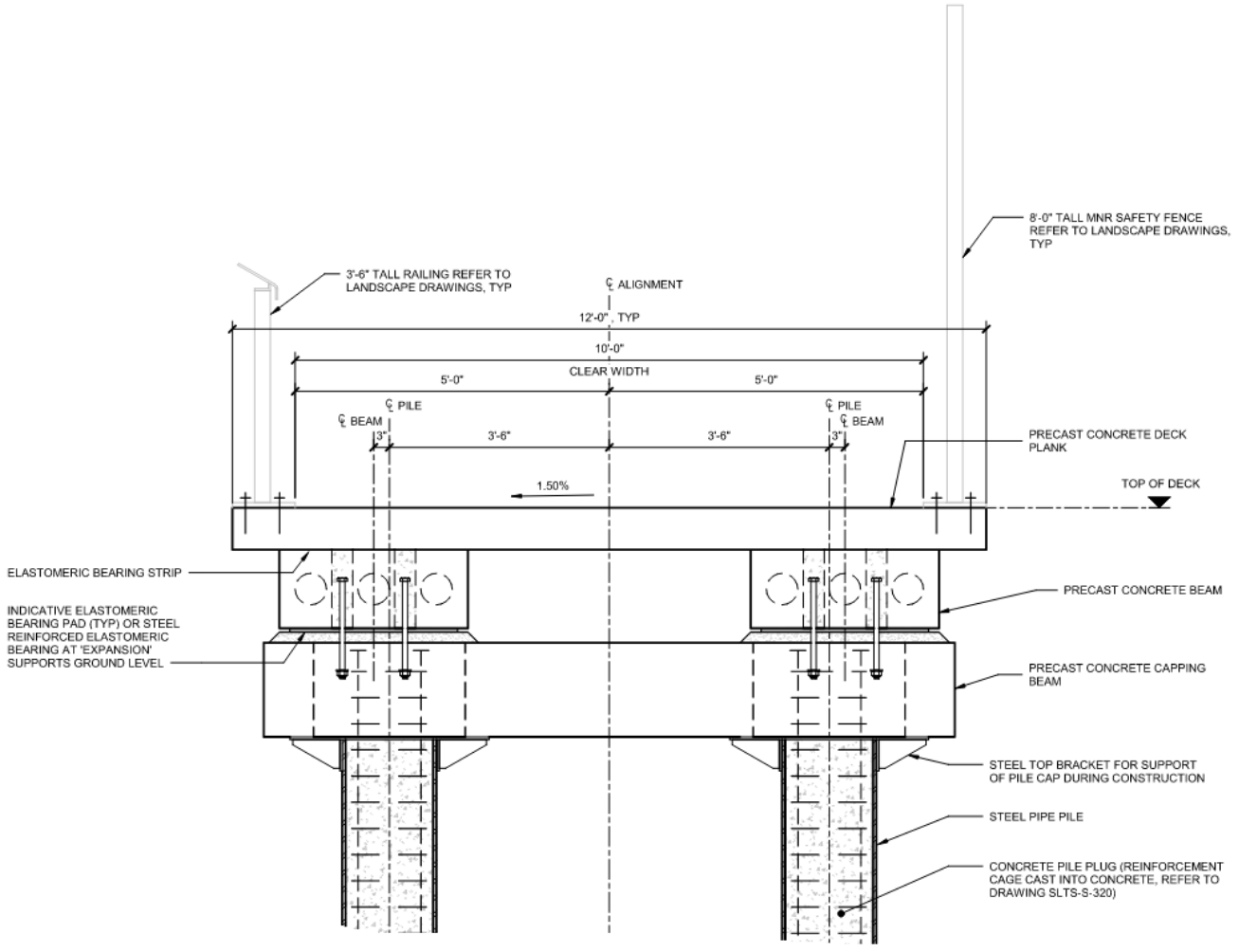


Figure 3 – Typical cross-section through on-structure trail.

- The first 12no. piers from LSP require the use of 4no. drilled micropiles at each support.
- Micropile lengths are anticipated to vary from 22 to 37ft from pile cut off level. All micropiles will have a 10ft socket into unweathered rock. The typical spacing between supports is adopted as 20ft, governed by equipment reach and capacities. A wall thickness of 0.5 in., which includes a sacrificial thickness of 0.2 in. for corrosion resistance, is used, along with a #14 central rebar.

2.1.2 Substructure

- A cast-in-place reinforced concrete plug extending approximately 8 ft below the mudline is used. This provides additional resistance to the pile to compensate for the loss of steel tube thickness as it corrodes over time.
- A precast concrete capping bam is adopted, with voids that are large enough to accommodate an assumed plan position tolerance of the driven steel piles of 6 in. at the pile head.
- The capping beam is temporarily supported on the pile tops by steel brackets fixed to the top of the pile, until the cast-in-place concrete stitch is constructed.
- Vertical anchor bolts are cast into the stitch to provide horizontal restraint to the superstructure beams. Elastomeric pads are placed on grout pads on top of the capping beams.

2.1.3 Superstructure

- Two 2 ft deep precast reinforced concrete beams are used to span between supports (typical span of 20 ft)
- The protruding anchor bolts from the capping beams are grouted into voids in the beams. Thermal expansion and contraction are accommodated using a compressible debonding material around the anchor bolts at typical 80 ft intervals.
- 8-in. thick precast reinforced concrete planks are supported on top of the beams. The total width of the planks is 12 ft to provide space along each edge for a handrail and 10-ft clear width. The planks are connected to the beams using anchor rods cast into the beams and grout pockets in the deck planks.
- Where the horizontal alignment of the on-structure trail is curved, straight beams are used between caps and the curvature is accommodated in the precast deck planks.

2.1.4 Trailbanks

- The two on-structure trailbanks use similar foundations to the main on-structure trail.
- The superstructure uses primary steel beams supported directly on the piles. The protruding threaded anchor bolts from the piles are inserted through holes in the beam’s connection plates and fastened.
- A secondary grid of steel beams forms the structural envelope of the platforms. This grid is bolted to the top of the primary beams.
- A steel mesh grating is supported on the secondary grid of beams and abuts (with a small gap) the edge of the main trail deck to provide a continuous surface.

2.2 On-Grade Trail

- The trail will be graded to elevations as defined on Civil grading drawings and in accordance with project specifications. Edge transitions from the primary trail proposed elevations to meet existing grades vary along the trail alignment as defined on drawings.

- The trail fill will be graded to meet existing grades with general fill where shown on Civil grading drawings. General fill shall be sloped at a maximum of 2H:1V or 3H:1V. Maximum fill slopes are defined along the trail alignment to indicate where each apply.
- The trail fill will be retained using either a stacked stone wall or a gabion basket wall. A stacked stone wall shall have a facing slope no steeper than 1H:4V and have a minimum top width of 0.5 ft and a minimum base width of 4 ft.
- When an existing slope is either steeper than 2H:1V or shows signs of erosion or slope failure, riprap shall be used to stabilize the slope at the toe. Riprap sizing shall be in accordance with NYSDOT Geotechnical Design Manual (GDM) Chapter 7. Efforts shall be made to match the new riprap with the existing riprap stone type and color.
- NYSDOT Type 1 subbase shall be used for the build-up of the on-grade trail portions beneath the upper wearing coarse. Where greater permeability is required a layer of open-graded subbase in accordance with NYSDOT GDM Chapter 7 shall be placed beneath the Type 1 subbase. It is anticipated that the fill thickness will vary from 2 to 8.5 ft along the on-grade trail.
- An aggregate pavement with a minimum subbase thickness of 1 to 2 ft and a 6 in. wearing coarse is required. An interlocking pavement grid may be used to reduce the risk of pavement wash out.
- At locations where the on-grade trail is to be constructed over existing boulder riprap, large boulders shall be removed and replaced with aggregate fill down to a depth where a level subgrade can be achieved.
- A permanent sheet pile may be needed to provide soil retention on the track side of the trail.
- Efforts shall be made to minimize impact to mature trees and/or tree clusters along the on-grade alignment. Air spade excavation and root bridging techniques shall be used to protect mature trees. In designated preserved low-slope habitat areas, efforts shall be made during construction to minimize the impact to the existing condition.
- Construction activities shall be coordinated with Dockside Park.
- Trail extents over existing mound of contaminated soil within Dockside Park to be constructed in accordance with environmental regulations.

3. Indicative Construction Methodology

This section describes an indicative stage-by-stage methodology for the typical construction activities.

3.1 On-Structure Trail

It is broken down into the stages described in Table 1 below.

Table 1 | Summary of Top-Down construction sequence

Stage #	Stage Name	Stage Description
1	Riprap Clearance	Excavator with rock breaker and bucket breaks up and clears large boulders away from the pile locations.
2	Pre-Drilling Piles	Excavator switches to auger drill attachment and drills through pile location to displace medium sized boulders.
3	Pile Driving – through fill	Excavator with vibratory hammer attachment progresses the first 20 ft section of steel pipe pile through the fill.
4	Pile Driving – through soft clay and dense glacial till	Excavator with open ended diesel hammer attachment drives the steel pipe piles through remaining soft soils and dense glacial till until termination criteria achieved. Changing of attachment required to lift and splice each steel pipe pile section.
5	Cleaning for pile plug	Excavator switches to auger drill attachment and cleans out soil in steel pipe pile to 8 ft below mud line.
6	Capping Beam Construction	Excavator removes auger and lifts precast capping beam into place on top of piles. Cast-in-place concrete stitch and pile plug is poured.
7	Temporary Platform Installation	Supporting crane de-assembles a span of temporary platform from behind and front excavator places it to span onto the newly constructed capping beam ahead.
8*	Superstructure Beam Installation	Supporting crane lifts superstructure beams into the span vacated by the previous temporary platform removal.
9*	Deck Plank Installation	Supporting crane lifts deck planks and places onto beams.

*In the sequence proposed, it is possible to complete these Stages in parallel with Stages 1 to 4.

The first 12no. piers from LSP require the use of drilled micropiles. The general construction sequence of these spans will be similar to the description above, replacing stages two to five of Table 1 with the following:

- Drilling and installation of micropile casing: Excavator switches to micropile drilling attachment and drills through the overburden and rock and installs steel casing.
- Hole is flushed and cleaned.
- Placement of central bar and grout (by tremie).
- Construction of pile cap, including cast-in steel tube columns to replicate the structural form of the typical spans.

3.1.1 Riprap Clearance

Move large riprap boulders away from the pile locations using an excavator bucket. This reduces the risk of pile obstructions during driving which may either prevent the piles from being able to be driven or displace the pile from its intended position.

3.1.2 Pre-Drilling Piles

Use excavator to lift and install piling template into place. This template may be cantilevered from the front of the temporary platform and can provide access to the pile head.

Change the excavator attachment to an auger and drill through up to 20 ft depth of the subsurface, displacing medium sized boulders.

3.1.3 Pile Driving – through fill

Change the excavator attachment to the vibratory pile driver and lift the first 20 ft long pile section into position.

Vibrate the first section into the ground and once at desired depth, install the coupler on top of the pile, and then lift the next pile section and insert it into the top of the coupler (or use a threaded joint). A friction grip coupler is proposed for all splices except for joints within the top 40ft where bending of the pile can be expected. For splices within the top 40ft, a welded connection is required.

3.1.4 Pile Driving – through soft clay and dense glacial till

Once the first 20 ft long section of pile is in place, change the vibratory pile driver to an open-ended diesel hammer and drive remaining pile sections to final depth.

3.1.5 Cleaning for pile plug

Cut the piles to the required level and clean them out to pile plug toe level using an excavator mounted auger attachment.

If there is water inside the piles, pump it out prior to pouring concrete inside the pile. If negligible water is present, the concrete can be poured using a tremie pipe. Any water discharge to the Hudson River will need to be coordinated with NYS DEC.

3.1.6 Capping Beam Construction

Lift the steel top bracket onto the pile, then lift the pile plug reinforcement cage into the pile. Lift the precast capping beam onto the steel top brackets that provide support. Survey and set the position and level of the cap accurately.

Seal any gaps between the capping beam void and the steel top bracket with temporary formwork. Pour the cast-in-place pile plug and stitch connection to top of capping beam level using a concrete bucket shuttled from the back of the temporary platform using the crane and excavator.

Grout the vertical deck beam connection anchors into accurate position.

3.1.7 Temporary Platform Installation

Remove the rear span of temporary platform and relocate it to span onto the newly constructed capping beam. First use the crane to remove and stack the temporary decking and longitudinal beams behind the excavator. Then use the excavator to lift and place the beams and decking at the work front.

3.1.8 Superstructure Beam Installation

Use the crane to lift and place the permanent superstructure beams into the span vacated by the advancement of the temporary platform. This is required to maintain access along the full length of the platform. This activity can happen in parallel with the piling works for the next span.

Place the beams on bearing pads grout up the anchor voids to complete the connection to the capping beam.

3.1.9 Deck Plank Installation

Lift and place the permanent deck planks onto the beams using the crane. Grout up anchor pockets to form connection.

3.2 On-Grade Trail

The anticipated construction sequence for the on-grade trail and lower overlook is broken down as follows:

1. Tree protection: install protection measures for existing trees as needed.
2. Place riprap: place riprap to stabilize the existing embankment in areas that show signs of erosion or failure or that are steeper than 2H:1V. Riprap shall be in accordance with NYSDOT GDM Chapter 7.
3. Ecological enhancements: construct planted shelf, as needed.
4. Grading operations: clearance of existing vegetation, debris, organic material, soft or compressible soils, and other unsuitable material.
5. Excavate to subgrade level: After stripping and grubbing, excavate to competent subgrade depth to allow construction of the stacked stone or gabion wall, pavement, and drainage measures. At locations where the on-grade trail is to be constructed over existing cobble/boulder riprap, large boulders shall be removed and replaced with NYSDOT Type 1 subbase fill down to a depth where a level subgrade can be achieved.
6. Prepare subgrade: proof roll the subgrade to aid in locating loose or soft areas, areas to be fill should then be scarified and moisture-conditioned, any loose or soft areas shall be removed and backfilled with NYSDOT Type 1 subbase. Subgrade shall be protected from wetting following exposure and prior to placement of fill, drainage should be implemented to avoid collection of water.
7. Survey subgrade elevations: survey subgrade elevations and stake proposed-grade elevations for each subsequent layer to be placed.
8. Geotextile: place a separation geotextile between the base of retaining wall/pavement subbase and subgrade.
9. Place bedding layer: place a 6 in. granular bedding layer between the base of the retaining wall / pavement subbase and geotextile to avoid damage to the geotextile.
10. Construct retaining wall: place stacked stone or gabion baskets to required height with a minimum embedment of 2 ft at the front of the wall. Construction seating area as needed.
11. Place subbase: place subbase in 6 in. layers followed by compaction to 95% of the maximum dry density. Subbase shall be NYSFOT Type subbase.
12. Place wearing course: place 6 in. wearing course, either impervious or open-graded with an interlocking grid.
13. Survey final elevations: survey final finished grade elevations and notify the Engineer of any discrepancies in accordance with the project specifications.

4. Outline Construction Logistics and Schedule

4.1 Construction Logistics

Construction for Shoreline Trail (South) requires the following key logistical items:

- A land access road through Dockside Park for the trail construction works commencing northwards.
- A land access road through Little Stony Point for the trail construction works commencing southwards.
- Temporary platforms at each work front.

These should enable construction to progress simultaneously from Dockside Park and Little Stony Point, meeting in the middle. All construction equipment must then exit the site via the permanent on-structure trail.

Figure 4 – Construction logistics concept for construction of Shoreline Trail (South).

4.1.1 Key Constraints

4.1.1.1 Access along site

There is no access for construction equipment or materials to the work front via land or water. This is due to the lack of access to the Metro North Railroad ("MNR") right of way to the east and the shallow water depths and permitting issues around the presence of Submerged Aquatic Vegetation ("SAV") to the west.

Therefore, all equipment and materials movements must travel along the 12f ft wide trail structure itself. This trail width limits the size and type of vehicle that can safely access the work front.

This also creates a linear construction sequence and means that construction productivity rates are highly dependent on logistics at the work front.

4.1.1.2 Equipment weights

Carrying out the primary construction activities from the permanent trail structure would heavily govern the member sizes, leading to even heavier equipment being required. Potentially suitable excavators and cranes to perform Top-Down construction of Shoreline Trail (South) are described in 0.

The suggested concept for Top-Down construction utilizes a temporary platform at each work front to:

1. Support heavy operational construction equipment, including one excavator and one mobile crane.

2. Store the different devices and equipment attachments required, including an excavator bucket, auger attachment, vibratory pile driver and diesel pile driving hammer.
3. Store the materials required to construct the foundations, including up to 10 no. 20 ft long sections of steel pipe pile.

Five spans of temporary platform are proposed to provide sufficient room for the above. These spans are moved along the work front as the top-down construction progresses span by span. A conceptual illustration of this can see seen in Appendix B.

4.1.1.3 Materials laydown area near Little Stony Point

A suitable location for materials and equipment storage at or near Little Stony Point is required to ensure any works advancing from this location can be continually serviced with the required materials and equipment. Priority conservation areas on Little Stony Point have been identified (Figure 5) and any impact on these areas should be minimized. Final staging areas are subject to agency review and discussions are ongoing to facilitate these approvals.

It is believed that the existing bridge has sufficient capacity for the required vehicle weights.

It is assumed that a suitable area of land at Dockside Park can be used to store materials and equipment to service northwards construction from Dockside Park.

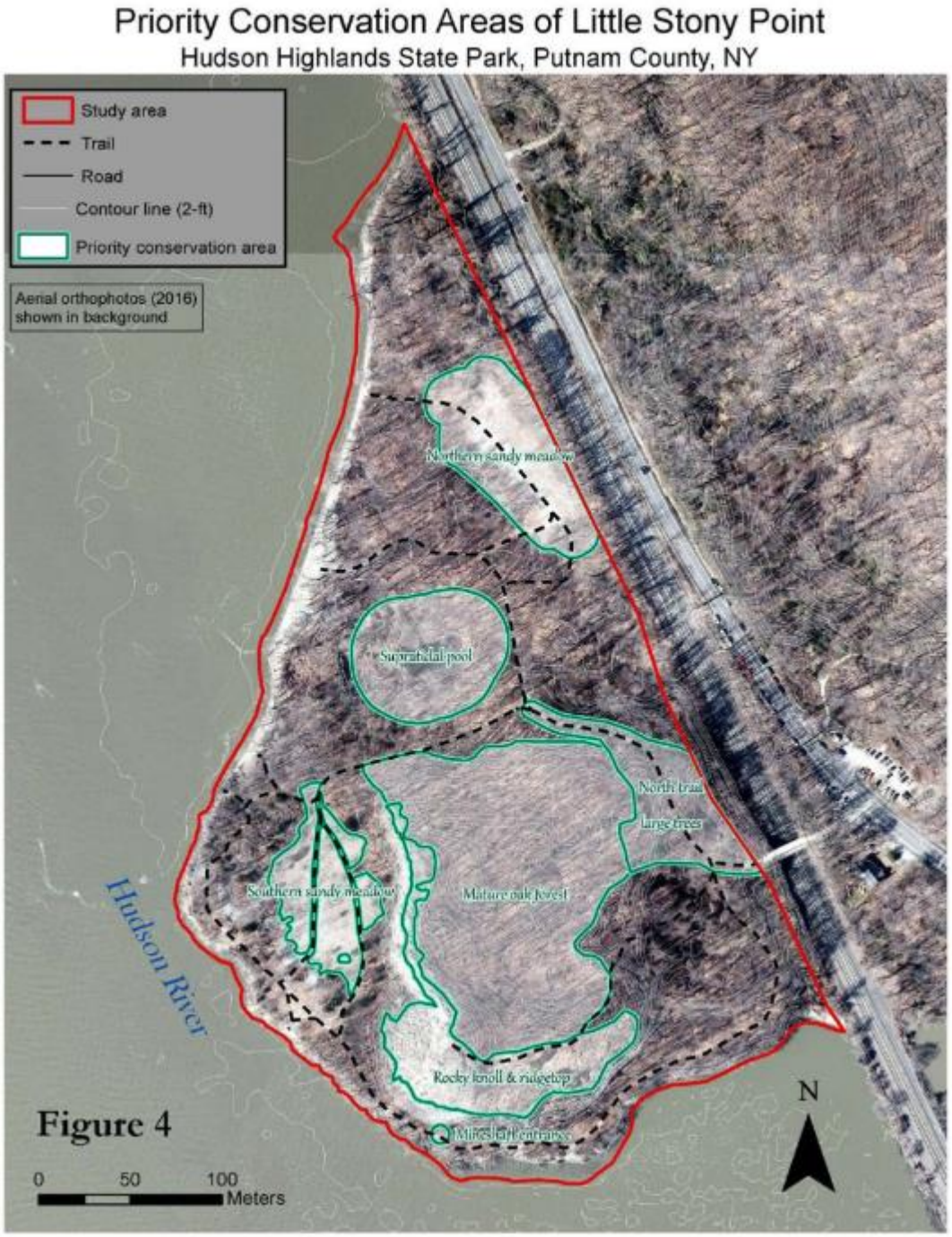


Figure 5 – Priority conservation areas of Little Stony Point. Figure 4 from Hudsonia's Flora Survey and Biodiversity Assessment of Little Stony Point (2021).

4.2 Construction Schedules

4.2.1 Assumptions

The indicative construction schedule is based on the following assumptions:

- Construction season duration due to environmental restrictions of 6 months, 4 weeks per month, for any in-water work.

- Standard working week of 5 days, 8 hours per day. Additional night working would present an opportunity to improve the schedule if permitted.
- Two work fronts working simultaneously from both ends.
- Finishing work for the on-structure trail cannot start until all structural construction is completed and heavy equipment used for top-down construction is demobilized. Since the structure is used to provide access and materials to the workfront, finishes cannot begin until this work is completed.
- Structural steel and grating deck sections can be installed at the on-structure trailbanks from the structure during seasonal restriction on in-water work.
- The duration to construct a single span using top-down methodology is 8 to 9 days. Therefore, approximately 14 spans can be constructed per each 6 month construction season. A detailed analysis of a single span cycle is provided in Appendix C.
- On-grade trail construction cannot begin until all structural construction is completed and heavy equipment used for top-down construction is demobilized. Since the structure is used to provide access and materials to the workfront, on-grade cannot begin until this work is completed.
- On-grade trail construction will proceed in parallel at Little Stony Point and Dockside Park.

4.2.2 Outline Schedule

Based on this average production rate, it is assumed that it will take 6 construction seasons to construct Shoreline Trail (South) using two work fronts. The sequence is summarized as follows:

1. Mobilization
    a. Clear and grub as necessary at Little Stony Point and Dockside Park.
    b. Establish temporary access for construction equipment through Little Stony Point and Dockside Park, including construction of a ramp on the east side of the bridge to Little Stony Point that can be traversed by construction equipment.
    c. Establish laydown area in Dockside Park
2. On-Structure Trail Construction
    a. Top-Down construction with two headings, one from north and one from south, continuing for five (5) construction seasons.
3. On-Grade Trail Construction
    a. Construct on-grade trail at Dockside Park and Little Stony Point in parallel, including trail surface preparation, revetment improvements, and stacked stone walls where required.
    b. Perform final site seeding, planting, and cleanup.

Appendix A

Top-Down Construction Equipment Study

A.1 Top-Down Construction Equipment Study

The primary piece of construction equipment at the work front needs to be multi-functional. It should be able to:

- Reach out and down to scrape riprap from the location of the next piles.
- Pre-drill up to 20 ft down through the location of the next piles.
- Lift and drive long sections of steel tube piles at reach.
- Lift and place heavy precast reinforced concrete capping beams at reach.
- Lift and place heavy temporary deck beams.

An excavator with multiple devices and attachments is deemed the most suitable piece of equipment for these tasks.

A supporting mobile crane is proposed to feed materials onto the temporary platform, assist in changing excavator attachment, and perform installation of precast deck members.

Suitable excavators and cranes are shown in Table 2 below. The purpose of this list is to verify that there are excavators and cranes on the market that meet the conceptual requirements at this stage. This is not an exhaustive list and similar machines are expected to be available from other suppliers.

Table 2 | Suitable excavators and cranes for Top-Down construction.

Name	Type	Operating Weight (lbs)	Overall Width (ft in)
Kobelco SK260LC	Excavator	~65,000	11’-1”
CAT 330GC R3.75CB2	Excavator	~68,400	11’-1”
Terex RT335	Mobile Crane	~63,300	10’-2”

Figure 6 – Kobelco SK260LC excavator. LiftRite (2023), *Kobelco SK260LC-10,* available at: https://www.liftrite.com.au/equipment_post/kobelco-sk260lc-10/.

Figure 7 – Terex RT335 crane. Crane Market (2023), *Terex RT 335 35-Ton Rough Terrain Crane,* available at: https://cranemarket.com/terex-rt-335-35-ton-rough-terrain-crane-for-sale-id3503.

For the identified excavators, an additional arm extension of 5 ft on top of the configuration shown in manufacturers specifications is required. This will reduce the capacity of the excavator by an unknown amount that is to be quantified by the contractor. A summary of the required excavator lifts is given in Table 3 below. A 0.75 factor has been applied to the rated excavator capacities stated.

Table 3 | Summary of required excavator lifts for Top-Down construction.

Lift Description	Load (lbs)	Orientation	Reach (ft)	Height (ft)	Capacity (lbs)
Riprap clearance (assumes large boulders broken into 27 ft^3 sized segments)	4,500	Front	30*	-15	N/A
Pre-drilling of piles	5,000	Side	-	25	8,200 – 8,450
		Front	30*	25*	8,200 – 8,450
20ft pile section and vibratory hammer	7,900	Side	-	25	8,200 – 8,450
		Front	30*	25*	8,200 – 8,450
Open ended diesel hammer	7,000	Side	-	25	8,200 – 8.450
		Front	30*	25*	8,200 – 8,450
Precast RC Capping Beam	7,850	Side	-	~10	18,850 – 21,850
		Front	30	~10	8,900 – 10,350
Temporary Steel Beam	3,000	Side	-	~10	10,800 – 13,700
		Front	20	~10	13,450 – 14,700

*The 30 ft reach relies on an additional arm extension of 5 ft on top of the configuration shown in manufacturers specifications. This will reduce the capacity of the excavator by an unknown amount that is to be quantified by the contractor. A 0.75 factor has been applied to the rated excavator capacities stated.

A summary of the required crane lifts is given in Table 4 below.

Table 4 | Summary of required crane lifts for Top-Down construction.

Lift Description	Load (lbs)	Orientation	Reach (ft)	Height (ft)	Capacity (lbs)
Auger drill	5,000	Front	30	~10	12,500
Open ended diesel hammer	7,000	Front	30	~10	12,500
Vibratory hammer	5,500	Front	30	~10	12,500
20ft pile section	2,400	Side	-	~10	12,400
		Front	35	~10	9,600
Precast RC Capping Beam	7,850	Side	-	~10	12,400
		Front	35	~10	9,600
Temporary Steel Beam	3,000	Side	-	~10	12,400
		Front	35	~10	9,600
Precast RC Longitudinal Beam	9,600	Front	35	~10	9,600
Precast RC Deck Planks	4,000	Front	35	~10	9,600

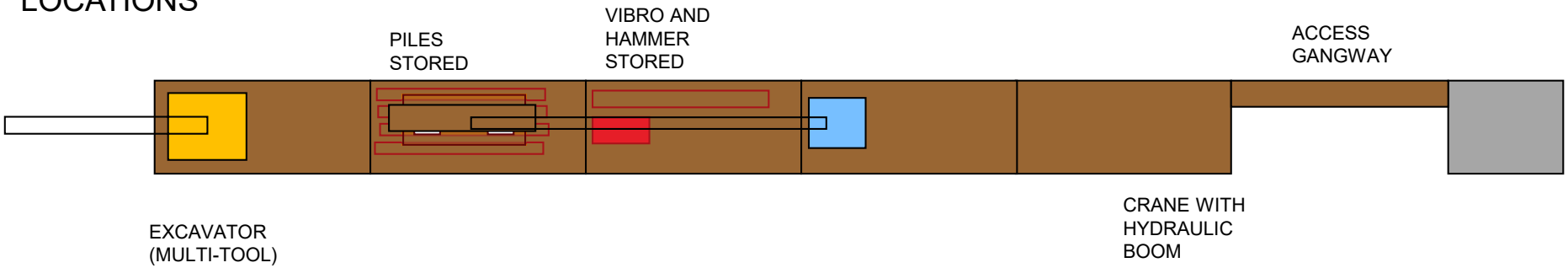
Other supporting equipment and machinery will be needed to accept delivery of materials to the site and transport them along the platform to the work front. These are not expected to impact constructability or govern the design concept at this stage.

Appendix B

Top-Down Construction Illustrations

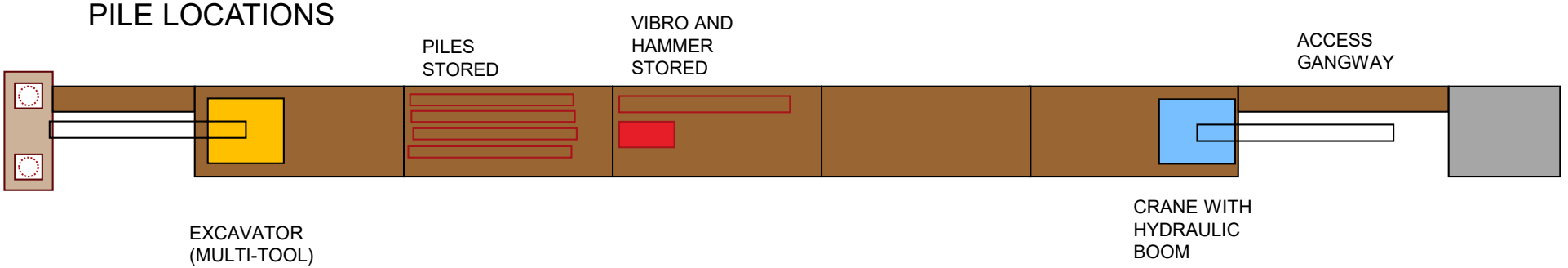
TOP-DOWN CONSTRUCTION
STEP 1

CLEAR RIPRAP FROM PILE LOCATIONS



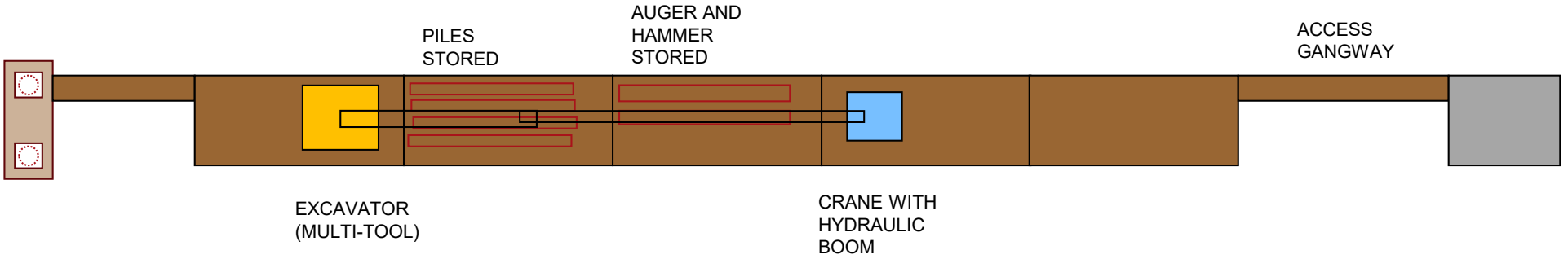
TOP-DOWN CONSTRUCTION
STEP 2

SET ACCESS PLATFORM &
PRE-DRILL WITH AUGER AT
PILE LOCATIONS

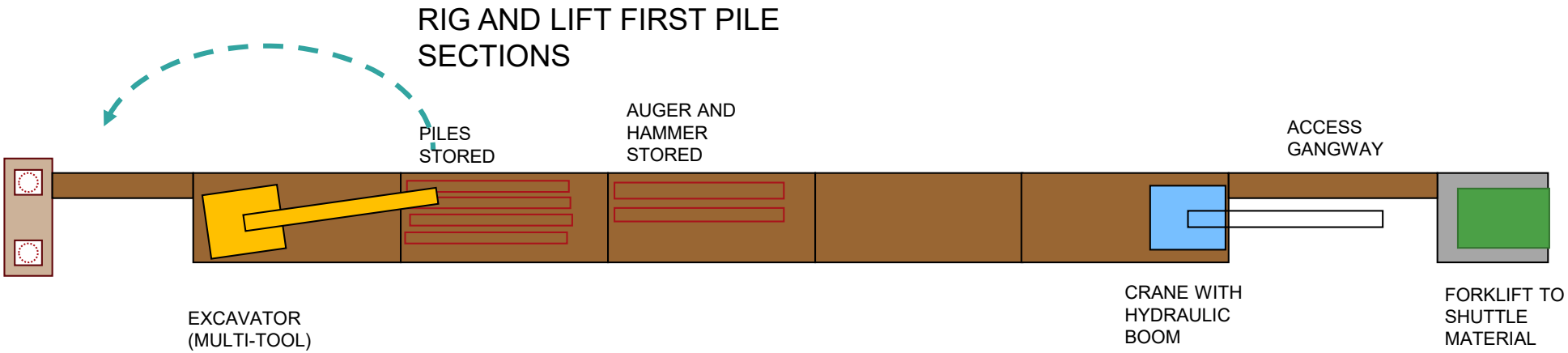


TOP-DOWN CONSTRUCTION
STEP 3

REMOVE AUGER HAMMER AND
INSTALL VIBRATORY HAMMER



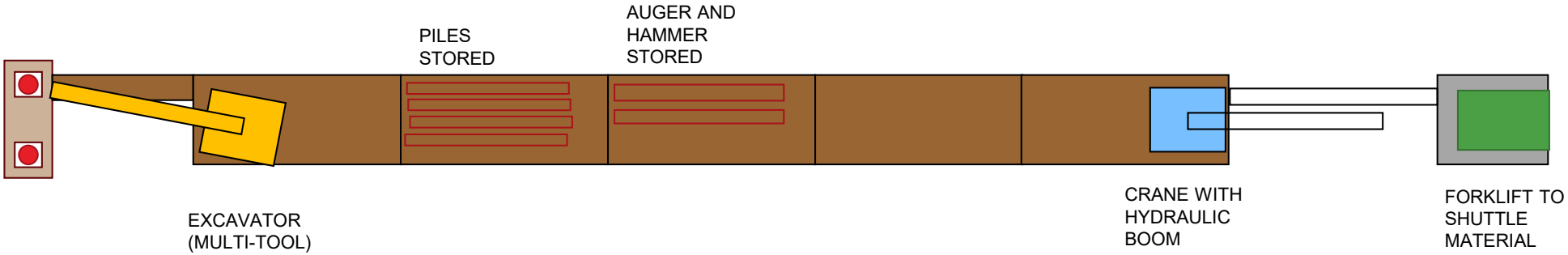
TOP-DOWN CONSTRUCTION
STEP 4



TOP-DOWN CONSTRUCTION
STEP 5

INSTALL PERMANENT
BEAMS

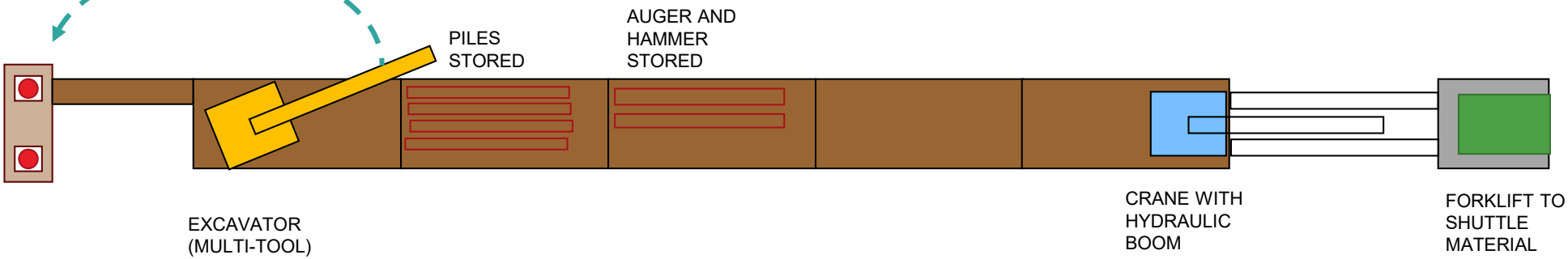
VIBRATE FIRST
PILE SECTION



TOP-DOWN CONSTRUCTION
STEP 6

RIG AND WELD COUPLER FOR 2ND PILE SECTION

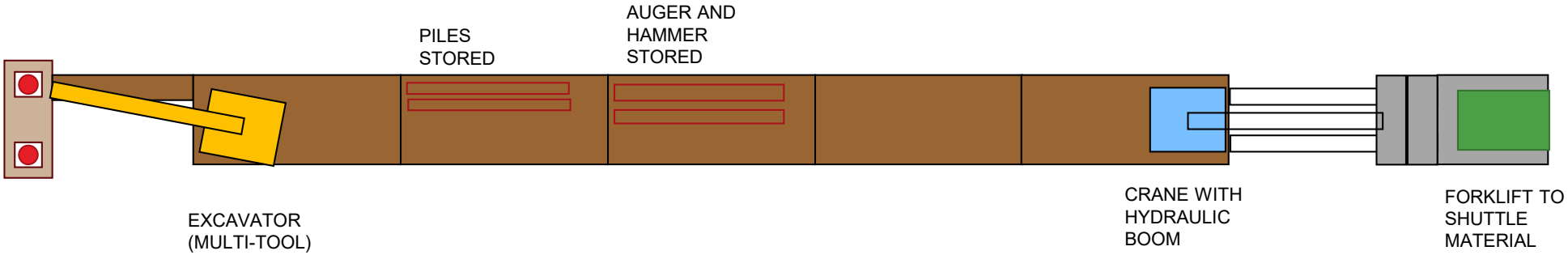
INSTALL PERMANENT BEAMS



TOP-DOWN CONSTRUCTION
STEP 7

VIBRATE 2ND PILE SECTION

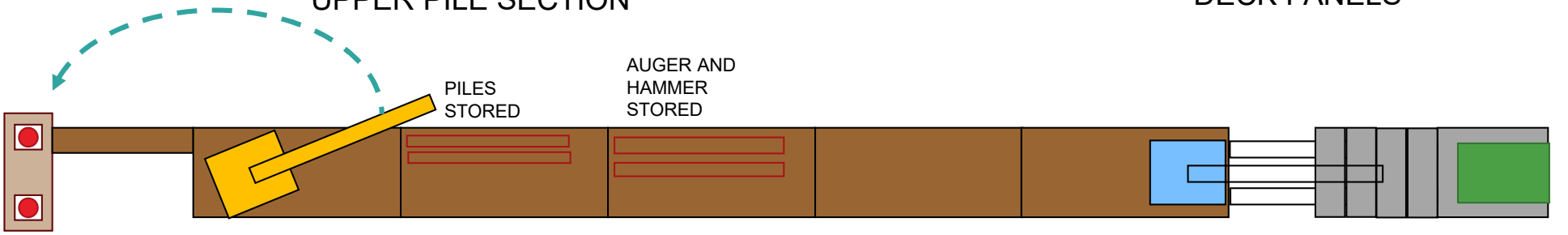
INSTALL PERMANENT DECK PANELS



TOP-DOWN CONSTRUCTION
STEP 8

RIG AND WELD CJP FOR
UPPER PILE SECTION

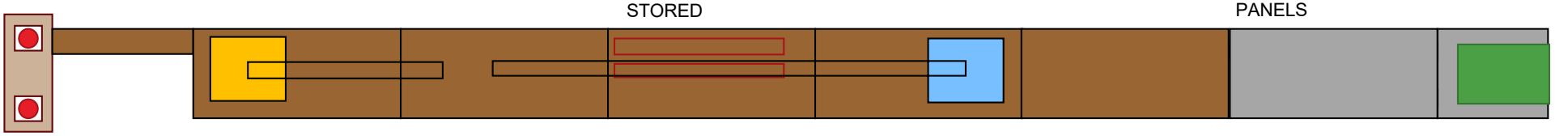
INSTALL PERMANENT
DECK PANELS



TOP-DOWN CONSTRUCTION
STEP 9

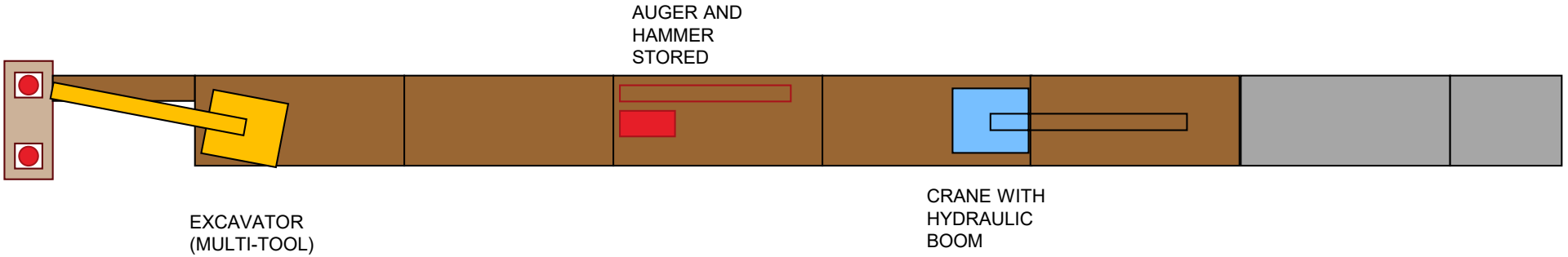
REMOVE VIBRATORY HAMMER
AND INSTALL IMPACT HAMMER

DECK PANELS
COMPLETE



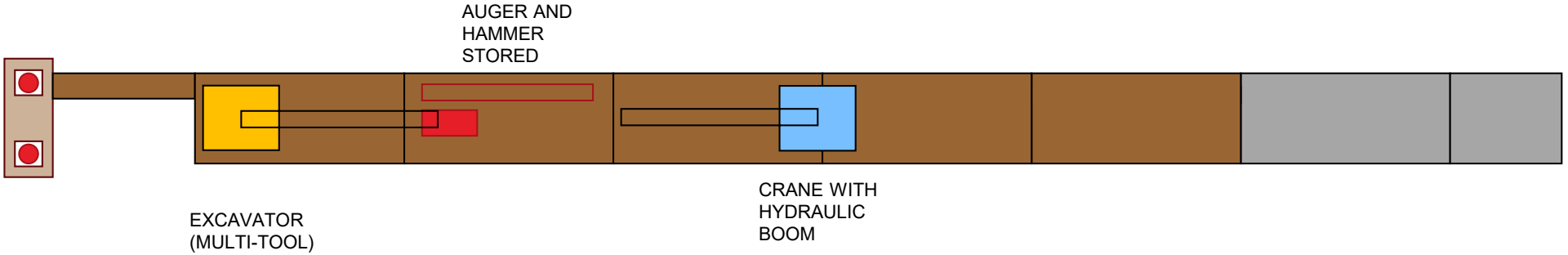
TOP-DOWN CONSTRUCTION
STEP 10

HAMMER UPPER
PILE SECTIONS



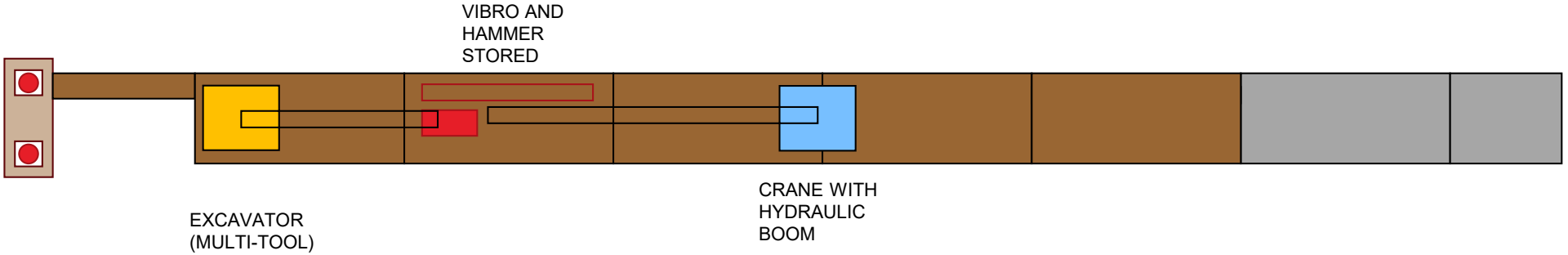
TOP-DOWN CONSTRUCTION
STEP 11

SHIFT EQUIPMENT
FORWARD

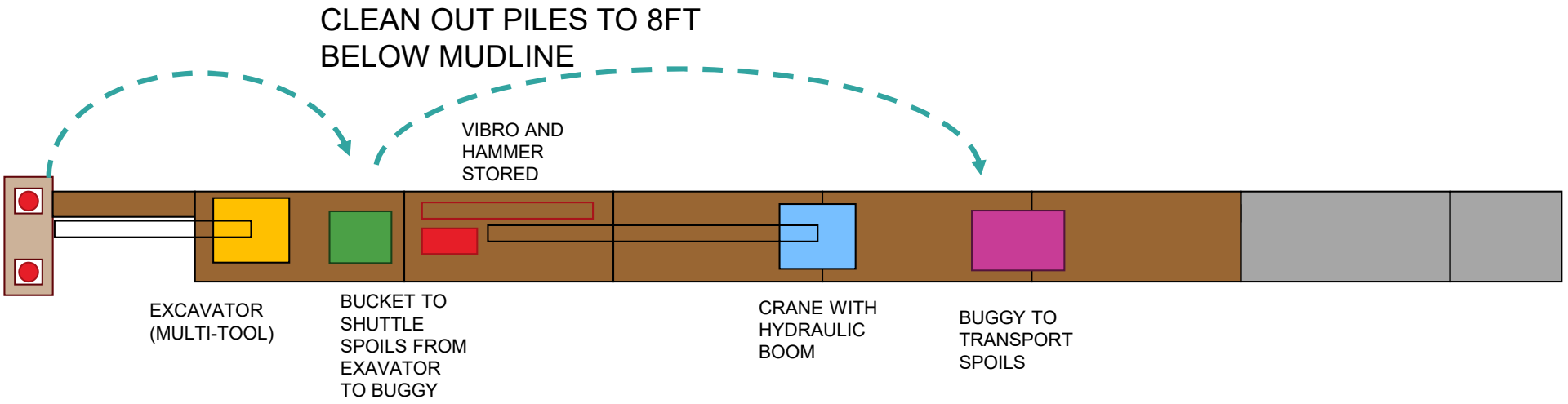


TOP-DOWN CONSTRUCTION
STEP 12

REMOVE IMPACT HAMMER
AND INSTALL AUGER HAMMER

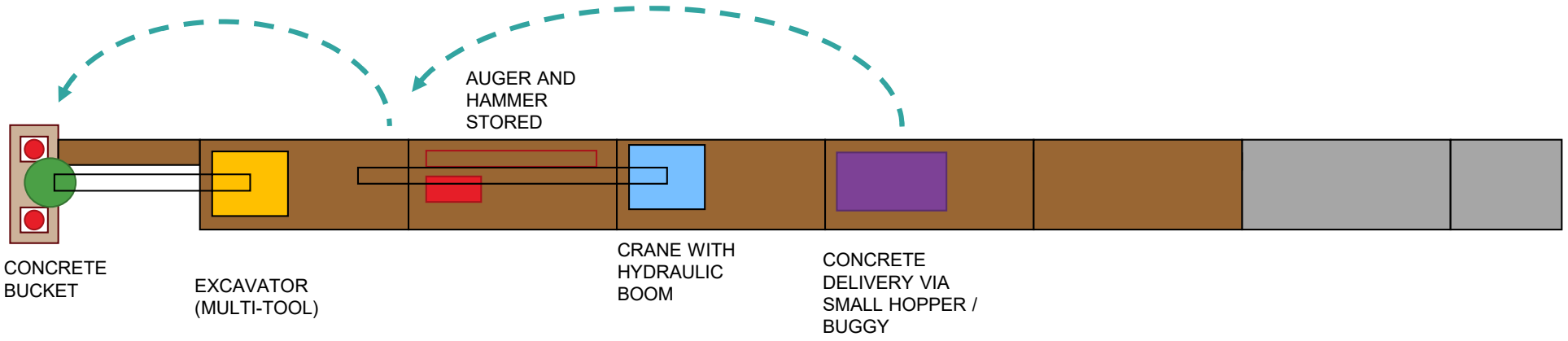


TOP-DOWN CONSTRUCTION
STEP 13

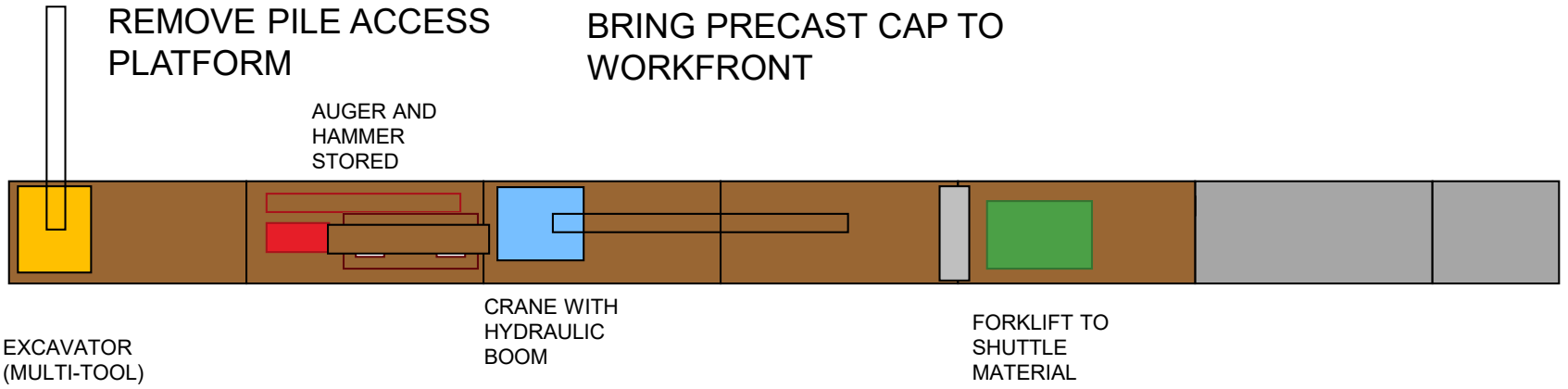


TOP-DOWN CONSTRUCTION
STEP 14

REBAR AND POUR CONCRETE
VIA CONCRETE BUCKET

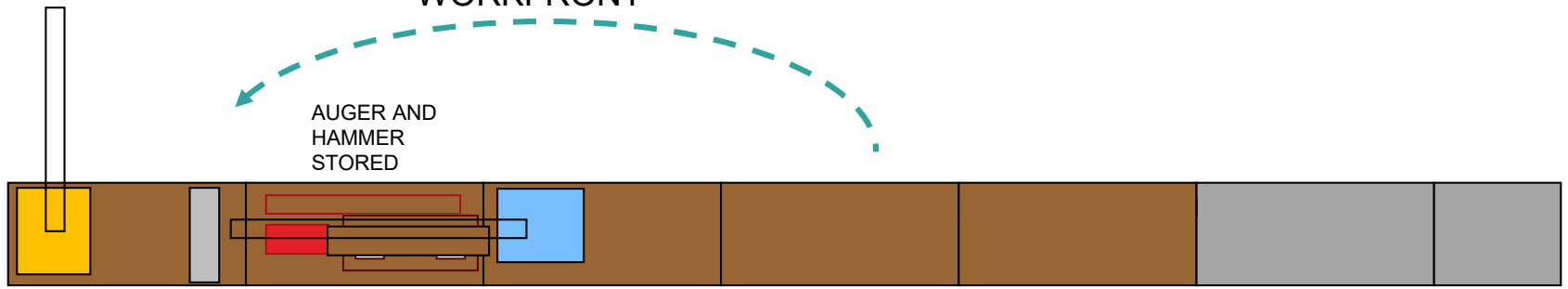


TOP-DOWN CONSTRUCTION
STEP 15



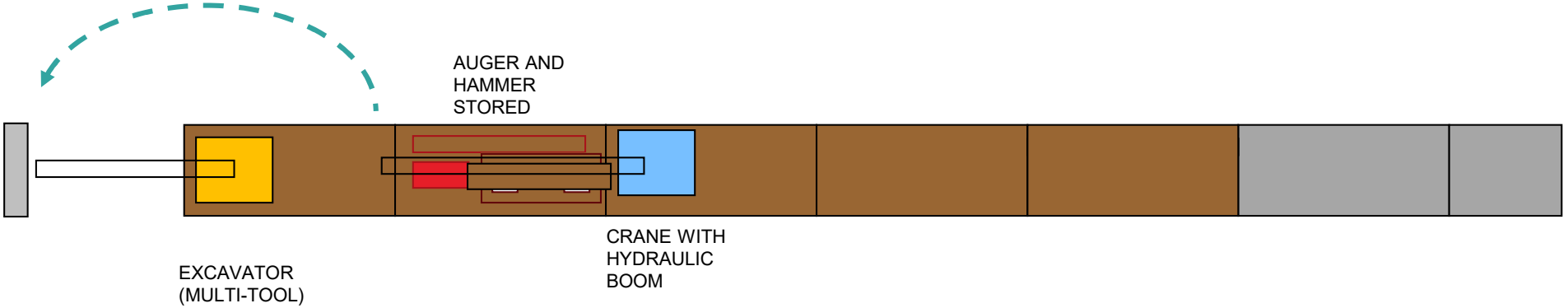
TOP-DOWN CONSTRUCTION
STEP 16

BRING PRECAST CAP TO WORKFRONT



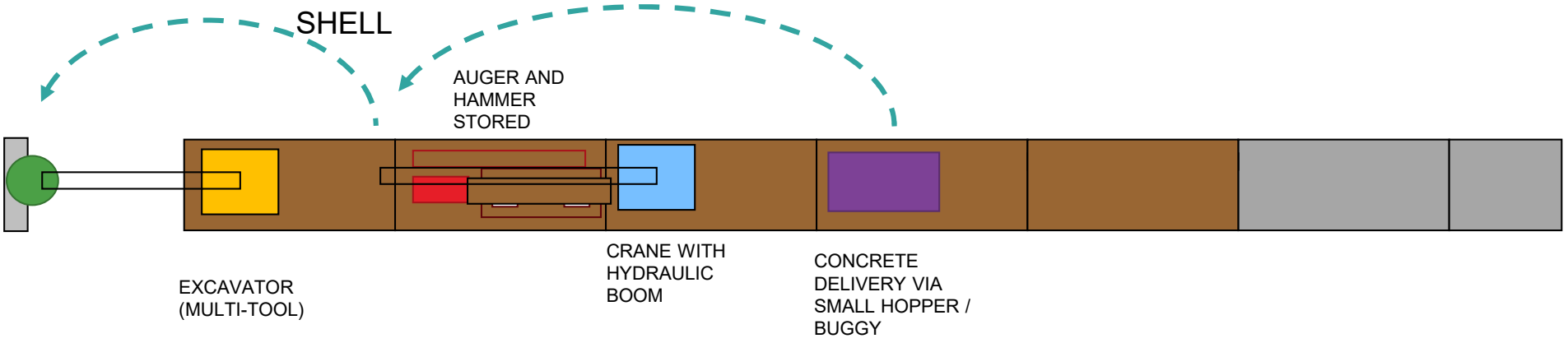
TOP-DOWN CONSTRUCTION
STEP 17

INSTALL PRECAST CAP



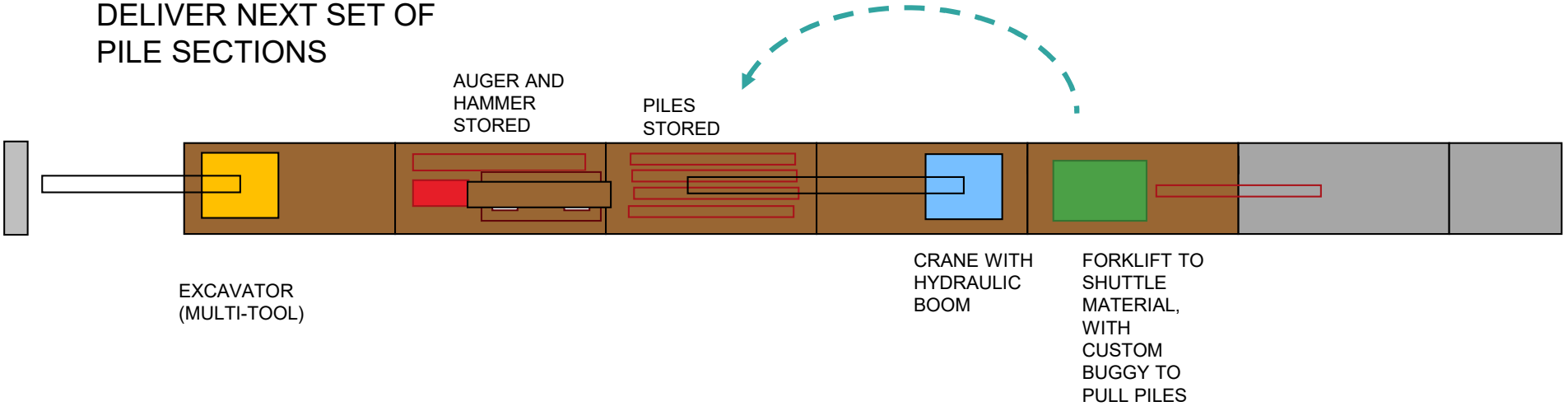
TOP-DOWN CONSTRUCTION
STEP 18

REBAR AND POUR CONCRETE IN CAP SHELL



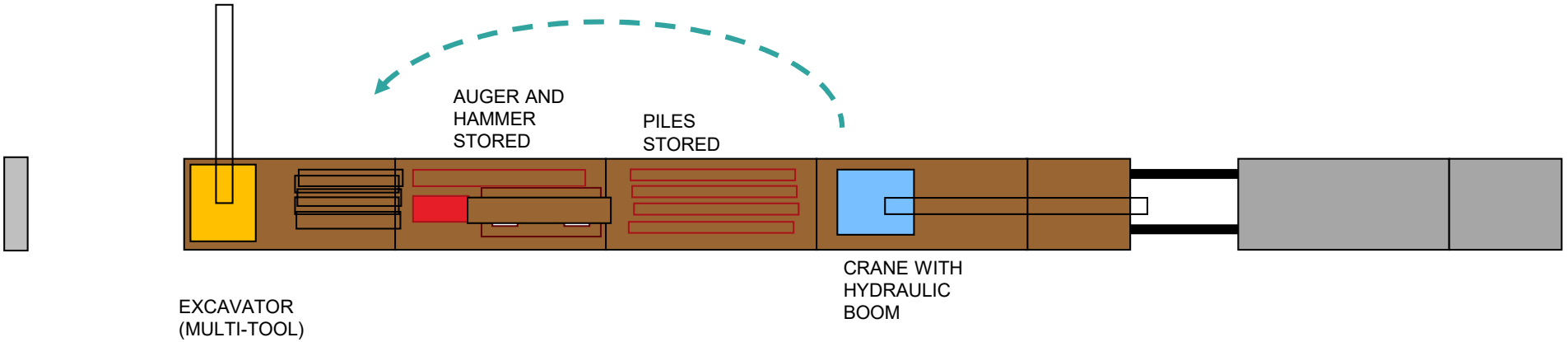
TOP-DOWN CONSTRUCTION
STEP 19

DELIVER NEXT SET OF PILE SECTIONS



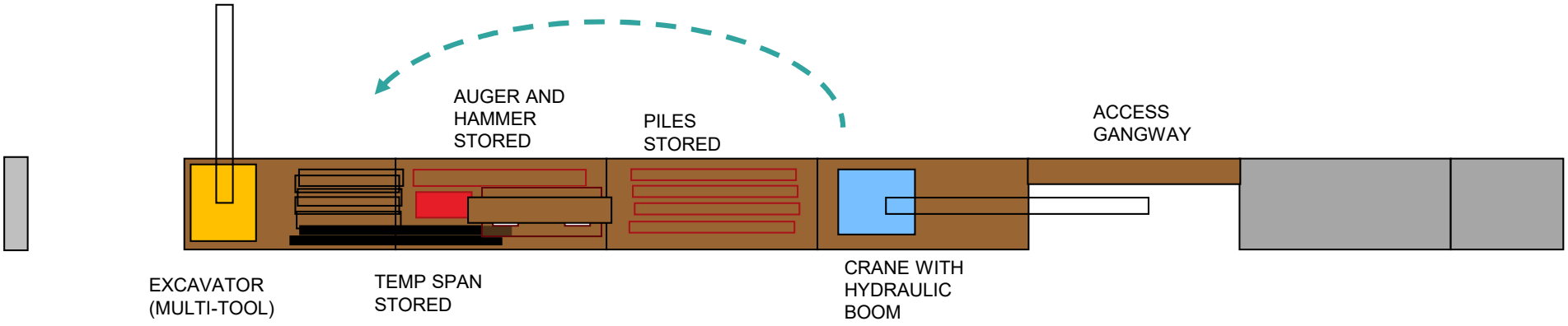
TOP-DOWN CONSTRUCTION
STEP 20

DISASSEMBLE LAST TEMP SPAN



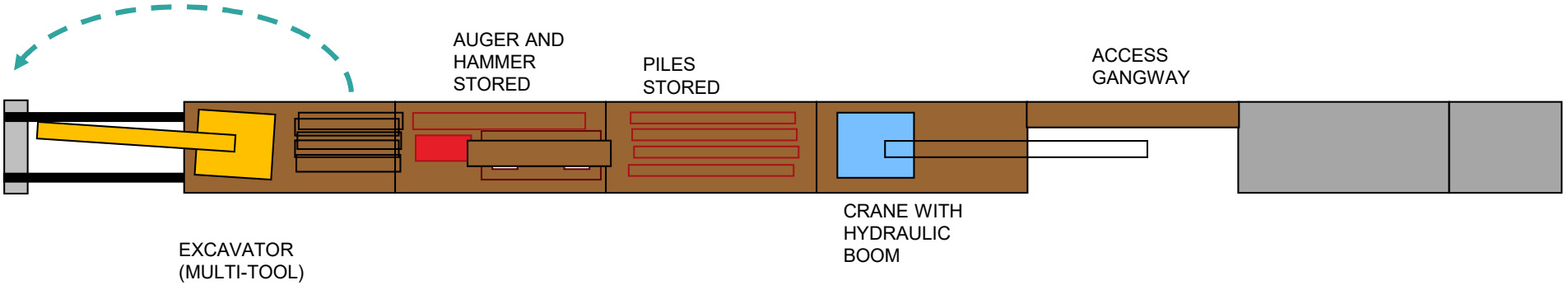
TOP-DOWN CONSTRUCTION
STEP 21

DISASSEMBLE LAST TEMP SPAN



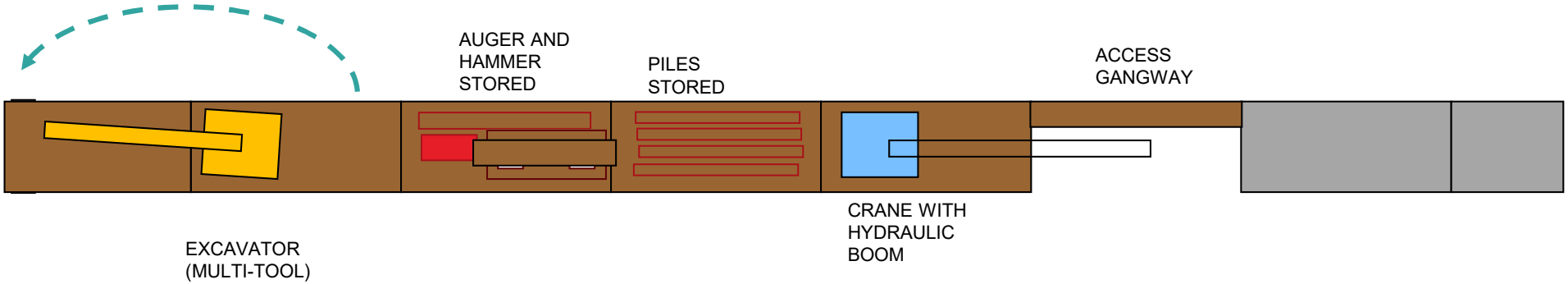
TOP-DOWN CONSTRUCTION
STEP 22

INSTALL NEW TEMP SPAN



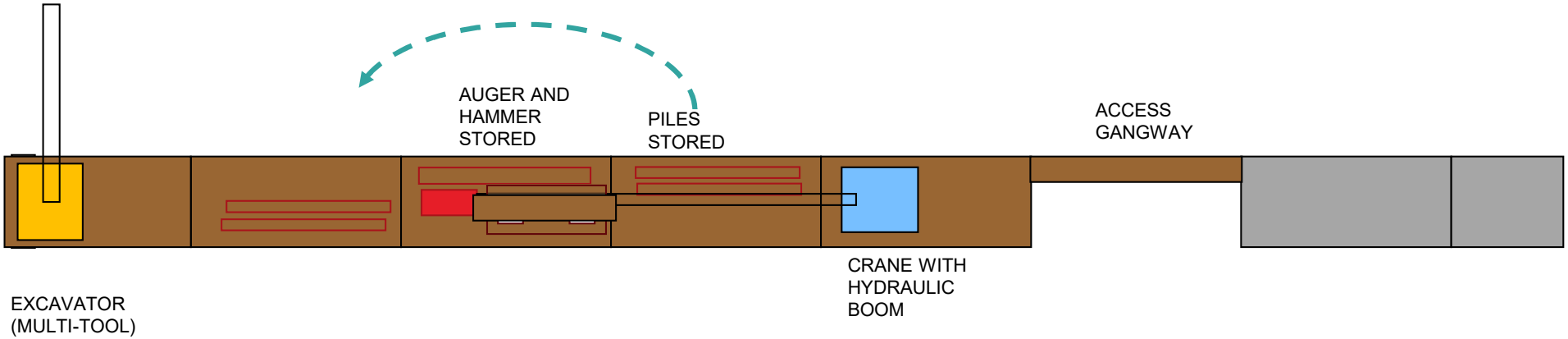
TOP-DOWN CONSTRUCTION
STEP 23

INSTALL NEW TEMP SPAN



TOP-DOWN CONSTRUCTION
STEP 24

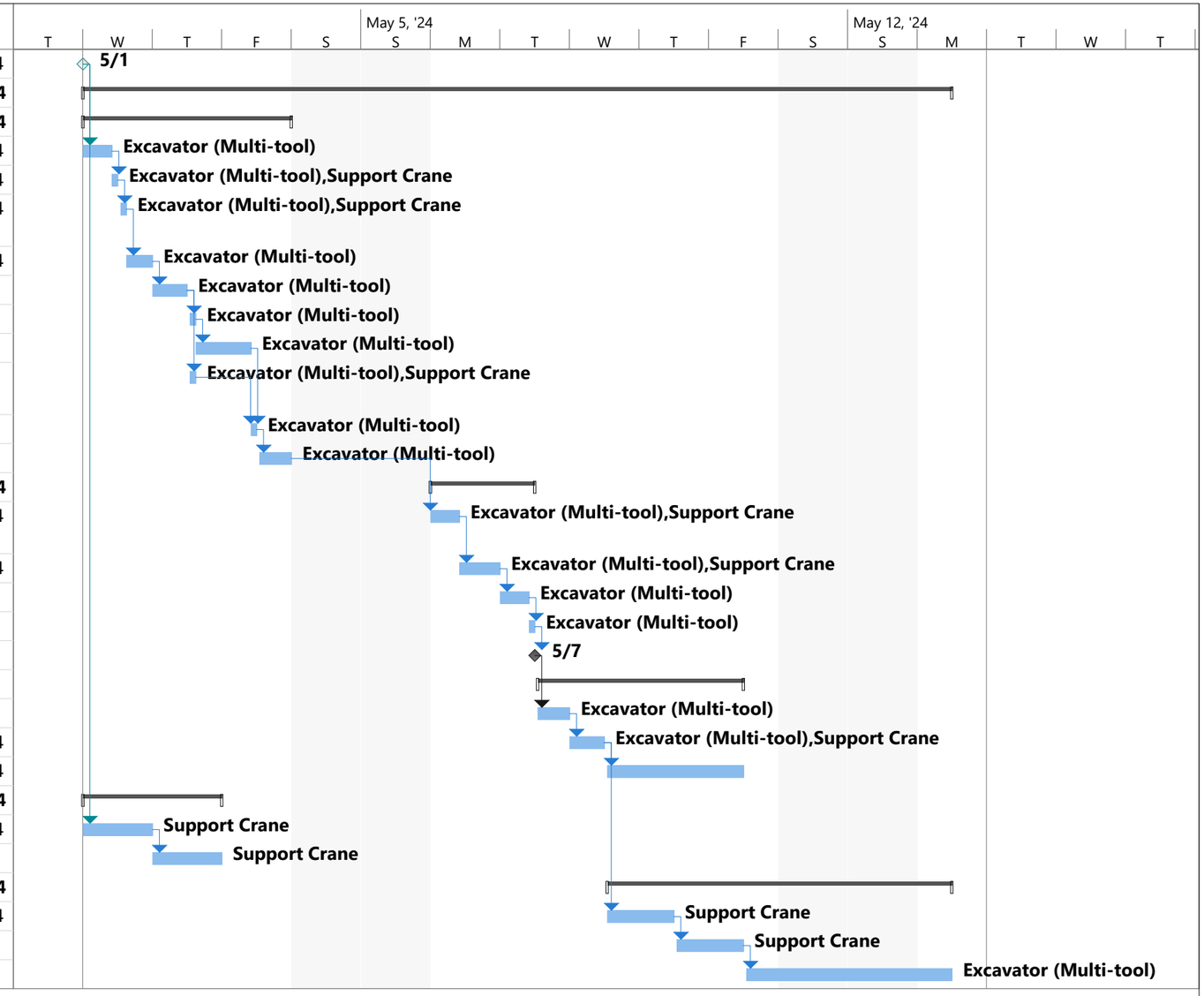
MOBILIZE PILES FOR NEXT CYCLE



Appendix C

Top-Down Span Construction Cycle

ID		Task Mode	Task Name	Duration	Start
1			Start of construction season	0 days	Wed 5/1/24
2			**Top-Down Construction Cycle**	**8.5 days**	**Wed 5/1/24**
3			**Pile Driving**	**3 days**	**Wed 5/1/24**
4			Install cantilever template / access platform	2 hrs	Wed 5/1/24
5			Install auger bit on excavator and predrill	2 hrs	Wed 5/1/24
6			Remove auger bit and install vibro hammer on excavator	2 hrs	Wed 5/1/24
7			Locate, lift, and vibrate 1st pile sections	2 hrs	Wed 5/1/24
8			Lift and weld coupler for 2nd pile sections	4 hrs	Thu 5/2/24
9			Vibrate 2nd pile sections	2 hrs	Thu 5/2/24
10			Lift and CJP weld upper pile sections	4 hrs	Thu 5/2/24
11			Remove vibro hammer and install impact hammer on excavator	2 hrs	Thu 5/2/24
12			Impact drive pile to final elevation	2 hrs	Fri 5/3/24
13			Survey and cut off pile at required elevation	4 hrs	Fri 5/3/24
14			**Pile Infill (Cleanout, Rebar, Pour)**	**1.5 days**	**Mon 5/6/24**
15			Remove impact hammer and install auger bit on excavator	2 hrs	Mon 5/6/24
16			Cleanout piles to depth of 8ft below mudline	6 hrs	Mon 5/6/24
17			Dewater piles	2 hrs	Tue 5/7/24
18			Install pile cages	2 hrs	Tue 5/7/24
19			Pour concrete in piles	0 hrs	Tue 5/7/24
20			**Pier Cap (Rebar, Pour, Cure)**	**3 days**	**Tue 5/7/24**
21			Install precast concrete pier cap on piles	4 hrs	Tue 5/7/24
22			Rebar and pour pier cap infill	4 hrs	Wed 5/8/24
23			Cure pier cap concrete	2 days	Wed 5/8/24
24			**Install Permanent Deck**	**2 days**	**Wed 5/1/24**
25			Lift permanent beams (2 per day)	8 hrs	Wed 5/1/24
26			Install precast deck panels (10 per day)	8 hrs	Thu 5/2/24
27			**Move Temp Deck for Next Span**	**3 days**	**Wed 5/8/24**
28			Deliver piles for next span	8 hrs	Wed 5/8/24
29			Disassemble last temp span	8 hrs	Thu 5/9/24
30			Install forward temp span	8 hrs	Fri 5/10/24



Project: HHFT Top Down Cycle
Date: Fri 1/26/24

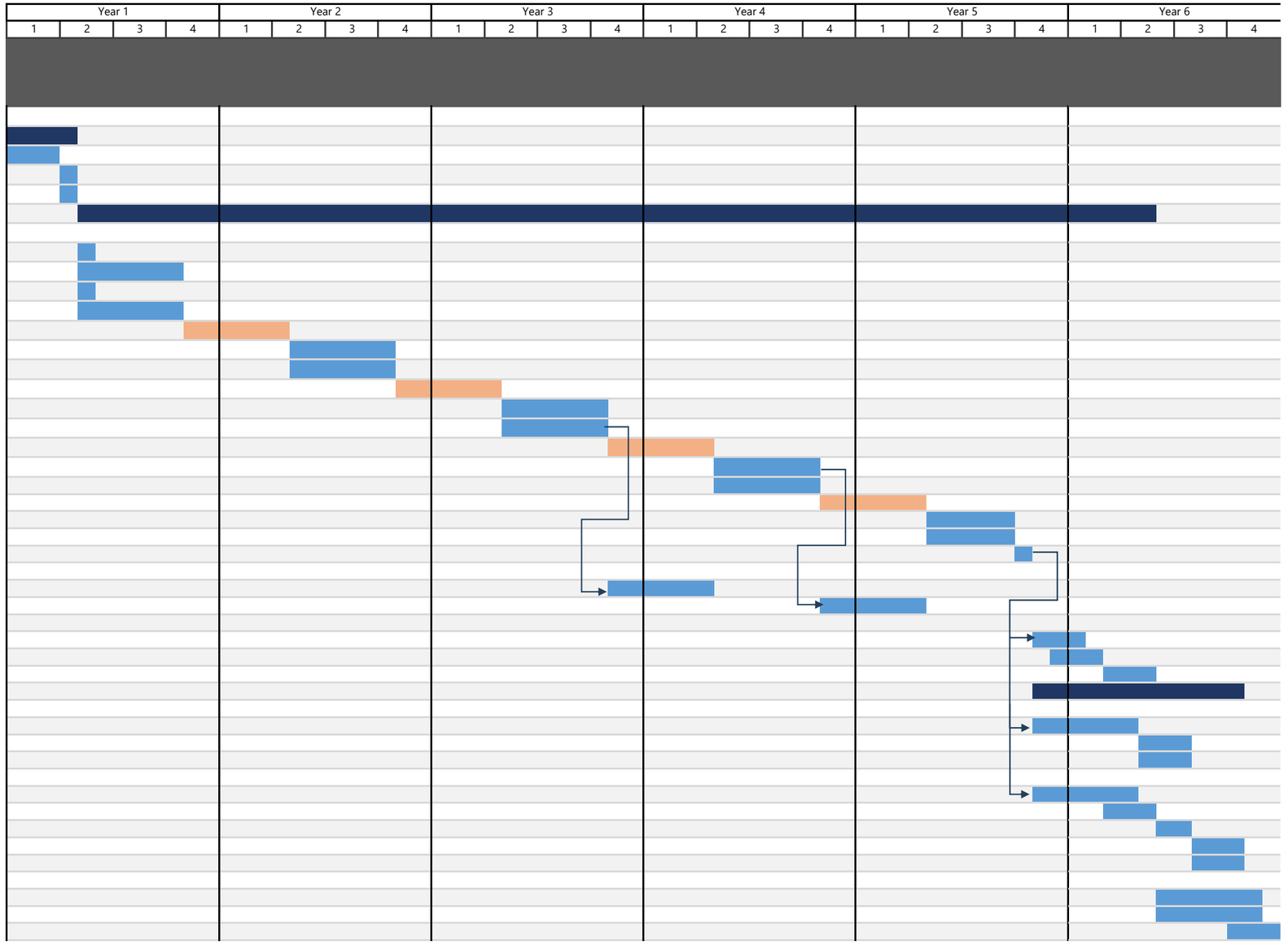
Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress
Summary	Inactive Summary	Manual Summary	External Milestone	

Appendix D

Indicative Construction Schedule

HHFT SHORELINE SOUTH TRAIL - INDICATIVE CONSTRUCTION SCHEDULE

WBS	Status	Task Name	Task Type	Resource
0		**NTP**	**Milestone**	
1		***Mobilization***	***Summary***	
1.1		Site Mobilization	Detailed	
1.2		Site Clearing	Detailed	
1.3		Establish access in Little Stony Point & Dockside	Detailed	
2		***On Structure Trail Construction***	***Summary***	
2.1		***Main Trail Structure Construction***	***Summary***	
2.1.1		Abutment A	Detailed	
2.1.2		Pier 1 to Pier 14	Detailed	Heading 1
2.1.3		Abutment B	Detailed	
2.1.4		Pier 126 to Pier 112	Detailed	Heading 2
2.1.5		Seasonal Restriction on In-Water Work	Detailed	
2.1.6		Pier 15 to Pier 29	Detailed	Heading 1
2.1.7		Pier 125 to Pier 111	Detailed	Heading 2
2.1.8		Seasonal Restriction on In-Water Work	Detailed	
2.1.9		Pier 30 to Pier 44	Detailed	Heading 1
2.1.10		Pier 110 to Pier 96	Detailed	Heading 2
2.1.11		Seasonal Restriction on In-Water Work	Detailed	
2.1.12		Pier 45 to Pier 59	Detailed	Heading 1
2.1.13		Pier 95 to Pier 81	Detailed	Heading 2
2.1.14		Seasonal Restriction on In-Water Work	Detailed	
2.1.5		Pier 60 to Pier 70	Detailed	Heading 1
2.1.16		Pier 80 to Pier 71	Detailed	Heading 2
2.1.17		Demobilize top-down workfronts	Detailed	
2.2		***Trailbank Structure Construction***	***Summary***	
2.2.1		Install Trailbank Steel & Grating- Pier 109 to 113	Detailed	
2.2.2		Install Trailbank Steel & Grating - Pier 52 to 60	Detailed	
2.3		***Finishes***	***Summary***	
2.3.1		Install Railing On Structure	Detailed	
2.3.2		Install Fencing On Structure	Detailed	
2.3.3		Amenities (benches, etc)	Detailed	
3		***On Grade Construction***	***Summary***	
3.1		***Little Stony Point***	***Summary***	
3.1.1		Prepare Subgrade (Excavate / Fill)	Detailed	
3.1.2		Install trail base and wearing course	Detailed	
3.1.3		Install Fencing On-Grade	Detailed	
3.2		***Dockside Park***	***Summary***	
3.2.1		Modify Rip Rap Revetment	Detailed	
3.2.2		Install Trailbank and Quarry Stone	Detailed	
3.2.3		Prepare Subgrade (Excavate / Fill)	Detailed	
3.2.4		Install trail base and wearing course	Detailed	
3.2.5		Install Fencing On-Grade	Detailed	
3.3		***Site Wide***	***Summary***	
3.3.1		Seeding	Detailed	
3.3.2		Planting	Detailed	
3.3.3		Cleanup	Detailed	



This is intended to be an indicative schedule to provide an order of magnitude estimate on the duration of construction. The actual duration can be influenced by the means and methods of the Contractor, equipment sizing and availability, finalization of environmental restrictions and weather.