

Date: 07.31.2019

From: Christopher G. DeGood
Tim Knutsen

To: **Ron VanZee, Township Supervisor**
Hayes Township
9195 Old US 31 North
Charlevoix, MI 49720

Project: Camp Seagull

Remarks:

In late June, Beckett & Raeder completed the project inventory scope of our work plan and assessed the recent construction at Camp Sea-Gull. The new construction includes a boat launch, roads, pathway, parking areas, and other ancillary improvements. The initial inventory scope included a site inventory of Camp Sea-Gull during which we performed a visual assessment of the “areas of concern” previously identified by the Township. Beckett & Raeder staff then met with Hayes Township officials to review and verify that the site inventory information was consistent with the areas of concern identified for incorporation in the final report.

The Beckett & Raeder team has reviewed the following documents associated with the project:

- Hayes Township Park Infrastructure Construction Phase I, Addendum No. 1, dated February 8, 2018, prepared by Performance Engineering, Inc.
- Geotechnical Investigation Report, dated May 2014, prepared by Otwell Mawby Geotechnical, P.C.
- Final Report: Analysis and Recommendations for the Camp Sea Gull Rock Wall, dated July 12, 2019, prepared by GeoEngineering North, LLC.

We have completed our analysis of the “areas of concern”, and generated the following report that includes an assessment of each issue, proposed approaches to resolving the issues and an opinion of estimated construction costs for implementation.

Inventory findings:

1. The layout to the slope of the driveway to the boat launch, the fishing pier, and the visible erosion to the base of the excavated slope that ends at the edge of the parking area of the fishing pier.

Review and Assessment:

Our team's structural engineering consultant, Machin Engineering, included the following information in their report letter (Exhibit 'A'):

1. A barrier would be needed to retain rock debris and to prevent injury to people and site improvements.
2. A barrier fence and preventative netting were evaluated as remedial measures.
3. The manufacturer of the barrier and netting systems recommended the barrier system.

Resolution:

Our recommendation is to install approximately 550 lineal feet of 6'-8' tall structural barrier fence along the rock wall.

Probable Cost:

We would suggest a magnitude of cost that ranges from approx. \$31,500 for 550 lineal feet of 6'-8' tall black vinyl coated fence fabric on 8" round black metal posts and top rail; to approx. \$45,000 for 550 lineal feet of 6'-8' tall black rectangular-pattern welded or woven wire mesh fence with 8" square black steel posts and a top rail.



2. Installation of safety railing along the sidewalk structure to reduce public from climbing and falling onto the path of vehicles driving along the sidewalk.

Review and Assessment:

The construction plans specify a 42" guardrail, or timber path barrier adjacent to the turf pedestrian path that descends from the upper parking area down to the boat launch and fishing pier. Portions of the retaining wall between the pedestrian turf path and the bituminous roadway exceed the 30" height above adjacent grade for which construction codes require a guardrail. It is not clear from the records available why the guardrail was not constructed. The fall hazard could be eliminated if the pedestrian turf path could be barricaded and closed, but this would create a hazardous situation by forcing pedestrians to share a steep narrow winding roadway with vehicles and boat trailers.



Photo # - Safety Railing Along the Turf Path Wall Structure

Resolution:

Install the timber path barrier per plan.

Probable Cost:

Original bid prices for this work ranged from a low of \$56 per foot to a high of \$122 per foot. Assuming a 20% contingency above the previous bid prices, the magnitude of cost for 260-feet of 42" tall timber path barrier could range from \$17,500 to \$38,100.

3. Installation of safety rail along the break wall on the lakeshore to reduce the potential of public from falling over the wall to the rocks below.

Review and Assessment: The safety rail has been installed. However, there is a gap in the railing over the wall between the wood railing and the metal railing.



Photo # - Safety Rail Along Break Wall

Resolution:

This gap could be filled by bolting an additional 2-feet of railing to the wood post and cantilevering it over the wall.

Probable Cost:

The magnitude of cost for the additional material and labor is approximately \$500-750.

4. Relocation of overflow parking area from its intended location to encourage park visitors to remain on designated pedestrian walkways.

Review and Assessment:

Per the construction plans, the overflow parking area designated is intended to be an unimproved turf field. The conditions at the time of observation appear to be consistent with the construction plans. The overflow parking is intended to provide additional parking for vehicles and trailers used by boaters to bring boats to the launch, when the parking area at the boat launch is full.

The pedestrian route from the overflow parking is not well defined nor signed to indicate an intended route. Potential routes a pedestrian could take include:

- Retrace route along the vehicular driveway from the boat launch.
- Shortcut southeasterly past the original amphitheater space and bunkhouses to meet the pedestrian path adjacent to the boat launch drive. Unfortunately, this route presents challenges that a first-time user may not realize until encountering them, such as the steep slope or turf pedestrian path framed by retaining walls.
- Attempt to take the most direct route. Because of the slope between the overflow parking area and the boat launch area, this is unfeasible and unsafe.

Resolution:

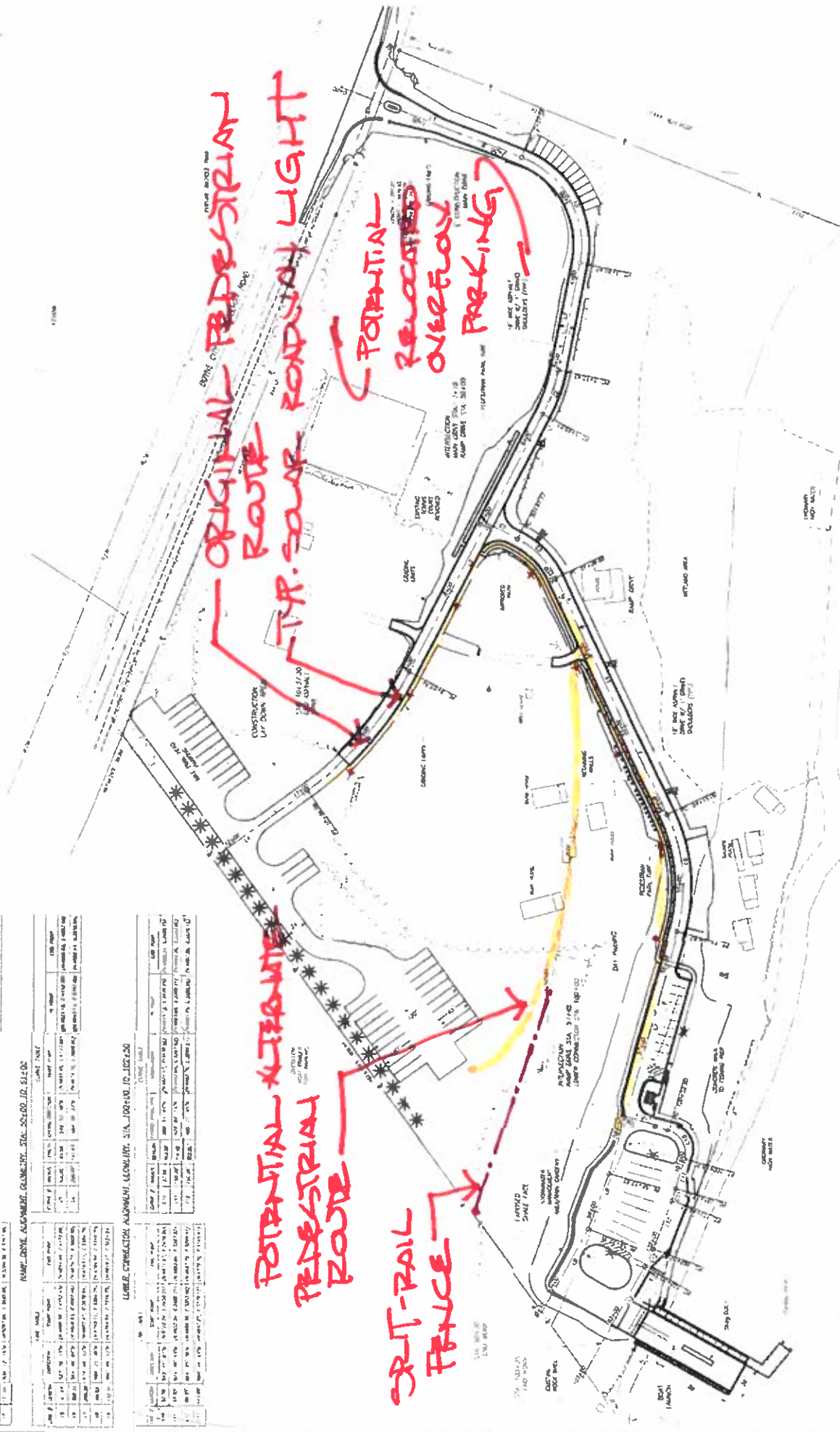
1. Area exists to indicate a pedestrian path route from the overflow parking area to the pedestrian path along the boat launch driveway. This route may be able to run past the amphitheater, and along the south side of the two bunkhouses before connecting with the pedestrian path along the boat launch driveway. See Figure 4.1 for potential route options. Should this route be established, we recommend placement of 450 lf of 42" double split-rail fence, as indicated in Figure 4.1, to notify users of the steep slope beyond. Whether the intended pedestrian route is maintained, or the above modified route is established, the pedestrian route can be indicated by informational "Pedestrian Route" signs at strategic locations.
2. An additional improvement to increase visibility of the pedestrian path for both pedestrians and drivers would be to add concrete pavement to the path, which will also provide a more even walking surface and would reduce maintenance in comparison to a turf path. In this case, we would recommend a concrete paved pedestrian walk for the entirety of the route from the overflow parking area to the pedestrian path along the boat launch driveway.
3. Relocate the overflow parking area from its current location to the open area west of the entry driveway. This option presents a slight advantage regarding proximity to the boat launch drive and pedestrian path. However, potential consequences may include increased pedestrian traffic conflicts along the entry drive.

FIGURE 4.1

MAIN LEVEL ALIGNMENT GEOMETRY - STA. 0+00 TO 1+21.00			
STATION	CHANGING POINT	CHANGING POINT	CHANGING POINT
0+00	0+00	0+00	0+00
0+05	0+05	0+05	0+05
0+10	0+10	0+10	0+10
0+15	0+15	0+15	0+15
0+20	0+20	0+20	0+20
0+25	0+25	0+25	0+25
0+30	0+30	0+30	0+30
0+35	0+35	0+35	0+35
0+40	0+40	0+40	0+40
0+45	0+45	0+45	0+45
0+50	0+50	0+50	0+50
0+55	0+55	0+55	0+55
0+60	0+60	0+60	0+60
0+65	0+65	0+65	0+65
0+70	0+70	0+70	0+70
0+75	0+75	0+75	0+75
0+80	0+80	0+80	0+80
0+85	0+85	0+85	0+85
0+90	0+90	0+90	0+90
0+95	0+95	0+95	0+95
1+00	1+00	1+00	1+00
1+05	1+05	1+05	1+05
1+10	1+10	1+10	1+10
1+15	1+15	1+15	1+15
1+20	1+20	1+20	1+20
1+21.00	1+21.00	1+21.00	1+21.00

MAIN LEVEL ALIGNMENT GEOMETRY - STA. 0+00 TO 0+10.00			
STATION	CHANGING POINT	CHANGING POINT	CHANGING POINT
0+00	0+00	0+00	0+00
0+05	0+05	0+05	0+05
0+10	0+10	0+10	0+10

LOWER CONNECTION ALIGNMENT GEOMETRY - STA. 100+00 TO 100+25.00			
STATION	CHANGING POINT	CHANGING POINT	CHANGING POINT
100+00	100+00	100+00	100+00
100+05	100+05	100+05	100+05
100+10	100+10	100+10	100+10
100+15	100+15	100+15	100+15
100+20	100+20	100+20	100+20
100+25.00	100+25.00	100+25.00	100+25.00



 Performance Engineers, Inc.	HAYES TOWNSHIP PHASE 1 (ALTERNATE)	HAYES TOWNSHIP PARK PHASE 1 (ALTERNATE)	SCALE: 1" = 40'
			DATE: 11/15/10

Probable Cost:



Pedestrian Route informational sign



MUTCD R5-6

- | | | |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Option 1: | Six 7" x 10" Informational "Pedestrian Route" signs on 2" x 2" black-painted steel posts, with footing per construction drawing detail A5/Sheet 20: | \$3,000 - 3,750 |
| Option 2: | Add 600 lf 4" concrete sidewalk with channel drains at sidewalk landings: | See item 5, next pg. |
| Option 3: | Option 1 above, PLUS relocate overflow parking: | TBD |
| | 450 lf 42" Double Split Rail Fence | \$5,400-9,000 |

5. Redesign of the sidewalk in graduated levels to eliminate the straight run down the slope of the landscape.

Review and Assessment:

The construction plans for the roadside pedestrian path from the boat launch to the main entrance drive measures approximately 550' long and is designed with an overall slope exceeding 10%. The steepest trail segment is a section measuring approximately 190' long, with a grade just over 14%, which can present a significant challenge for many pedestrians. The purpose of the pedestrian path is to facilitate pedestrian movement between the boat launch at lake level and the overflow parking area at upper park level. It does not appear that there is significant space to accommodate overflow parking near the launch at lake level, or at any location within the park that is not at the upper level.

Boating access sites are typically held to the ADAAG accessibility requirements, in which the pedestrian pathway from the upper park level and overflow parking to the boat launch could be considered an accessible route from the upper park level to the boat launch. The construction plans do include accessible parking spaces and defined accessible routes to the boat launch. Because no practical conditions exist to engineer an accessible route from the boat launch to upper park level and overflow parking, we consulted a more relaxed applicable standard, which would be AASHTO's Guidelines for Bicycle Facilities, under the "shared use" category of pathways. When we review these guidelines, we have determined that the overall slope of over 10% for a run of 550' exceeds even these standards. At this point, we would suggest that no practical condition exists to bring the path into compliance with the shared use category within the aforementioned AASHTO guidelines.

Resolution:

The determination above should not imply that an opportunity does not exist to introduce level landings along the path for pedestrians to rest. This assessment previously mentions a 190' segment of trail that exceeds 14%. Referring to Figure 5.1a-c, we have illustrated that by steepening the more gradual trail segments at the top and bottom of the pedestrian path, it should be possible to introduce level landings at approximately 55' intervals along the steepest section of trail, and at lesser intervals throughout. To facilitate the placement of level landings, approximately 80' of 2' precast concrete unit wall would be required to contain the walking surface, as indicated in Figures 5.1 a-c. Given the steepness of the proposed pedestrian path, the existing condition and the impracticality of meeting the AASHTO shared-use pathway standards or the ADAAG accessibility guidelines, our recommendation would be to include the level landings as indicated in Figures 5.1a-c.

A final note is required to address the proposed pedestrian path surface. The path is shown on the construction plans to be a grass pathway. We would recommend reconsideration of that surface in favor of a more uniform surface that facilitates easier pedestrian movement. We also believe that the grass pathway at the proposed slope will present significant maintenance challenges. Options could be a pervious paver, to allow stormwater to infiltrate, or a poured concrete sidewalk with intermittent channel drains to capture runoff.

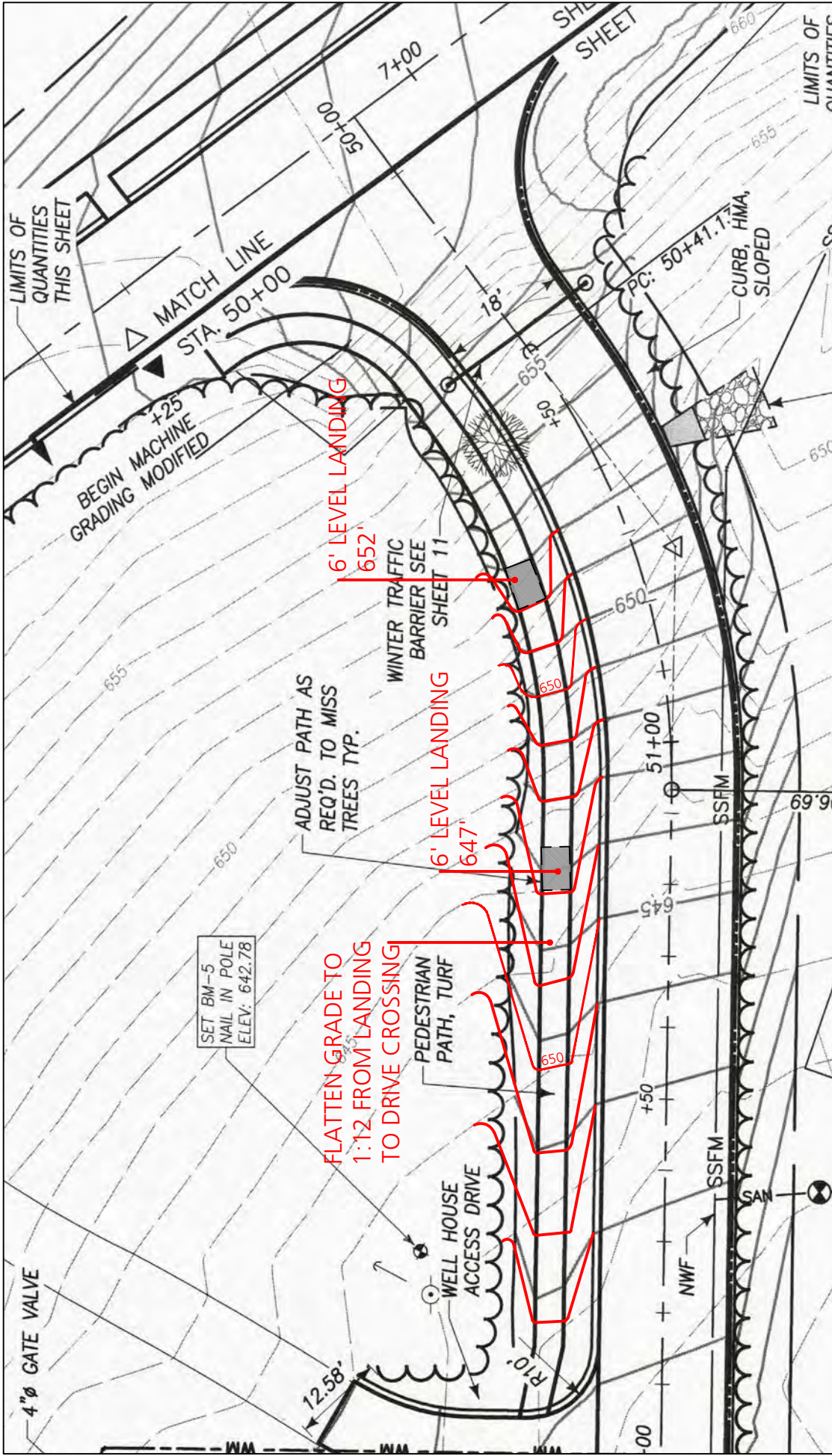


FIGURE 5.1a

Walking Path Proposed Level Landings
 Boat Launch Drive Sta. 50+00 to Sta. 52.00

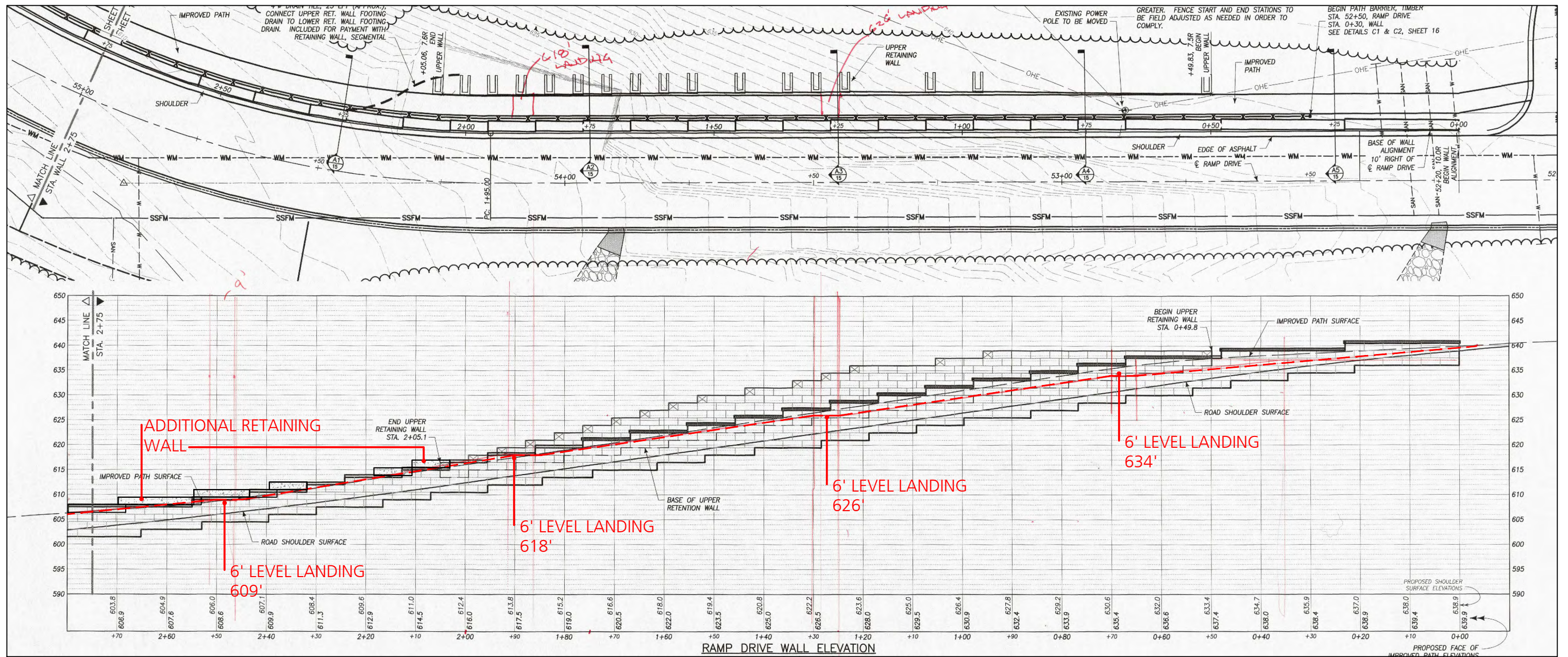


FIGURE 5.1b
 Walking Path Proposed Level Landings
 Boat Launch Drive
 Retaining Wall Sta. 00+00 to Sta. 02+75

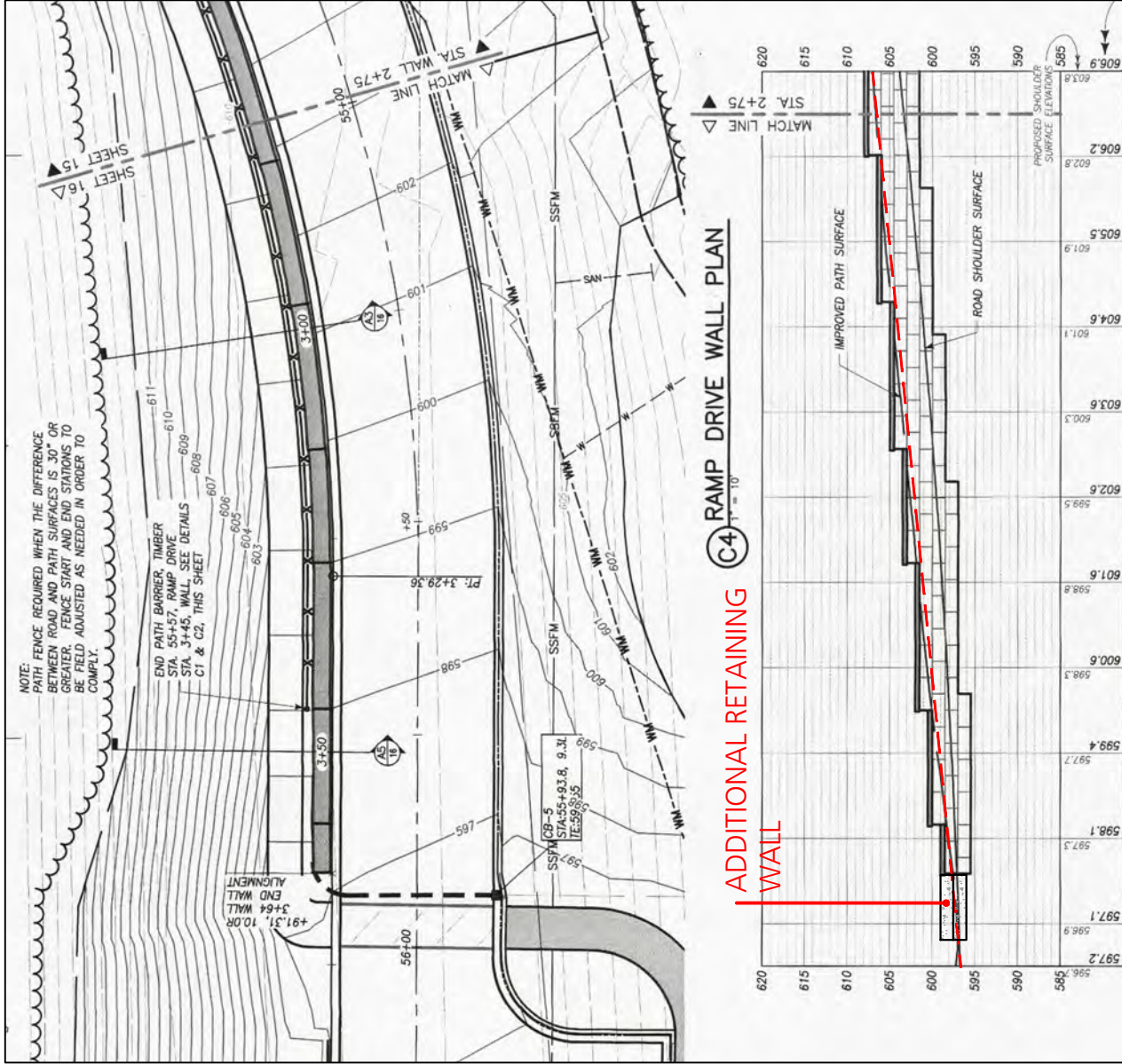


FIGURE 5.1C
 Walking Path Proposed Level Landings
 Boat Launch Drive
 Retaining Wall Sta. 02+75 to Sta. 03+73

project memorandum

Probable Cost:

- | | |
|------------------------------------------------------------------------------------------------------------|-----------------|
| 1. Add 600 lf 4" concrete sidewalk: | \$16,800-21,000 |
| 2. Add channel drains at landings within retaining walls,
6 total, connect to existing wall drain tile: | \$ 4,200-6,500 |

6. Installation of an escape ladder on the fishing pier and throw rings in the event someone falls in the water.

Review and Assessment:

The pier design includes a guardrail installed around the perimeter of the fishing pier. The guardrail varies between a 42-inch and a 32-inch rail height. The higher 42-inch standard rail height meets the most restrictive fall prevention barrier requirement specified by the International Building Code (IBC). The lower 32-inch accessible rail height complies with the ADDAG requirements for fishing piers and platforms. This height provides a person using a wheelchair or other mobility device with the opportunity to fish from the pier. This lower rail height is below the standard IBC guard rail height and inadvertently increases the possibility of a fall occurring.

Neither safety rail height will prevent an individual from deliberately entering the water from the pier. Signage intended to communicate that swimming and diving are prohibited uses is discussed under item 7.



Photo # - Pier Guard Rail

If an individual were to enter the water from the pier either by unintentionally falling or deliberately entering the water, additional precautionary measures that would prevent drowning include the installation of life rings and an escape ladder.

Resolution:

A life ring would provide someone standing on the pier the opportunity for to assist a person in the water. Life rings need to be strategically placed so that they are readily accessible. The life rings need to be in good working order and have enough line to reach the persons in the water. The line should also be made of a material which allows it to float on the water. This line would also provide the thrower with the ability to retrieve and throw the life ring again. Additionally, the floating line allows the swimmer to grab the line in case the life ring is not accurately thrown. The U.S. Coast Guard promulgates a standard for a 30-inch (76.2 cm) life ring, with at least 90 feet (27.43 m) of line attached. Various agencies specify an installation frequency of 200-feet shall be available at readily accessible points

If a person is alone on the pier and their fall into the water goes unnoticed, a life ring will not help her or him in getting out of the water. A safety ladder would provide the opportunity for a person to exit from the water by themselves.

Various agencies specify an installation of 200-feet shall be available at readily accessible points. Installation of a safety ladder at the inside corner of the pier would provide a water egress location within 200-feet of any point on the pier. In addition, this location is protected from boating activities on the west side of the pier as well as the more exposed wave and wind conditions on the south side of the pier. The ladder should be installed so it extends from the top of the 42" rail down into the water.

Probable Cost:

The magnitude of cost for two USCG approved 24 Inch Orange Hard Shell Ring Buoy with 90' line bag and single point mounting hook would be approximately \$350 each for a total of \$700.

The magnitude of cost for an aluminum safety ladder would be approximately \$700-1,000.

7. Signage on the pier for no climbing or jumping from the pier due to shallow water below.

Review and Assessment:

The intended purposes of the facility include fishing and boating which are uses not compatible with swimming. This pier has not been designed and constructed with the intent to accommodate swimming in the vicinity of the pier nor provide access to the water. Furthermore, variable and shallow depths adjacent to the pier pose a hazard to entering the water from the pier. We recommend that signage be provided to indicate that swimming and diving are not permitted uses of the pier.

Resolution:

Signage should be installed on the interior and exterior side of the pier to indicate that swimming or diving from the pier is a prohibited activity. There are a variety of signs available some of which are illustrated in the figure below. These signs can be secured to the wood and metal railings in the vicinity of the pier. Signs should be installed at a minimum on every section of railing at a reasonable frequency.



Figure # - No Swimming and No Diving Signs

Probable Cost:

The magnitude of cost for ten combined “No swimming or Diving Permitted in this Area” signs made of aluminum and secured with screws or straps would be approximately \$50 per sign for a total of \$500-750.

8. Installation of a rail along the boat launch break wall and signage posted to deter the public from walking or climbing on the break wall.

Review and Assessment:

The sheet pile wall adjacent to the west edge of the boat ramp presents a hazard should people decide to walk along the top of the wall, which is held to just above the elevation at the top of the boat launch. Because the top of the wall is near pavement grade at the top of the ramp, it also presents a challenge for drivers backing into the boat ramp, because there is no clear indication nor significant barrier to notify the driver of the location of the top of wall and edge of ramp.

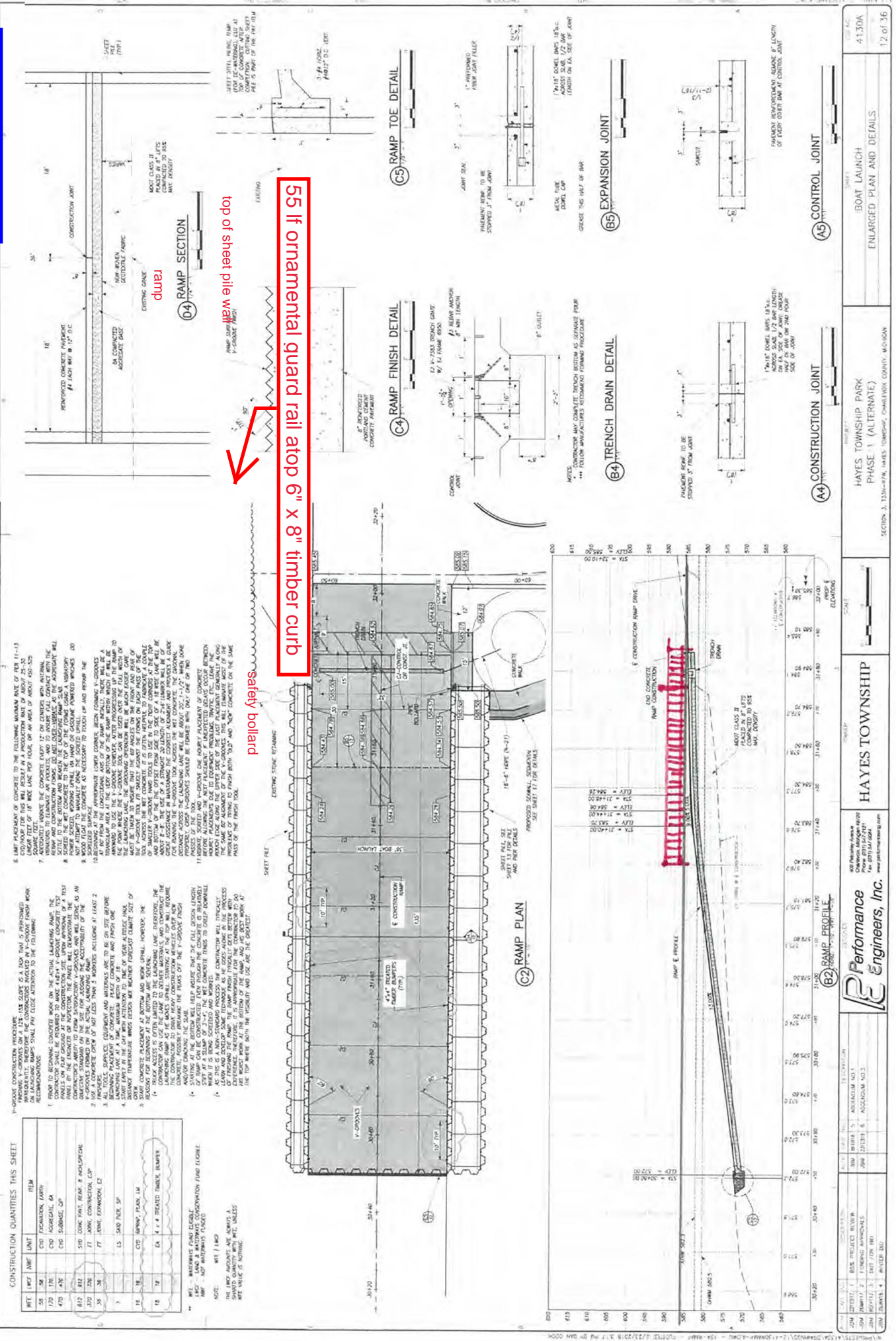
Reviewing the drawings, it appears that a double sheet-pile wall was originally proposed in this location but was eliminated.

Resolution:

Add a bumper to help reduce the risk of a car backing over the edge of the wall and ramp and add a guardrail to fulfill the building code requirement that pedestrians be protected from falls exceeding 18" in elevation. Surface-mount guard rail could be installed atop a 6" x 8" timber bumper, which in turn would be mounted on spacers to allow boat ramp surface drainage to pass beneath it. Include 7" x 10" "Danger – Keep Off" sign at north end of wall on guardrail signage prohibiting people from walking or climbing on the wall.

See Figure 8.1.

FIGURE 8.1





Probable Cost:

- | | |
|-----------------------------------------------------|---------------|
| 1. 6" x 8" Timber bumper on 2" wood spacers, 55 lf: | \$ 425 - 600 |
| 2. 42" Painted Walk Railing, 55lf @ \$155/lf-175/lf | \$8,525-9,625 |
| 3. 7" x 10" "Danger – Keep Off" sign: | \$ 50 - 75 |

9. Continuation of the fishing pier deck railing from its current position to the start of the decking along the boat launch.

Review and Assessment:

There is apportion of the pier directly adjacent to the boat launch where a guard rail was not installed. The absence of a barrier between the fishing pier and the drop to the concrete boat launch poses a roll-off risk for people in wheelchairs. This issue could be addressed by simply extending the fishing pier rail to the end of the pier.



Photo # - Pier Guard Rail

Resolution:

Extend Fishing pier Rail to the end of the pier (terminate at the steel bollard)

Probable Cost:

The magnitude of cost for infilling the safety rail is approximately \$8,000-12,500.

10. Installation of night lighting along the drive and parking area of boat launch.

Review and Assessment:

Our site investigation indicated that site lighting has been installed per the construction documents, with a total of three light fixtures within the boat launch parking area. However, it also appears that the park will remain open at all hours. It does not appear that the Township has a minimum requirement for outdoor lighting in this instance.

Resolution:

The primary concern is that pedestrian and roadway areas are lighted to provide safety for pedestrians and motorists. Installing pathway lighting along the pedestrian route from the boat launch parking area to the overflow parking area would accomplish improvement of pedestrian safety. However, to address both pedestrian and vehicular safety and to provide light for the roadway, we recommend installation of light fixtures matching those already installed in the boat launch parking areas.

Probable Cost:

Street lighting, from boat launch parking to overflow parking,
8 LED overhead lights, 120' o.c. @ \$2,200 ea \$17,600-21,500
(see Figure 4.1 for layout):

11. Signage at the top of drive and along the sidewalk barrier to alert drivers of the pedestrian crossing at the base of the road.

Review and Assessment:

Our site investigation determined that the pedestrian route was placed according to the construction plans. At the bottom of the driveway that accesses the boat launch area, the pedestrian route takes pedestrians from the pedestrian path on the north side of the road, crossing the road via a striped pedestrian crosswalk before joining the south side of road and driveway. The pedestrian crossing is otherwise unmarked and not easily seen as the pedestrian path emerges from the end of the roadway retaining wall. Additionally, the pedestrian path is a turf path and as such is not an intuitive route for pedestrians.

Resolution:

The recommended solutions include placing warning signage based on The Manual for Uniform Traffic Control Devices.

1. Place "W11-2" Pedestrian Crossing Sign with supplemental sign W16-2P "500 Feet" at a location 500' from the existing crosswalk.
2. Place "W11-2" Pedestrian Crossing Sign with supplemental sign W16-7P behind back of curb at either side of the existing crosswalk, facing oncoming traffic.
3. We also recommend placing informational signs at the top and bottom of the pedestrian path indicating "Pedestrian route". Include the MUTCD sign R5-6, which prohibits bicycle traffic, due to the surface type and narrow width of the pedestrian path.



MUTCD W11-2 w/w16-2P



MUTCD W11-2 w/w16-7P



Pedestrian Route informational sign



MUTCD R5-6

Probable Cost:

1. One "W11-2" with "W16-2P" signs on 2" x 2" black-painted steel posts, footing per construction drawing detail A5/Sheet 20: \$ 500-750

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 2. Two "W11-2" with "W16-7P" signs on 2" x 2" black-painted steel posts, footing per construction drawing detail A5/Sheet 20: | \$ 1,000-1,250 |
| 3. Two "Pedestrian Route" signs with "R5-6" signs on 2" x 2" black-painted steel posts, footing per construction drawing detail A5/Sheet 20: | \$ 1,000-1,250 |

Additional Concerns Not Listed in the RFP:

A. Pavement Markings Failure.

Review and Assessment:

It was noted in many places that the edges of the pavement markings have curled. When applying traffic paint to new asphalt, the asphalt typically needs to have cured about 30 days before the pavement markings applied. When paints applied used before the proper cure time is allowed, the paint tends lift or curl. This can be reduced by applying two thin coats of paint instead of one. It is likely that application of paint was either applied to early and/or too thickly.

Resolution:

The pavement markings that have failed should be milled off and replaced

Probable Cost:

The magnitude of cost for mobilization and labor for this work will would be approximately \$500-750. However, it is possible that correction of this issue could be addressed by the construction contractor as a warranty issue.

B. Gap in Pier Guard Rail

Review and Assessment:

There is an approximately 4-foot gap in the 42-inch tall guard rail along the west side of the fishing pier. We assume that this gap is provided for the purpose of accessing boats that have been launched. However, the boat ramp dock provides access to boats after they have been launched. This guard rail gap poses a fall risk to people on the pier.



Photo # - Gap in Pier Guard Rail

Resolution:

Infill gap in rail with additional 42-inch tall guard rail

Probable Cost:

The magnitude of cost for infilling the guard rail is approximately \$500-800.

C. Rain gardens

Review and Assessment:

Our site investigation identified three new rain gardens constructed in the boat launch parking lot area. Size and location of the rain gardens are consistent with the Construction Drawings. Upon further review of the construction drawings, it appears as though the rain gardens were intended to accept site drainage from the parking lot, the driveway to the upper park level, and the retaining wall systems. However, field observations indicate that the rain gardens in general and the easternmost rain garden do not appear to be receiving surface stormwater runoff from pavement surfaces.

One factor contributing to the lack of surface runoff that the rain gardens receive is the raised asphalt edge that borders the two rain gardens within bituminous pavement. Another factor contributing to the diversion of stormwater surface runoff from the easternmost rain garden is the concrete curb and gutter installed at the southwest corner of the parallel parking east of the restroom (see attachment 13.1). Presently, the curb is flattened to allow for barrier-free pedestrian movement from the barrier-free parking space. However, the curb remains flattened beyond the painted barrier-free access zone, which reduces its ability to direct stormwater to the catch basin. An additional note regarding the catch basin is that the current cover is not ADAAG-compliant.

An additional concern is the steepness of the rain garden slopes. One cross-sectional detail calls for a 1:6 slope, while another plan-view detail seems to indicate a 1:2 slope, which is what appears to have been constructed. The slopes are planted with a limited palette of perennial plants with no additional erosion protection. As currently installed, it will be a challenge for the Township to maintain the slopes should the site receive significant rains, and should the rain gardens receive the volume of water apparently intended in the design. Additionally, the steep slopes of the rain gardens present a potential hazard to pedestrians.

Resolution:

1. Confirm existence of storm sewer lines based on the Construction Drawings.
2. Determine whether there is a minimum stormwater volume that the rain gardens were intended to receive.
3. Based on examination of the above information, remove, store and maintain landscape plantings, re-grade the rain gardens so that side slopes do not exceed 1:3, seed the side slopes with an erosion controlling seed mix, and re-install the landscape plants.
4. Remove flattened concrete curb, including bituminous pavement to sufficiently accommodate removal and replacement.
5. Replace the existing catch basin grate with a catch basin with curb inlet back. The grate for the catch basin must be ADAAG-compliant.
6. Replace the flattened curb with a full 8" curb. Taper curb to flush with gutter pan at barrier-free path.

Probable Cost:

- | | |
|------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1. Remove and store landscape plantings, re-grade rain gardens, place erosion control seed mix, reinstall landscape plantings: | \$5,500-7,000 |
| 2. Remove 12 lf concrete curb, concrete sidewalk, and bituminous pavement to sufficiently allow installation of new concrete curb: | \$ 125-200 |
| 3. New Concrete Curb & Gutter: | \$ 275-400 |
| 4. New Concrete Sidewalk: | \$ 225-350 |
| 5. Replace existing catch basin grate with ADAAG-compliant grate with curb inlet: | \$ 850-1,000 |

References:

AASHTO Guide for Planning, Design and Operation of Bike Trail Facilities, 2010 Edition.

Guidelines, Regulations & Safety Standards Related to Marina Drownings – Expert Research; Carl F. Wolf; February 2, 2018

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Manual on Uniform Traffic Control Devices, U.S. Department of Transportation -Federal Highway Administration. 2009 Edition.

Michigan Department of Natural Resources
Standard Boating Access Site Drawings and Details

National Water Safety Congress (n.d.). Guidelines for the Safe Operations and Maintenance of Marinas.

http://www.usace.army.mil/Portals/2/docs/civilworks/recreation/Water_Safety/tools/guidelines_safe_operation_maint_marinas.pdf?ver=2016-07-25-130937-857 2001 Revision of 1988 Guidelines

United States Access Board. Accessible Fishing Piers& Platforms,
<https://www.access-board.gov/attachments/article/590/fishing.pdf>

Hayes Township, Michigan

Camp Sea-Gull Report



Preliminary Opinion of Probable Construction Cost

31-Jul-19

ITEM	DESCRIPTION	COST, LOW	COST, HIGH
1	Shale Wall and Slope at Boat Launch Parking	\$ 31,500.00	\$ 45,000.00
2	Pedestrian Ramp and Protective Guard Rail	\$ 17,500.00	\$ 38,000.00
3	Guard Rail Along Breakwall at Boat Launch Parking	\$ 500.00	\$ 750.00
4	Overflow Parking and Circulation	\$ 8,400.00	\$ 12,750.00
5	Pedestrian Ramp and Level Landings	\$ 21,000.00	\$ 27,500.00
6	Escape Ladder on Fishing Pier	\$ 700.00	\$ 1,000.00
7	Signage on Pier to Discourage Climbing, Jumping or Swimming	\$ 500.00	\$ 750.00
8	Protect West Edge of Boat Ramp	\$ 9,000.00	\$ 10,300.00
9	Extension of Fishing Pier Railing	\$ 8,000.00	\$ 12,500.00
10	Lighting Installation	\$ 17,600.00	\$ 21,500.00
11	Signage Regarding Pedestrian Crossing	\$ 2,500.00	\$ 3,250.00
A	Pavement Markings Failure	\$ 500.00	\$ 750.00
B	Pier Guard Rail Gap	\$ 500.00	\$ 800.00
C	Rain Gardens	\$ 6,975.00	\$ 8,950.00
Subtotal:		\$ 125,175.00	\$ 183,800.00
General Conditions:		\$ 12,517.50	\$ 18,380.00
Subtotal:		\$ 137,692.50	\$ 202,180.00
Construction Contingency		\$ 13,769.25	\$ 20,218.00
TOTAL:		\$ 151,461.75	\$ 222,398.00
Design and Engineering:		\$ 18,932.72	\$ 31,135.72

EXHIBIT 'A'



July 29, 2019

Mr. Tim Knutsen
Beckett & Raeder
113 Howard St
Petoskey, MI 49770

Re: Structural Barrier Wall Review
Camp Seagull (Hayes Twp Park)
ME Project No. 19110

Dear Tim:

Machin Engineering was requested to perform a structural evaluation of alternatives for the protection of the public from the exposed rock face along the Camp Sea Gull Park (Hayes Township Park) project, Hayes Township, Charlevoix County, Michigan. A site visit was conducted by this firm on 6/25/19 to review the current condition of concerned area.

Discovery

The purpose of the visit was to visually witness the current condition of the rock wall comprising of the Paxton and Norwood shale. The total length of the cut and exposed bedrock units was paced off to measure approximately 550 linear feet along the access drive at the Camp Seagull park facing the lake. The wall was cut to a near vertical face with exposed heights generally ranging from 3 to almost 8 feet. A little more than half of the length was in the 3-4-foot range. A ribbon of crushed stone of 2-3 feet was present between the wall and bituminous pavement. See image below. Block fracturing was visible along the higher portions of the wall anywhere from one foot cubed to several feet cubed in volume. See Image below. These fractures pose possible safety concerns. Other areas experienced flaking along the bedding planes of the rock. In general, the bedrock is orientated in almost a purely horizontal alignment. Localized flows of surface water were visible over the rock more near the western end of the face. Native plants have taken root along wall as expected. See image below. The natural plants provide additional stability of the rock face.

The rock face has been evaluated by Dr. Stanley Vitton, Ph.D., P.E. of GeoEngineering North located in Houghton, MI. In summary, Dr. Vitton's report stated, in general, the rock face and adjacent slopes are stable from analysis for slope stability and review of the rock types. The report further described the shale rock as inherently stable given its composition, strike and dip angles. The strike and dip were stated to be almost horizontal.

Barrier Alternatives

Barrier alternatives including a barrier fence and fall preventative netting or drapery were reviewed. The barrier fence would include a structural element and be installed at a distance of 3-5 feet, in front of the rock, and along the edge of the asphalt running the length of the rock face. Another option is the use of rock fall netting or drapery consisting of metal fabric anchored to the rock. As stated above, this is perhaps around 550-feet in length. The barrier fence would be installed in such a manner as to provide protection to the public from falling or flaking rock masses. The fence would be installed such that individual; localized sections can be replaced without discounting the integrity of the entire fence. Think of the netting like a soccer net. The purpose is to retain and prevent from injuring people or damaging other property.

Review of Selected Alternatives

Structural Barrier

The minimum height of the fence should be 6'-6" to discourage people from scaling and to protect against falling rocks where the exposed rock face is 8-feet above grade. Sections should be removable between each post location without removing large sections to maintain serviceability to the public. Gates should be added to allow passage for maintenance. Ends of the fencing should be closed without gaps between the rock face and the fence run.

Posts should be structural grade embedded in a firm concrete footing with wire fence containing properties to absorb localized impact forces without causing damage to neighboring sections similar to that supplied by Maccaferri USA.

The fencing material must be manufactured and installed to support impact loads on the order of 3,000-4,000 lbs in a horizontal direction with an estimated setback distance of 3 to 5-feet from wall face to fence. We have estimated 8-inch diameter schedule 80 steel posts at 8-feet on center with steel fabric between each post.

Steel Rock Fall Netting or Drapery

The drapery would be similar to Maccaferri DT Mesh. Anchorage would be as recommended by the manufacturer but may consist of anchoring at the top, bottom, and along various interior points to maintain constant contact with the rock surface. This option could be coupled with a more permanent and aesthetically pleasing option of constructing a short concrete stem wall of 3-feet max height set back from the rock a minimum of 3-feet. The stem wall setback would allow for footing construction but also maintain adequate drainage and natural weathering processes to remain intact.

While we have provided a couple of valid options, considerations for overall aesthetics are recommended and are outside the scope of our work. However, care should be taken so safety is not sacrificed for aesthetics.

This concludes our review. Please let me know if there are any questions or comments.

Sincerely,

MACHIN ENGINEERING, INC



Patrick J. Machin, P.E.
Principal

PJM/pjm

Image looking East



Image of Example Block Fracture



Image of Example Flaking



Natural Plants Taking Root along Rock Face



Crushed Stone Ribbon

