GENERAL SERVICES COMMITTEE
420 N Front St.
Suttons Bay, MI 49682
Tuesday, January 3. 2023 at 8:30 am

For the public wishing to view the meeting using remote attendance, there will also be a Zoom link (which can be found on our website at www.suttonsbayvillage.org). Public participation shall be limited to in-person or via written communication received prior to the meeting

AGENDA

Call to Order

1. Reports (staff)
   a. DPW Director Report

2. Public Comments
   Please limit remarks to no more than three (3) minutes or less.

3. Committee Business
   a. Report VSB 2022-71 Water Wheel Park Study
   b. Report VSB 2022-72 Elm Street Study

4. Status Update – Other Committees
   a. Report VSB 2022-75 Personnel Manual Considerations

5. Public Comments/Written Communication

6. Committee Member Comments

7. Announcements

8. Adjournment

Village of Suttons Bay Michigan	DEPARTMENT OF PUBLIC WORKS REPORT DPW -2022- 09		
Prepared:	Dec 29, 2022	Pages:	1 of 1
Meeting:	Jan 03, 2023	Attachments:	None ☒
Subject:	Monthly DPW Updates		

GENERAL SERVICE HIGHLIGHTS

Christmas Blizzard of 22: Our crew did a great job keeping major routes open during the peak of the storm and the subsequent cleanup afterwards. The additional salt truck that was purchased this year came in handy along with the improved capabilities of the new loader.

Removal of snow stockpiles in town are underway to make room for future snow clearing operations.

Storm drains and culverts are being checked this week due to the potential melt off with the warmer temperatures. Additionally, material will be applied to the streets as needed to prevent slick spots as the temperatures dip below freezing at night.

UTILITY HIGHLIGHTS

Quarterly inspections and maintenance of low flow sewer areas were completed and jetted out.

Our entire department was on hand operating the Vactor to clean out sludge layer and remaining water in the south clarifier at the WWTP. This project was done so Jacobs operations staff could enter the tank safely and complete an interior inspection of walls and sludge collector mechanisms.

Effluent PFAS sample was collected at the WWTP for analysis, sampling plan is currently being developed for future testing frequency per EGLE.

Currently working on developing a monthly water loss report to track production vs. metered end user accounts.

REGULATORY HIGHLIGHTS

Water reliability study is completed, meeting with engineer on Jan 6th, 2023, to review results prior to submittal to EGLE WRD.

Annual Pumpage Report for will completed in early January.

Village water supply monthly sample results were all clear.

VILLAGE OF SUTTONS BAY

REPORT VSB -2022-71

Prepared:	December 7, 2022	Pages:	1 of 1
Meeting:	January 3, 2023	Attachments:	☒
Subject:	Waterwheel Cost Estimate Discussion		

PURPOSE

To provide engineer cost estimates for waterwheel park.

OVERVIEW

Attached are the two waterwheel estimates requested by the Village Council. For the purpose of this report, the cost estimates will be referred to as "Plan A" and "Plan B"

Plan A – Waterwheel reconstruction – Restore the Past.

Machin Engineering works closely with Federal and State agencies on projects such as dam analysis and reconstruction. A cost estimate to reconstruct the waterwheel structure, fix the stream and re-route the stream to flow over the structure is before you for consideration. That cost is approximately $266,340.

Plan B – Creek Restoration - A New Beginning.

GEI, an environmental engineering firm who works closely with communities, non-profits, the Grand Traverse Band and State in creek restoration. The cost estimate for consideration would forgo replacing the waterwheel structure and create a cascading creek. That cost is approximately $169,684

STAFF COMMENT

Preliminary discussions with experts in the field seem to share the same sentiment regarding the two choices listed above. Although we cannot say for sure, these types of restoration projects (Plan B) have a higher probability for qualifying for grants than would Plan A.

ACTION REQUESTED

Discussion & Direction

A.

Machin Engineering, Inc.
2301 N Garifled Rd, Suite C
Traverse City, MI 49686
ph 855.935-1530
www.machinengineeing.net

OPINION OF PROBABLE CONSTRUCTION COST
Village of Suttons Bay
WATER WHEEL STRUCTURE REPLACEMENT
December 21, 2022

Item No.	Item Description	Unit	Qty.	Unit Cost	Cost
Demolition and Excavation					
1	Mobilization & Demobilzation	LS	1	$9,000.00	$9,000.00
2	Silt Fence	LS	1	$1,000.00	$1,000.00
3	Earth Excavation	CY	200	$35.00	$7,000.00
4	Dewatering	LS	1	$15,000.00	$15,000.00
5	Crushed Stone Base	CY	40	$90.00	$3,600.00
6	Backfill, MDOT Class II, CIP	CY	130	$20.00	$2,600.00
7	Remove and Restore Temporary Stream Area	LS	1	$7,500.00	$7,500.00
8	Topsoil, Seed, and Mulch	SY	900	$6.00	$5,400.00
9	Relocate Power Pole & Service	LS	1	$12,000.00	$12,000.00
				SUBTOTAL:	$63,100.00
New Structure					
11	Reinforced Concrete Retaining Wall	LF	39	$1,500.00	$58,500.00
12	Concrete Slab, 6"	SF	540	$25.00	$13,500.00
13	Stream Bank Restoration	LF	80	$150.00	$12,000.00
14	Stream Channel Hand Form	LF	32	$320.00	$10,240.00
15	Overflow Structure	LS	1	$1,200.00	$1,200.00
16	Waterwheel Structure (not i/c wheel)	LS	1	$6,600.00	$6,600.00
17	Observation Deck	LS	1	$26,000.00	$26,000.00
18	Rip-Rap Stone, 18"-24"	CY	20	$200.00	$4,000.00
19	Disconnect & Reconnect Site Electrical	LS	1	$3,500.00	$3,500.00
20	Site Lighting	LS	1	$10,000.00	$10,000.00
				SUBTOTAL:	$145,540.00
				SUBTOTAL:	**$208,640.00**
				20% CONTINGENCIES:	**$41,700.00**
				CIVIL & STRUCTURAL ENGINEERING FEES:	**$16,000.00**
				TOTAL ESTIMATED PROJECT COST:	**$266,340.00**

- Costs for engineering, surveying, permit fees, etc. are not included in the estimate.
- Costs for financing, land, right-of-way, easement acquisition, and permit fees are not included in this cost estimate.
- This cost estimate is approximate. Actual construction bids may vary significantly from this statement of probable costs due to timing of construction, changed conditions, labor rate changes, or other factors beyond the control of Machin Engineering, Inc.
- Clean backfill sand to be provided by the Village. Material costs are not included in the estimate, labor and equipment only for the placements and compaction. Costs for dispocsal of excavted materials and debris is provided in the estimate. Discosal by the Village.
- Engineering fees do not include electrical engineering or construction administration services.

B.

Design Memorandum

To: Mr. Rob Larrea

From: Dan DeVaun, PE

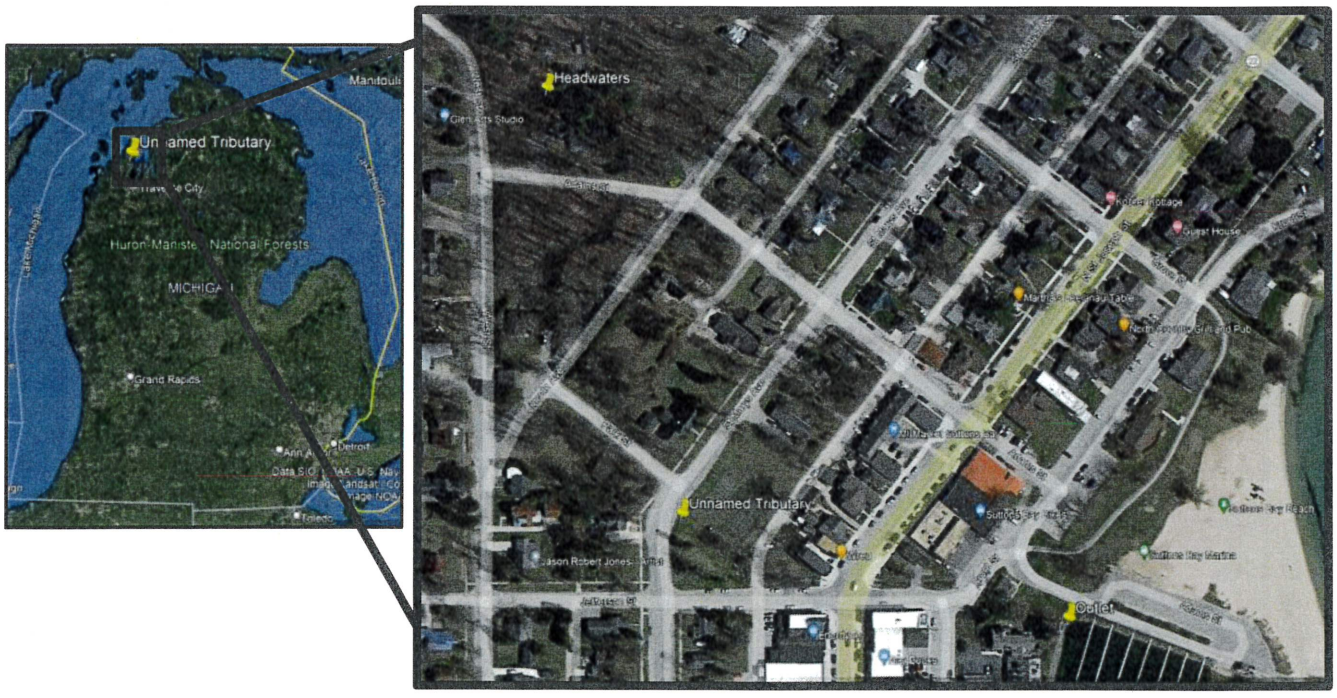
Date: November 30, 2022

Re: Stream Restoration Conceptual Design
Suttons Bay Stream Restoration
Suttons Bay, MI
GEI Project No. 2204115

This memo summarizes the design methodology and conceptual design completed by GEI Consultants Inc. (GEI) for the referenced project located in Suttons Bay, MI.

Project Information

GEI was contracted by the Village of Suttons Bay to assist in the restoration of a section of an unnamed spring-fed tributary that commences just north of Adams St and extends to an outlet into Suttons Bay. GEI's goal was to develop a conceptual design for the restoration of the stream section located between St Mary's Ave and an alley where a water-wheel was previously located. The water-wheel structure and its associated appurtenances have been removed and feasibility of replacement versus restoration is currently under evaluation.



Data Collection

GEI staff completed a site visit and site survey on October 31st, 2022. The site visit included walking the entirety of the tributary from the outlet into Suttons Bay, upstream to the headwaters to establish an understanding of the contributing watershed. Photos from the site visit are included in the appendices. Stream elevations from within the existing channel geometry were collected in the project area using a Trimble R6 GPS System. Existing survey data was obtained from Machin Engineering and was combined with the GEI survey data to create the working surface for the conceptual design.

Hydrology and Hydraulics

Based on our observations and measurements obtained during our site visit and a cursory review of existing LIDAR elevation contours (FEMA 2015), the contributing watershed to the culvert located at the alley was estimated to be about 5.2 acres assuming there is no culvert conveying water under West St. (none observed during site visit). The source of the majority of flow within the stream can be attributed to spring features present within the vicinity of the headwaters. Based on the relatively small watershed area and the contributing groundwater presence the stream is considered a stable system with low hydrologic flashiness. Land use and soil types for the watershed were determined to support understanding of hydrologic and hydraulic processes within the tributary and to identify appropriate restoration design. The watershed land use is primarily 1 acre residential with type A soils (USDA 2003). Type A soils are well draining, sandy soils with high infiltration rates that limit runoff volume during rain events. A cursory hydraulic analysis was performed assuming a curve number of 51 which estimated the 100-year flood flow to be 16 cubic feet per second (cfs). This low flood flow to base flow ratio is indicative of a hydrologically stable system.

Existing Conditions

The existing stream runs about 190 feet in length within the project reach from the culvert under N St. Mary's Street to the culvert located under the alley. The average slope is about 6% which is relatively steep. During our visit on October 31st, 2022, the existing stream was recently rerouted beginning 80 feet downstream from the culvert under N St. Mary's St to the culvert at the alley (Figure 1). The stream was temporarily rerouted due to the deterioration of the water wheel and ongoing erosion concerns. The rerouted section was covered with geotextile fabric and held in place with cobbles and sandbags.

Figure 1. Stream reroute. Photo taken on 10/31/2022.

Design Approach and Recommendations

The proposed stream design was broken into two separate reaches due to the variation of slope from the upper 80 feet (3%) to the lower 110 feet (10%). The classification system developed by Dr. Dave Rosgen for confined and unconfined valleys and stream types A through G was used to develop the appropriate design criteria (Figure 2).

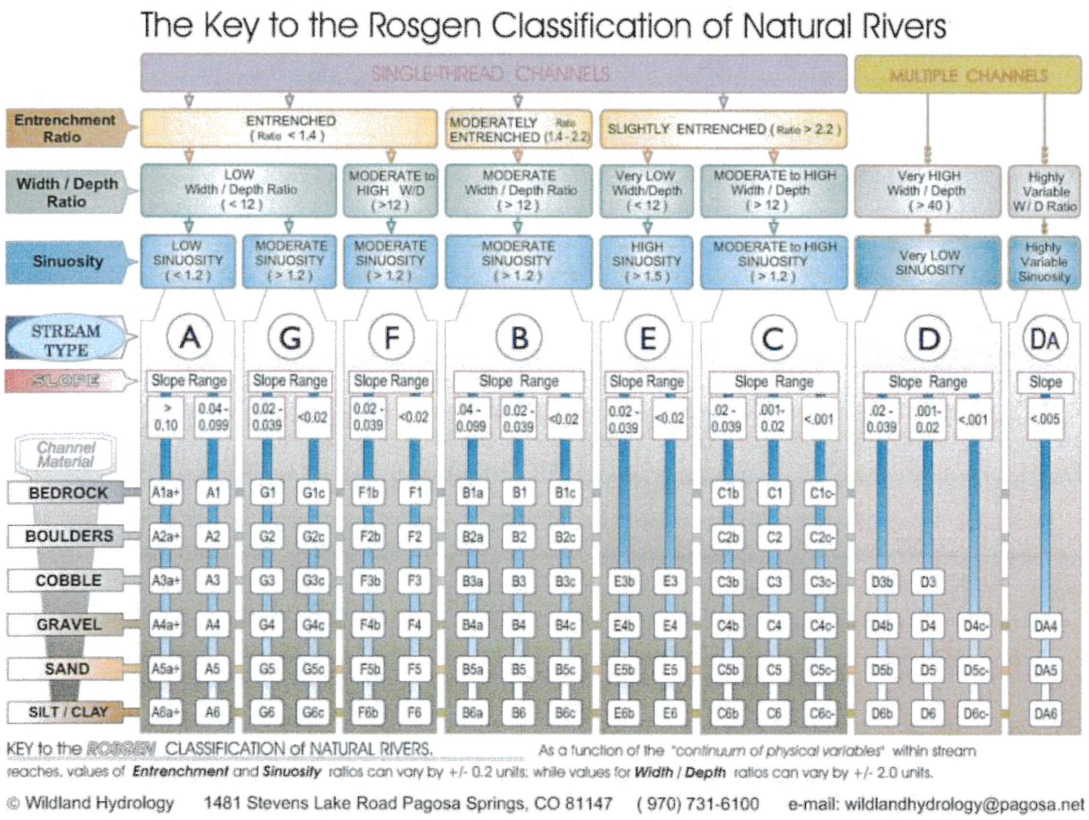


Figure 2. Rosgen classification system (Rosgen, 2019).

The first reach was designed to meet the characteristics of a C type channel. The channel is single-thread and slightly entrenched. The recommended design has a Width/Depth (W/D) ratio narrower than 12 to allow the channel to widen naturally. In order to decrease the current slope, the reach was designed with meanders to increase the wetted length of the channel, resulting in a sinuosity of 1.49. To dissipate stream energy in a stable manner, the conceptual design incorporates shallow riffles and deeper pools to hydraulicly control flows. Riffles and pools naturally occur in stable river systems, and enhance the aesthetic value of the stream by adding visual interest. Channel geometry was determined through a hydraulic and hydrologic evaluation based on observed flow depth and approximated bankfull flow. The recommended geometry within the meander section based on this analysis is about 6 inches in depth and 4 feet wide.

The second reach was designed as a B type channel due to the higher slope. The channel is single-thread and moderately entrenched. As with the meander section, the recommended design has a W/D ratio narrower than 12 to allow the channel to widen naturally. The channel sinuosity is 1.16. To convey the flow down a steeper slope while maintaining channel stability, a cascade designed with rock steps and pools is recommended. Similarly to the converging rock clusters, rock steps and pools in the cascade section would provide grade control and energy dissipation (Rosgen 2019). Additionally, the cascades will create falling water down each of the placed rocks, which makes for a visually and aurally appealing experience for park users which may provide a similar atmosphere that was created by the waterwheel. Based on the hydraulic and hydrologic evaluation, the recommended channel geometry within the cascade section will be about 6 inches in depth overall but will vary

based on rock placement. Pool depths are estimated to be one foot or greater to allow adequate energy dissipation. The width of the channel should be designed to approximately 4 feet.

Throughout the entirety of the project reach, the floodplain bench is recommended to be a non-mowed area vegetated with native plant species to provide a riparian buffer zone between the stream and surrounding watershed that provides flood conveyance and water quality enhancement through pollution filtration. Additionally, this deeper-rooted vegetation will help to provide increased stability of the stream banks and reduce erosion potential. The conceptual design plans reflect the referenced buffer zone and are provided in the appendices.

For the stream reach between the alley and Front Street, the ideal channel geometry recommended is a bankfull width between 3 and 4 feet with a depth of approximately 6 inches. The floodplain width is recommended to be at least twice the length of the bankfull width. As with the project reach, the floodplain bench is recommended to be a non-mowed area with native vegetation.

Cost Estimate

A preliminary design cost was estimated based on estimated quantities of materials, labor, maintenance, and other construction activities. A contingency of 30% was included in the final estimated cost for the project of $169,684. As with any cost estimate, unit rates may vary based on timing of construction and locally provided contractors and materials.

Engineers Opinion of Probable Cost					
	Bid Item Description	**Estimated Qty**	**Unit**	**Unit Cost**	**Total**
1	Mobilization General	1	LS	$ 20,000	$20,000
2	Soil Erosion/ Sediment Control	1	LS	$ 10,000	$10,000
3	Dewatering during construction	1	LS	$ 21,000	$21,000
4	Clearing and Grubbing	0.18	AC	$ 25,000	$4,500
5	Excavation	140	CY	$ 20	$2,800
6	Granular filter (.25"-4" stone)	15	CY	$ 80	$1,200
7	Armor Stone (MDOT Heavy)	40	CY	$ 142	$5,680
8	Boulders (D50 = 3')	55	TON	$ 100	$5,500
9	Site Restoration	1	AC	$ 10,000	$10,000
10	Soil Wrap/Bioengineered Lifts	150	LF	$ 40	$6,000
		Subtotal			$86,680
		Contingency (30%)			$26,004
		Subtotal			**$112,684**
		Engineering Design			$40,000
		Construction Oversight			$17,000
		Total			**$169,684**
Unit Definitions: LS=Lump Sum, AC=Acre, TON = ton, CY=Cubic Yard, LF = Linear Foot					

Table 1. Conceptual Level Cost Estimate.

Appendices

Site photographs and conceptual design plans are attached.

We thank you for the opportunity to serve the Village of Suttons Bay. Please let us know if we can assist you in any other way. If you have any questions regarding the memorandum, please feel free to contact me at 616-915-7013 or ddevaun@geiconsultants.com.

Sincerely,

Dan DeVaun, PE
Senior Project Manager

Brad Parlato, PE
Vice President

[author initials : admin initials]
B:\Working\VILLAGE OF SUTTONS BAY\2204115 Suttons Bay Stream Restoration\00_CAD_Engr Analysis\11302022 Conceptual Design Memo

References

Federal Emergency Management Agency (FEMA). (2015). 2015 FEMA Lidar: Michigan Part 2 (Alger, Benzie, Delta, Grand Traverse, Leelanau, Mackinac, Manistee Counties).

Rosgen, Dave. (2019). Applied River Morphology. Wildland Hydrology.

United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). (2003). Soil Survey Geographic Database. Leelanau County, Michigan (MI089).

Photo Log

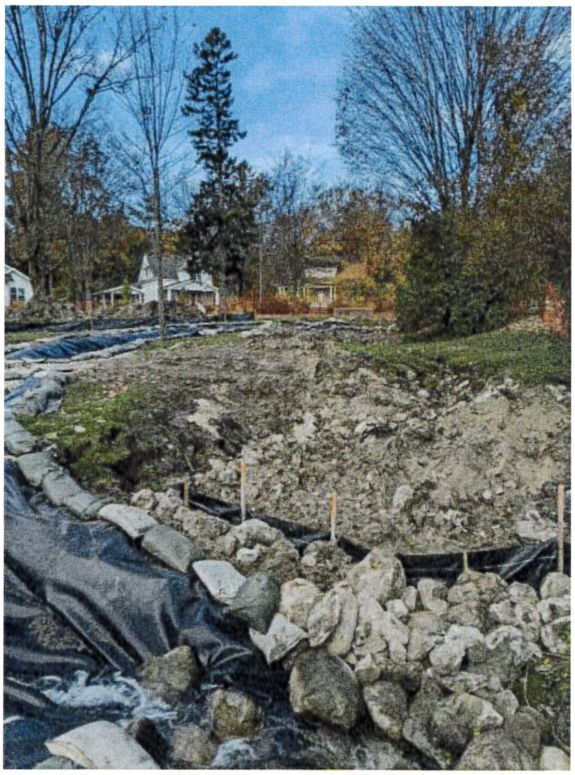


Photo 1. Looking upstream from alley at former water wheel location and relocated channel.

Photo 2. Beginning of stream reroute.

Photo 3. Downstream culvert inlet.

Photo 4. Upstream project reach near St. Mary's Street.

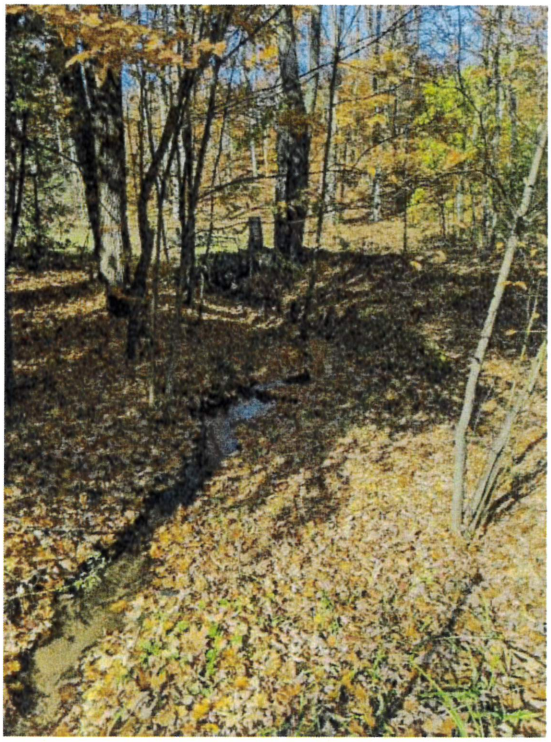


Photo 4. Tributary upstream of project area (West of St. Mary,s Street).

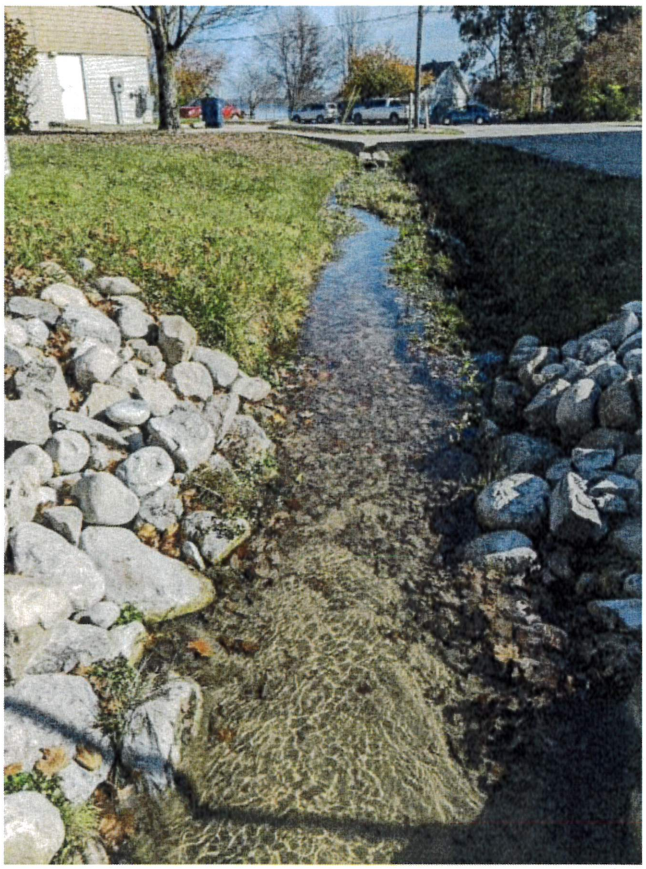
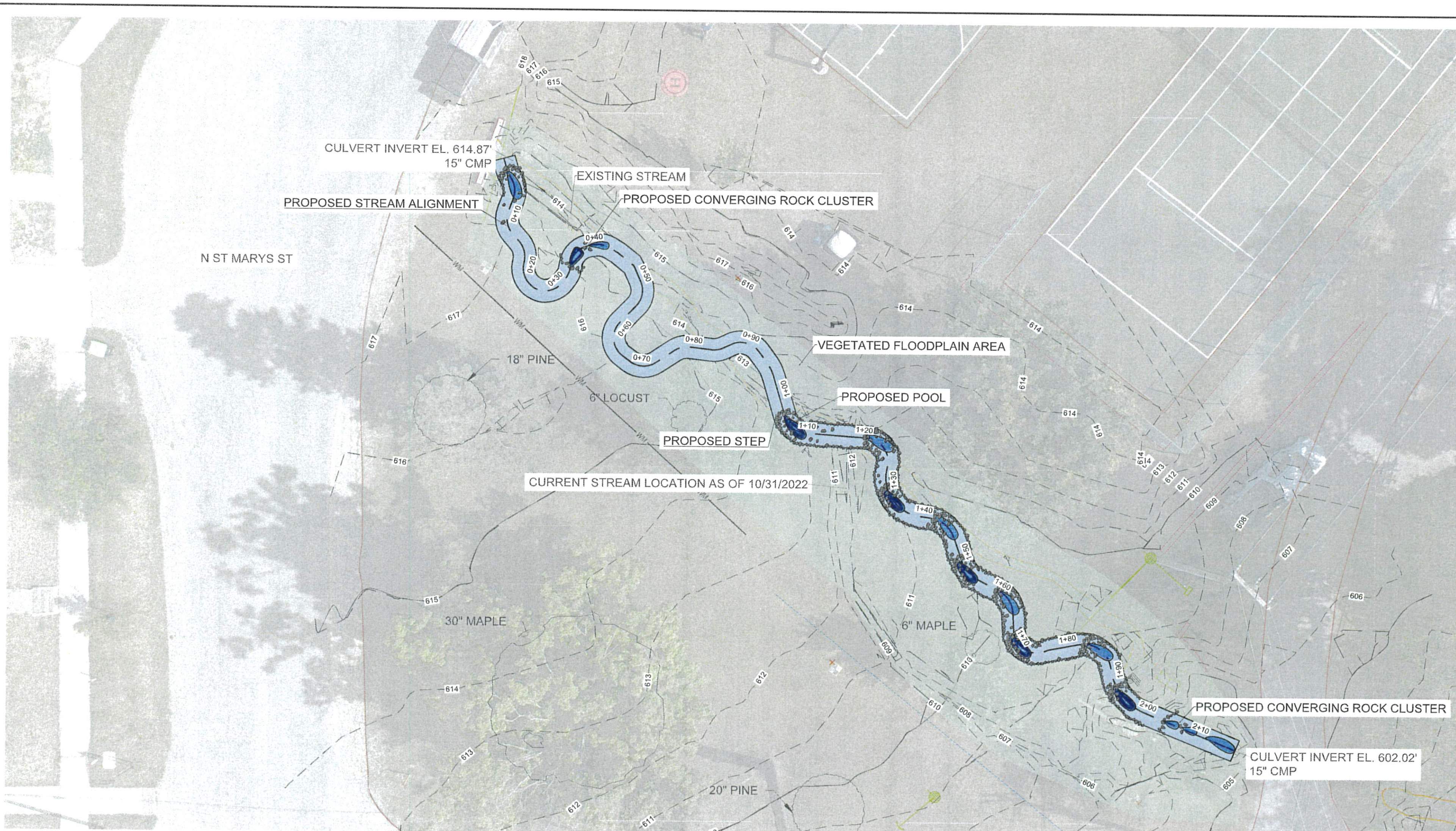


Photo 5. Tributary downstream of project area (east of M-22).



SCALE, FEET (0, 8, 16)

Attention: If this scale bar does not measure 1" then drawing is not original scale.

DRAFT

Designed: SHP
Drawn: MLF
Checked:
Approved:
P.E. No:
GEI Project

GEI Consultants
GEI CONSULTANTS OF MICHIGAN, P.C.
4472 MOUNT HOPE ROAD, SUITE A
WILLIAMSBURG, MI 49690
(231)933-4041

VILLAGE OF SUTTONS BAY

SUTTONS BAY STREAM RESTORATION

SUTTONS BAY
LEELANAU COUNTY, MICHIGAN

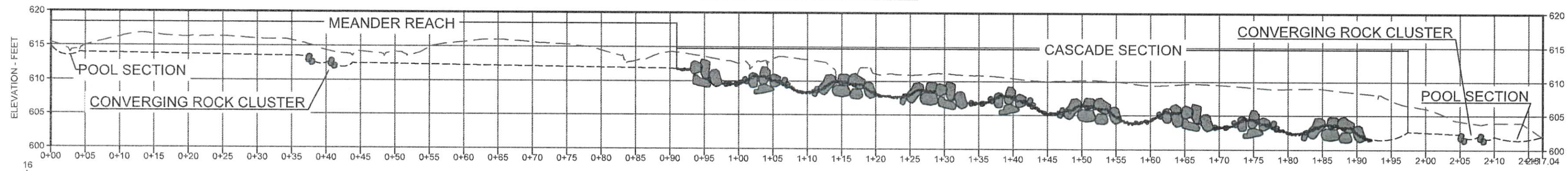
NO	DATE	ISSUE/REVISION	APP
0	11/21/2022	PRELIMINARY PLAN	

SHEET NAME: **C-01 CONCEPTUAL PLAN VIEW**

SHEET NO.: ----

FREEBY, MEREDITH \\bos-pzcc-1\Data_Storage\Working\VILLAGE OF SUTTONS BAY\2204115 Suttons Bay Stream Restoration\00_CAD\Design\Sheets\C-01_PLAN VIEW.dwg - 11/30/2022

CONCEPTUAL PROFILE



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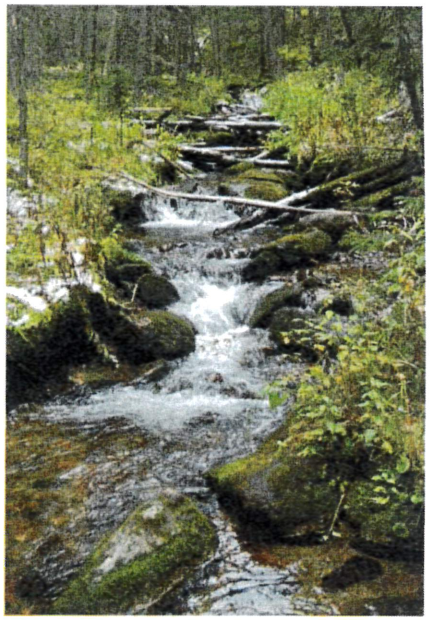
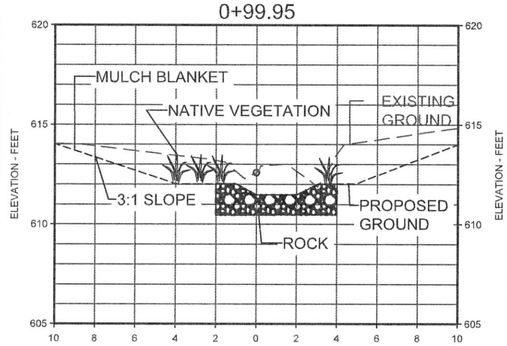
EXAMPLE CASCADE
EAST ST. LOUIS CREEK

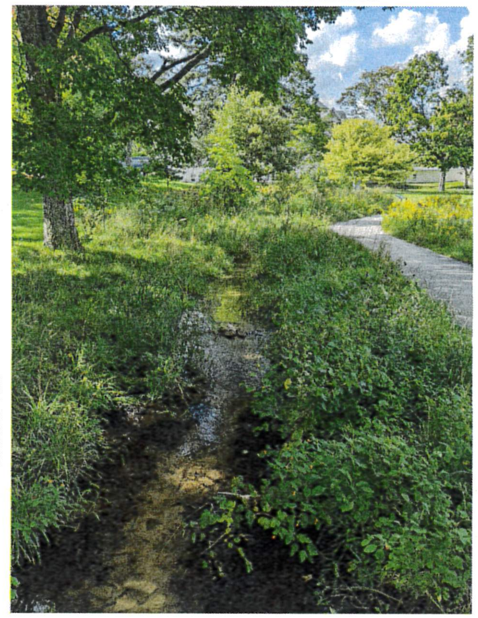


SOURCE: YOCHUM, STEVEN E. ET AL. 2014. PHOTOGRAPHIC GUIDANCE FOR SELECTING FLOW RESISTANCE COEFFICIENTS IN HIGH-GRADIENT CHANNELS. UNITED STATES DEPARTMENT OF AGRICULTURE.

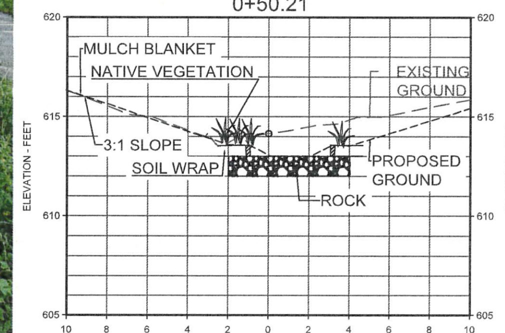
TYPICAL CASCADE CROSS SECTION
0+99.95



EXAMPLE MEANDER REACH
KIDS CREEK TRIBUTARY



TYPICAL MEANDER REACH CROSS SECTION
0+50.21



PRELIMINARY

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Attention: 0 1" If this scale bar does not measure 1" then drawing is not original scale.

DRAFT

Designed:	SHP
Drawn:	MLF
Checked:	
Approved:	
P.E. No:	
GEI Project	

GEI Consultants
GEI CONSULTANTS OF MICHIGAN, P.C.
4472 MOUNT HOPE ROAD, SUITE A
WILLIAMSBURG, MI 49690
(231)933-4041

VILLAGE OF SUTTONS BAY

SUTTONS BAY STREAM RESTORATION

SUTTONS BAY
LEELANAU COUNTY, MICHIGAN

NO	DATE	ISSUE/REVISION	APP
0	11/21/2022	PRELIMINARY PLAN	

SHEET NAME: **C-02 CONCEPTUAL PROFILE AND CROSS SECTIONS**

SHEET NO. ####

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CASCADE DETAIL

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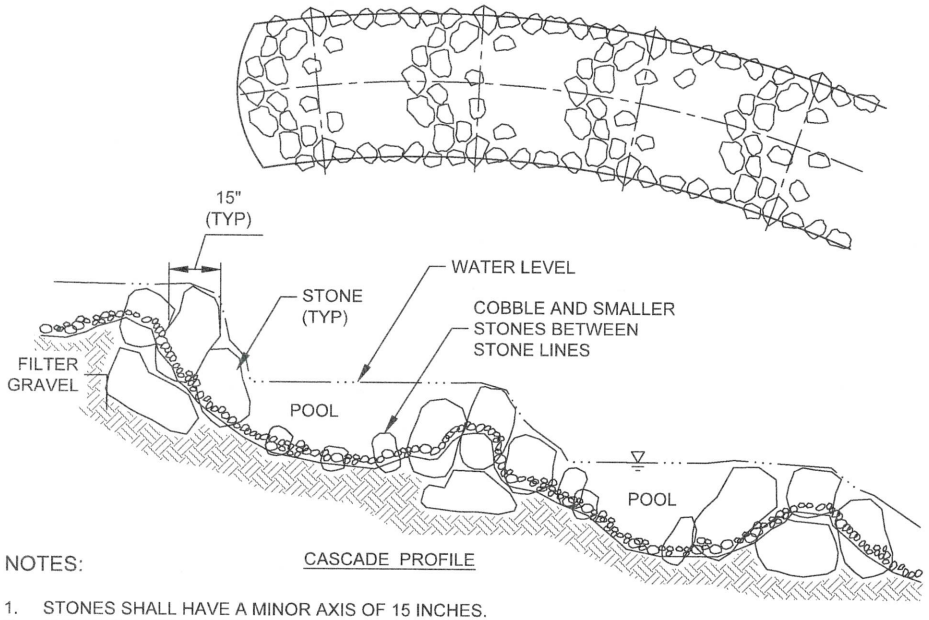


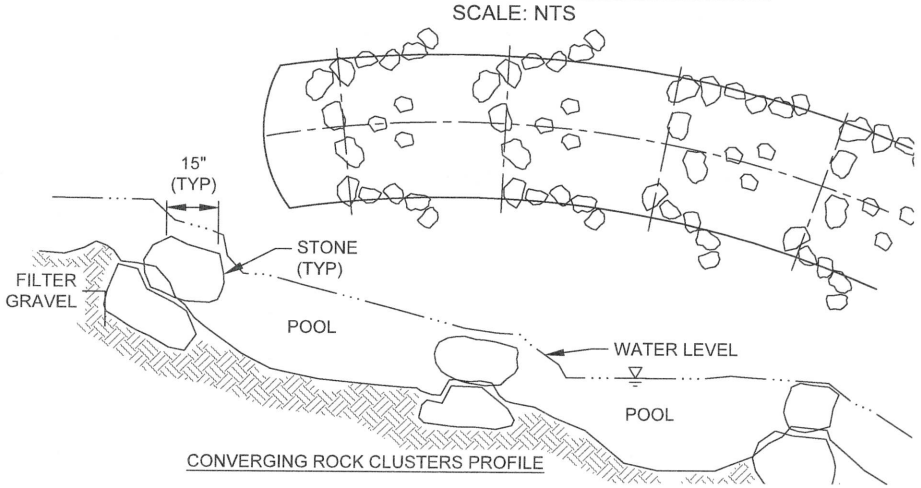
CASCADE PROFILE

NOTES:

1. STONES SHALL HAVE A MINOR AXIS OF 15 INCHES.
2. APPROXIMATELY 33% TO 50% OF STONES SHALL BE BURIED INTO THE SUB-GRADE.
3. STONES AND COBBLES INTERLOCK TO FORM COMPLETE LINES THAT CROSS THE CHANNEL FROM BANK TO BANK.
4. STONE LINES SHALL BE PERPENDICULAR OR DIAGONAL TO THE BANKS.

CONVERGING ROCK CLUSTERS

SCALE: NTS



CONVERGING ROCK CLUSTERS PROFILE

REPRESENTATIVE PHOTOGRAPH

PRELIMINARY

Attention: 0 1" If this scale bar does not measure 1" then drawing is not original scale.	DRAFT	Designed: SHP Drawn: MLF Checked: Approved: P.E. No: GEI Project	GEI Consultants GEI CONSULTANTS OF MICHIGAN, P.C. 4472 MOUNT HOPE ROAD, SUITE A WILLIAMSBURG, MI 49690 (231)933-4041	VILLAGE OF SUTTONS BAY	**SUTTONS BAY STREAM RESTORATION** SUTTONS BAY LEELANAU COUNTY, MICHIGAN	NO: 0 DATE: 11/21/2022 ISSUE/REVISION: PRELIMINARY PLAN APP:	SHEET NAME: **C-03 SAMPLE DETAILS**	SHEET NO.: ####

COMMITTEE

VILLAGE OF SUTTONS BAY

REPORT VSB -2022-72

Prepared:	December 7, 2022	Pages:	1 of 1
Meeting:	January 3, 2023	Attachments:	☒
Subject:	Elm Street All Way Stop Study		

PURPOSE

To provide the Elm Street Traffic Operations Analysis Report

OVERVIEW

Please find attached a copy of the Elm Street Traffic Operations Analysis Report regarding the all way stop. Rather than provide you with my opinion or assessment of the report, it is provided to you for your review, discussion and direction.

ACTION REQUESTED

Discussion & Direction

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

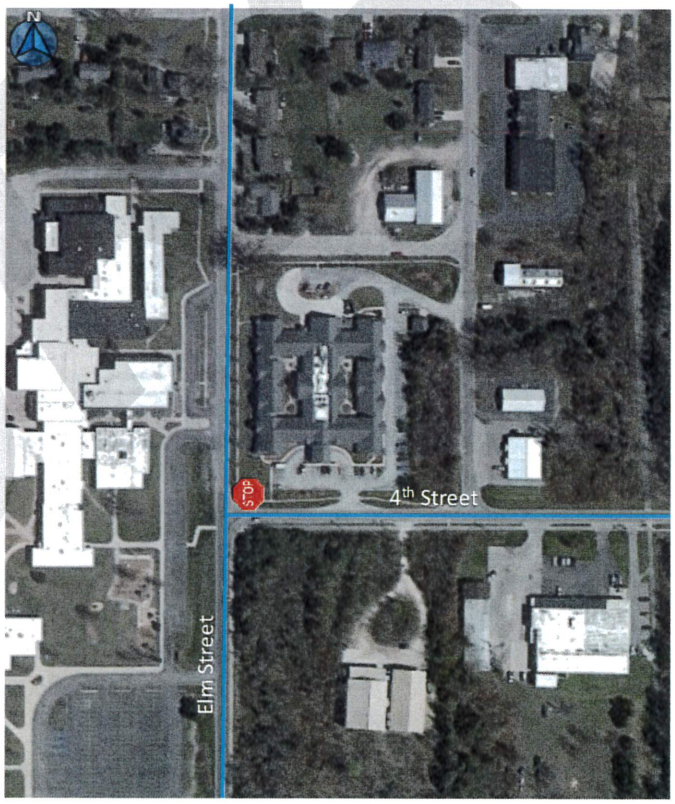
MEMO

To:	**Village of Suttons Bay**
From:	**Julie Kroll, PE, PTOE** **Fleis & VandenBrink**
Date:	**November 14, 2022**
Re:	**Elm Street & 4th Street Intersection** **Suttons Bay, Michigan**

1 INTRODUCTION

This memorandum presents the findings of the intersection evaluation performed for the intersection of Elm Street & 4th Street in Suttons Bay, Michigan. The study intersection location is shown on **Figure 1**. The Village requested an evaluation of the intersection due to concerns regarding, vehicle speeds, school traffic, and pedestrian crossings at the Elm Street & 4th Street intersection. This study was performed to provide recommendations to improve the safety at this intersection for all road users.

Figure 1: Site Location Map



603 Bay St, Suite B
Traverse City, MI 49684
P: 231.932.8600
F: 231.932.8700
www.fveng.com

2 MULTI-WAY STOP ANALYSIS

Section 2B.07 of the *MMUTCD* provides a set of criteria to evaluate in order to determine when the installation of multi-way stop should be considered at an intersection. The applicable criterion includes the evaluation of the following: *Signal Warrant Analysis*, *Crash History*, and *Traffic Volumes* at the intersection.

A. Signal Warrant Analysis

A multi-way stop may be used as an interim measure that can be installed quickly to control traffic prior to the installation of traffic signal control. Therefore, a signal warrant analysis was performed to determine if a signal is warranted and recommended at this intersection. The *Michigan Manual on Uniform Traffic Control Devices (MMUTCD)* documents eight warrants by which traffic signal control for evaluation. The applicable volume warrants: Warrant 1 (8-Hour Vehicular Volume), Warrant 2 (4-Hour Vehicular Volume), Warrant 3 (Peak-Hour), and Warrant 7 (Crash Experience) were evaluated at this intersection. The results of the analysis are summarized below, and the signal warrant data is attached. The results show that a signal is not warranted at this intersection, therefore this criteria is **Not Met**.

Table 2: Signal Warrant Analysis Summary

Warrant		Criteria Met
Warrant 1: Eight-Hour		NO
Condition A	*Hours Met*	0
	Warrant Met	NO
Condition B	*Hours Met*	0
	Warrant Met	NO
Warrant 2: Four-Hour	*Hours Met*	0
	Warrant Met	NO
Warrant 3: Peak-Hour	*Hours Met*	0
	Warrant Met	NO
Warrant 5: Crash Experience	Hours Met	0
	Warrant Met	NO

B. Crash History

A multi-way stop may be considered based on crash history where five (5) or more reported crashes occur in a 12-month period that are correctable by multi-way stop control. F&V reviewed historical crash data for the past **five years** of available data (January 1, 2017 – December 31, 2021) as obtained from the Michigan Traffic Crash Facts (MTCF) website. The results of the crash analysis are summarized in **Table 2** and show two crashes occurred within the five-year study period and both were weather related and are *not* correctable with STOP control. Therefore, the crash history is **Not Met**.

Date	Crash Type	Cause	Correctable with STOP Control
3/6/2018	Angle	Speed too fast for conditions/Icy Roads	No
3/6/2019	Other	Speed too fast for conditions/Icy Roads	No

C. Traffic Volumes

1. *The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour, for any 8 hours of an average day.*
2. *The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but*
3. *If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.*

When no single criterion is satisfied, but where Criteria A, B, and the Crash Criteria are all satisfied to 80 percent of the minimum values. Criterion C is excluded from this condition.

F&V subconsultant Gewalt Hamilton Associates (GHA) collected 12-Hour turning movement counts on October 6, 2022. This data was used to evaluate the traffic volume criterion of the Multi-Way Stop control warrant. The results of the analysis are summarized below. The detailed data is attached and shows that the traffic volume criteria is **Not Met**.

Table 3: Intersection Crash Summary (5 Years)

Criteria	Hours Met			Minimum Volume	Criteria
	C-1	C-2	Both Met		
Minimum Volumes	4	0	**0**	8	**Not Met**
80% Minimum Values	3	0	**0**	8	**Not Met**

Summary

- The results of the multi-way stop analysis shows that all-way stop control is not warranted or recommended at this intersection. Therefore, additional mitigation measures were reviewed to improve the safety and reduce the crash potential for all road users at this intersection.

3 PEDESTRIAN CROSSING ANALYSIS

There are two marked pedestrian crossings on both Elm Street and 4th Street at this intersection. The existing crossing treatments were reviewed to determine if additional measures are recommended at this intersection.

The pedestrian volumes collected are summarized in **Table 4** below for the 12-hours of data collection performed on September 22, 2022.

TABLE 4: MDOT PEDESTRIAN CROSSWALK CRITERIA

Start Time	*Crossing Elm Street*			*Crossing 4th Street*		
	To the East	To the West	Total	To the North	To the South	Total
6:00 AM	0	0	0	0	0	0
7:00 AM	0	0	0	0	0	0
8:00 AM	0	23	23	0	0	0
9:00 AM	0	0	0	0	0	0
10:00 AM	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0
12:00 PM	18	0	18	0	0	0
1:00 PM	0	0	0	1	0	1
2:00 PM	0	0	0	0	0	0
3:00 PM	2	7	9	0	0	0
4:00 PM	5	2	7	0	0	0
5:00 PM	1	1	2	1	0	1
6:00 PM	1	2	3	0	0	0
Total	***27***	***35***	***62***	***2***	***0***	***2***

Elm Street Pedestrian Crossing

MDOT provides guidance for determining appropriate pedestrian treatments as outlined in the MDOT *Guidance for Installation of Pedestrian Crosswalks on Michigan State Trunkline Highways, March 2020*. While it is understood that Elm Street is not a state trunkline, CR 633 is a bi-pass for M-22 and becomes Elm Street at the Village limits and operates more similarly to a trunkline than other roads in the Village.

There is an existing school crossing at the intersection to facilitate both east/west and north/south movements at this intersection. The analysis is summarized in **Table 5** below and shows that the existing number of pedestrians meet the thresholds for a marked crossing.

TABLE 5: MDOT PEDESTRIAN CROSSWALK CRITERIA

Pedestrian Threshold	Young, Elderly, Disabled Pedestrian Threshold	Hours Required	Met
20 pedestrians	10 pedestrians	per hour in any one hour	Yes
18 pedestrians	9 pedestrians	per hour in any two hours	Yes
15 pedestrians	8 pedestrians	per hour in any three hours	Yes
10 school age (grades K-12) pedestrians and is a designated school walking route		per hour in any one hour	Yes
Criteria Met for Unsignalized Crossing			Yes

Where crosswalks are recommended, MDOT provides guidance for the crossing types which includes uncontrolled crossing treatments. The posted speed limit at this intersection is 25 mph, however the actual speeds at this intersection are higher. Therefore, the criteria for Crossing Type B are recommended at this location, as identified in the attached Table 1 from the MDOT Guidance. Additionally, review of the pedestrian traffic volumes shows that the criteria to consider a Rectangular Rapid Flashing Beacon (RRFB) is met. Therefore, the following recommendations, as applicable to the Elm Street crossing location:

- Marked special emphasis crosswalk
- School crossing pedestrian warning signs
- Advance school crossing warning signs
- Rectangular Rapid Flashing Beacon (RRFB)

4th Street Pedestrian Crossing

The volume of pedestrians crossing north/south is relatively low, however there is a potential for vulnerable road users to cross at all legs of this intersection. Therefore, the following recommendations for the 4th Street crossing location are summarized below.

- Marked special emphasis crosswalk

4 CONCLUSIONS

- The results of the study show that neither all-way stop control or a traffic signal is warranted or recommended at this intersection.
- Mitigation measures are recommended to reduce vehicle speeds at the Village Limits and increase awareness of pedestrian crossings.

5 RECOMMENDATIONS

- Several treatments are recommended below that can be implemented in combination to improve the safety for pedestrians and reduce the speeds. Items of note include:
  - **Village of Suttons Bay Gateway Signage**: The northbound approach at the CR 633 transitions to Elm Street at Herman Road. This change from County Road to Village Street is not very clear, so vehicles continue driving at high speeds. Adding signage to indicate that drivers have entered the Village will help create a sense of place and reduce speeds in combination with other measures.
  - **Overhead Flashing Beacon**: Northbound drivers may not be aware that there is a cross-street north of Herman Street. Increased awareness at this intersection can be accomplished through the addition of an overhead flashing beacon.
  - **School Crossing Signage:** The pedestrian signage should be updated in accordance with current standards. The Elm Street crossing at 4th Street meets the criteria for the installation of a Rectangular Rapid Flashing Beacon (RRFB).

RECOMMENDATION SUMMARY

4th Street
➢ Provide marked special emphasis crosswalk
Elm Street
➢ Provide marked special emphasis crosswalks (2 locations)
➢ Rectangular Rapid Flashing Beacon (RRFB) school crossing at 4th Street
➢ Upgrade advance school crossing warning signs to current standards
➢ Upgrade 25 mph sign (larger) with speed feedback sign
➢ Provide Village Limit Sign/Gateway north of Herman Road
➢ Update pavement markings
Intersection
➢ Provide Overhead Flashing Beacon

Any questions related to this memorandum, study, analysis, and results should be addressed to Fleis & VandenBrink.

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Michigan.

Attached:
Exhibit 1-Recommended Mitigation Measures
Traffic Volume Data
Signal Warrant Analysis
All-Way Stop Warrant Analysis
Crash Data Summary
Auxiliary Turn Lane Criteria