

## CHECKLIST TO DESIGNATE AREAS OF EVALUATION FOR REQUESTS FOR PROPOSAL (RFP)

	REQUISITION NUMBER		DUE DATE <del>XXXXXXXXXX</del> <del>XXXXXXXXXX</del> <del>XXXXXXXXXX</del>
MDOT PROJECT MANAGER	JOB NUMBER (JN)	CONTROL SECTION (CS)	
DESCRIPTION			
<b>MDOT PROJECT MANAGER:</b> Check all items to be included in RFP  WHITE = REQUIRED GRAY SHADING = OPTIONAL  Check the appropriate Tier in the box below		<b>CONSULTANT:</b> Provide only checked items below in proposal	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>TIER I</b> (\$25,000-\$99,999)	<b>TIER II</b> (\$100,000-\$250,000)	<b>TIER III</b> (>\$250,000)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Understanding of Service
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<i>Innovations</i>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Organizational Chart
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Qualifications of Team
Not required as part of Official RFP	Not required as part of Official RFP	<input type="checkbox"/>	Quality Assurance/Quality Control
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<b>Location:</b> The percentage of work performed in Michigan will be used for all selections unless the project is for on-site p=inspection or survey activities, then location should be scored using the distance from the consultant office to the on-site inspection or survey activity.
N/A	N/A	<input type="checkbox"/>	Presentation
N/A	N/A	<input type="checkbox"/>	Technical Proposal (if Presentation is required)
3 pages (MDOT Forms not counted) ( <b>No Resumes</b> )	7 pages (MDOT Forms not counted)	14 pages (MDOT forms not counted)	Total maximum pages for RFP <b>not including key personnel resumes.</b> Resumes limited to 2 pages per key staff personnel.

**PROPOSAL AND BID SHEET EMAIL ADDRESS** – [mdot-rfp-response@michigan.gov](mailto:mdot-rfp-response@michigan.gov)

### GENERAL INFORMATION

Any questions relative to the scope of services must be submitted by e-mail to the MDOT Project Manager. Questions must be received by the Project Manager at least five (5) working days prior to the due date and time specified above. All questions and answers will be placed on the MDOT website as soon as possible after receipt of the questions, and at least three (3) days prior to the RFP due date deadline. The names of vendors submitting questions will not be disclosed.

MDOT is an equal opportunity employer and MDOT DBE firms are encouraged to apply. The participating DBE firm, as currently certified by MDOT's Office of Equal Opportunity, shall be listed in the Proposal.

### MDOT FORMS REQUIRED AS PART OF PROPOSAL SUBMISSION

**5100D** – Request for Proposal Cover Sheet

**5100J** – Consultant Data and Signature Sheet (Required only for firms not currently prequalified with MDOT)

**(These forms are not included in the proposal maximum page count.)**

**REQUEST FOR PROPOSAL**

The Michigan Department of Transportation (MDOT) is seeking professional services for the project contained in the attached scope of services.

If your firm is interested in providing services, please indicate your interest by submitting a Proposal, Proposal/Bid Sheet or Bid Sheet as indicated below. The documents must be submitted in accordance with the latest (Consultant/Vendor Selection Guidelines for Services Contracts" and "Guideline for Completing a Low Bid Sheet(S)\*, if a low bid is involved as part of the selection process. **Reference Guidelines are available on MDOT's website under Doing Business > Vendor/Consultant Services >Vendor/Consultant Selections.**

**RFP SPECIFIC INFORMATION**

BUREAU OF HIGHWAYS  BUREAU OF TRANSPORTATION PLANNING  OTHER

THE SERVICE WAS POSTED ON THE ANTICIPATED QUARTERLY REQUESTS FOR PROPOSALS

NO  YES DATED \_\_\_\_\_ THROUGH \_\_\_\_\_

**Prequalified Services** – See page \_\_\_\_ of the attached Scope of Services for required Prequalification Classifications.

**Non-Prequalified Services** – If selected, the vendor must make sure that current financial information, including labor rates, overhead computations, and financial statements, if overhead is not audited, is on file with MDOT's Office of commission Audits. This information must be on file for the prime vendor and all sub vendors so that the contract will not be delayed. **Form 5100J is required with Proposal for firms not currently prequalified with MDOT**

**Qualifications Based Selection** – Use Consultant/Vendor Selection Guidelines

**For all Qualifications Based Selections**, the section team will review the information submitted and will select the firm considered most qualified to perform the services based on the proposals. The selected vendor will be contacted to confirm capacity. Upon confirmation, that firm will be asked to prepare a priced proposal. Negotiations will be conducted with the firm selected.

**For a cost plus fixed fee contract**, the selected vendor must have a cost accounting system to support a cost plus fixed fee contract. This type of system has a job-order cost accounting system for the recording and accumulation of costs incurred under its contracts. Each project is assigned a job number so that costs may be segregated and accumulated in the vendor's job-order accounting system.

**Qualification Review / Low Bid** – Use Consultant/Vendor Selection Guidelines. See Bid Sheet instructions for additional information.

For Qualification Review/Low Bid selections, the selection team will review the proposals submitted. The vendor that has met established qualification threshold and with the lowest bid will be selected. The selected vendor may be contacted to confirm capacity.

**Best Value** – Use Consultant/Vendor Selection Guidelines, See Bid Sheet Instructions below for additional information. The bid amount is a component of the total proposal score, not the determining factor of the selection.

**Low Bid** (no qualifications review required – no proposal required.) See Bid Sheet Instructions below for additional instructions.

**BID SHEET INSTRUCTIONS**

Bid Sheet(s) must be submitted in accordance with the "Guidelines for Completing a Low Bid Sheet(s)\* (available on MDOT's website). Bid Sheet(s) are located at the end of the Scope of Services. Submit bid sheet(s) separate from the proposal, to the email address: [mdot-rfp-response@michigan.gov](mailto:mdot-rfp-response@michigan.gov). Failure to comply with this procedure may result in your bid being rejected from consideration.

**NOTIFICATION  
MANDATORY ELECTRONIC SUBMITTAL**

**Proposals submitted for this project must be submitted electronically.**

**The following are changes to the Proposal Submittal Requirements:**

- Eliminated the Following Requirements:
  - Safety Program
  - Communication Plan
  - Past Performance as *a separate section*
  - Separate section for DBE Statement of goals. Include information in Qualification of Team section
  
- Implemented the Following Changes:
  - All proposals require an Organization Chart
  - Resumes must be a maximum of two pages
  - Only Key (lead) staff resumes may be submitted
  - Tier III proposal reduced from 19 to 14 pages
  - Forms 5100D, 5100I, and 5100G combined – 5100D
  - Forms 5100B and 5100H combined – 5100B
  - RFP's will be posted on a weekly basis -- on Mondays

**The following are Requirements for Electronic Submittals:**

- Proposals must be prepared using the most current guidelines
- The proposal must be bookmarked to clearly identify the proposal sections (See Below)
- For any section not required per the RFP, the bookmark must be edited to include “N/A” after the bookmark title.  
**Example:** Understanding of Service – N/A
- Proposals must be assembled and saved as a single PDF file
- PDF file must be 5 megabytes or smaller
- PDF file must be submitted via e-mail to [MDOT-RFP-Response@michigan.gov](mailto:MDOT-RFP-Response@michigan.gov)
- MDOT's requisition number and company name must be included in the subject line of the e-mail. The PDF shall be named using the following format:
  - Requisition#XXX\_Company Name.PDF
- MDOT will not accept multiple submittals
- Proposals must be *received* by MDOT on or before the due date and time specified in each RFP

**If the submittals do not comply with the requirements, they may be determined unresponsive.**

The Consultant's will receive an e-mail reply/notification from MDOT when the proposal is received. Please retain a copy of this e-mail as proof that the proposal was received on time. **Consultants are responsible for ensuring the MDOT receives the proposal on time.**

**\*\*Contact Contract Services Division immediately at 517-373-4680 if you do not get an auto response\*\***

**Required Bookmarking Format:**

- I. Request for Proposal Cover Sheet Form 5100D
  - A. Consultant Data and Signature Sheet, Form 5100J (if applicable)
- II. Understanding of Service
  - A. Innovations
- III. Qualifications of Team
  - A. Structure of Project Team
    - 1. Role of Firms
    - 2. Role of Key Personnel
  - B. Organization Chart
  - C. Location
- IV. Quality Assurance / Quality Control Plan
- V. Resumes of Key Staff
- VI. Pricing Documents/Bid Sheet (if applicable)

**2/14/12**

# Michigan Department of Transportation

## SCOPE OF SERVICE FOR SPECIALTY SERVICES

**CONTROL SECTION:** 84911

**JOB NUMBER:** 115175A

**PROJECT LOCATION:**

Various locations throughout the Superior Region, Upper Peninsula of Michigan.

**PROJECT DESCRIPTION:**

The Superior Region ESS Equipment Installation project consists of the following major items:

- Install remote processing units and cellular modems in ITS and traffic signal cabinets.
- Install environmental sensors on ESS towers and/or poles
- Install environmental sensors in the pavement
- Install cameras on ESS towers and/or poles
- Install traffic monitoring equipment on ESS towers and/or poles
- Install communication equipment at ESS site 26

**ANTICIPATED SERVICE START DATE:** November 1, 2012

**ANTICIPATED SERVICE COMPLETION DATE:** February 22, 2014.

**PRIMARY PREQUALIFICATION CLASSIFICATION:**

None

**SECONDARY PREQUALIFICATION CLASSIFICATION:**

None

**DBE REQUIREMENT:** There is no DBE requirement for this project.

**MDOT PROJECT MANAGER:**

Dawn Gustafson, P.E.  
MDOT- Superior Region  
1818 3<sup>rd</sup> Ave. North  
Escanaba, MI 49829  
Email: [gustafsond@michigan.gov](mailto:gustafsond@michigan.gov)  
Tel: (906) 786-1830 x 316  
Fax: (906) 789-9775

**SCHEDULE:** All equipment that can be installed per the manufacturer's requirements by February 22, 2013 shall be furnished installed and integrated by February 22, 2012. This does not include any applicable burn in period as specified in the special provisions. As equipment is

brought on line it shall be accessible on the MDOT RWIS. Any additional equipment that is temperature sensitive will be completed by July 1, 2013.

## **I. GENERAL INFORMATION**

The State of Michigan Department of Transportation, hereinafter referred to as "MDOT", is requesting Proposals that are comprised of a written Technical Proposal and Proposal Price, which will be used for project selection.

A Vendor can submit only one (1) Proposal as the Prime Vendor. This document refers to the Vendor who submits the Proposal for the award of the SUPERIOR REGION ESS EQUIPMENT INSTALLATION project.

The Vendor shall be required to demonstrate good project management practices while working on this project. These practices include frequent and regular communication with MDOT's project manager and others as necessary, management of time and resources, and documentation. The Vendor will set up and maintain throughout the design of the project a contract file in accordance with MDOT procedures. MDOT approval will be required prior to any changes required throughout the course of construction of this project. It is anticipated that the Vendor will develop a project specific approach and develop a list of potential issues to avoid unnecessary delays.

MDOT will provide contract administration, management services, system management services, technical reviews, as necessary, of all work associated with the development and preparation of shop drawings, and installation and construction of the project. MDOT will provide job specific information and/or functions as outlined in this contract.

Vendors are requested to follow the numeric format and organization of the information below when preparing the Technical Proposal and are required to follow the latest version of the Michigan Department of Transportation Consultant/Vendor Selection Guidelines for Service Contracts. For purposes of this response, the page limit does not include project profiles, resumes, proof of certifications and bonding documents which may be contained in the proposal Appendix.

## **II. BACKGROUND**

MDOT currently has a Road Weather Information System (RWIS) in Superior and North Region. MDOT will have an additional 16 towers installed during the summer of 2012. This proposal will be to install equipment on those 16 towers and in 4 existing traffic signal cabinets.

### III. UNDERSTANDING OF SERVICES

Describe your firm's understanding of the existing RWIS system, towers that are installed and the results of this proposal.

**A. Schedule** – Include a project schedule representative of the course of the project from initiation to completion. Schedule should include the timeline for completion of the milestones as included in the proposer's bid as well as indicate critical and connected tasks.

**B. Management Approach** - Describe your project management approach to this project. Include descriptive language of how the project management needs and approach will vary throughout the life of the project. Describe how you will incorporate the operational needs of the Road Weather Information System (RWIS), proactive measures used to avoid schedule delays, and cost overruns. Explicitly indicate who will manage the project, who will be making decisions, and who will be the point of contact for the entire project.

**C. Communication with the Department and Subcontractors** - Describe how communications will be handled and documented with the Department, subcontractors, and others during this project. Describe any variations to the general project communication plan relative to specific tasks such as at critical junctures of the project.

**D. Project Execution** – Describe how your firm will execute the project include details such as how various elements of work will overlap and be coordinated. Provide sufficient detail in this section as to provide clarity of who (staff/vendor) will perform the critical elements of construction, testing, and integration for this project. Provide sufficient detail in this section that clearly demonstrates an understanding of the how the installation and integration of this project will be accomplished. Provide equipment information as outlined in the attached Proposed Equipment Sheet.

**E. Innovations** – Include any innovations for this project which may provide the Department with efficiencies, cost savings, and schedule acceleration. Vendor is cautioned to bid the project under the assumption that cost saving innovations may not be accepted by the Department

**F. Quality Assurance and Quality Control** - Describe how your firm maintains and ensures the quality of your work as well as the work performed by subcontractors. Describe how you will apply your firm's quality control procedures to this project and provide details to the variations from standard procedures as necessary to address project specific tasks.

### IV. QUALIFICATIONS OF TEAM

#### A. FIRM REQUIREMENTS

**1. Overview of Firm** – Include the location of the firm, number of employees, annual revenue, and history of the firm (as currently named). Also provide the Vendor's licensing information, and evidence of the Vendor's ability to provide sufficient bonding and insurance in the state of Michigan for this project.

**2. Roles and Responsibilities** – Describe your firm's role and the role of your key staff on this project, including any subcontractors. Descriptions should

be related to your ability, capacity, and process to complete the tasks and primary components of the project as described in previous sections of this RFQ and as detailed in the attached plans and specifications.

3. **Minimum Requirements**
  - a) **Proof of financial stability and standing**
  - b) **Insurance**
  - c) **Financial Bonding**
  - d) **Bank References**
  - e) **Pending Lawsuits or Claims**

## **B. TEAM ORGANIZATION**

1. Provide an organizational chart that visually explains the project team hierarchy, communication and responsibility paths. Provide descriptions of the roles and responsibilities for each key staff member and/or subvendor.
2. Identify key staff assigned to the project for these roles:
  - a) Project Manager
  - b) Project Superintendent
  - c) Quality Manager
  - d) Lead System Integration Engineer
3. **KEY STAFF**
  - a) Resumes of key staff must show directly related project experience, education, certifications, and professional licensure for the following key areas of work as they relate to this project and the individuals role. **Maximum of three (3) pages per resume** for each key staff member.
4. **PROJECT MANAGER**
  - a) Project Manager must be a current employee of the Vendor's firm. A single key staff person may be assigned to no more than two roles, however the Quality Manager may not be assigned to any other role.
5. **QUALITY MANAGER**
  - a) Quality Manager and quality control checkers/reviewers must not be directly involved in the day to day project activities and must have prior experience or expertise to check/review the work being done by others. The details of the Quality Manager's experience/expertise is to be presented in the proposal as well as how the QA/QC process will be documented and coordinated with the MDOT Project Manager.

## **C. ESS QUALIFICATIONS**

1. Provide the qualifications of the staff and subcontractor's firm (if applicable) responsible for these services. Proposals should include sufficient information of any subcontractor's firm. At a minimum the staff responsible for ESS work must meet the following requirements:
  - a) Five (5) Years of Experience with ESS design, installation, integration, and testing projects

- b) Have experience with at least three (3) ESS projects relating to transportation.
- c) Provide knowledge and understanding of the MDOT RWIS and the requirements of this proposal.

**D. COMMUNICATIONS SYSTEMS QUALIFICATIONS**

1. Provide the qualifications of the staff and subcontractor's firm (if applicable) responsible for these services. Proposals should include sufficient information of any subcontractor's firm. The personnel responsible for COMMUNICATIONS SYSTEMS work must meet the following minimum requirements:

- a) Firm must have five (5) Years of Experience with Intelligent Transportation System Technology, Testing, and Integration projects
- b) Provide proof of a Registered Communications Distribution Designer (RCDD) to supervise all work on-site.
- c) Provide proof of Grounding and Bonding Certification
  - (1) NFPA 780 Master Label Certification
  - (2) UL 96A and UL 96
- d) Provide proof of Networking Certification (ie CCNA) Factory certified technicians for network equipment configuration and support

**V. PAST PERFORMANCE**

A. Relevant performance evaluations for the past three (3) years will be evaluated for firms on the Vendor's team. If references are provided because the firm has not previously worked for MDOT or they have only had a few service opportunities that have been evaluated, the references will be contacted

**B. Project Profiles** - Provide three (3) or more successfully **completed** projects with at least 25 ESS that are similar to the scope of work described in this RFP and demonstrate your firms/teams ability to execute this project. Please provide the following information at a minimum for each project:

- 1. Project description and date completed
- 2. Firm's role and responsibility
- 3. Project location (state, city)
- 4. Project size (quantity of ESS and vendors installed and integrated)
- 5. Client reference contact information

**VI. LOCATION**

A. Provide the estimated amount of labor to be provided by Michigan based employees on percentage of total hours.

**VII. DELIVERABLES**

A. Project QA/QC Plan – 15 days after Notice To Proceed (NTP);

B. Monthly Project Review Meeting Minutes and Report –electronic copy submitted for review. Electronic copy submitted to distribution list within five (5) working days following the meeting;

- C. Monthly Progress Report with a one month look-ahead; addressing items that need to be resolved.
- D. Other project meeting minutes or notes – Meeting minutes will be prepared and distributed to all attendees and the MDOT PROJECT MANAGER and/or DELIVERY ENGINEER within five (5) working days following the meeting;
- E. Miscellaneous correspondence and project management documentation.
- F. Submit drawings and details for approval by engineer for installation of equipment at sixteen (16) locations requiring integration into existing intelligent transportation systems cabinets and four (4) traffic signal cabinets 10 work days prior to anticipated installation date.
  - 1. Complete the spreadsheet in attachment A
  - 2. All equipment will meet specifications provided in attachment E.
  - 3. Equipment will be placed at each site as noted in attachment B and C.
  - 4. Attachment D is provided for background information at the ESS locations.
- G. Utilize the attached maintain traffic typicals in Attachment F as needed.
  - 1. Shoulder closures, 2 lane, 2 way no speed reduction (M0050a and M0110a)
  - 2. Shoulder closures, divided roadway no speed reduction (M0050a and M0880a)
  - 3. Lane closures, 2 lane, 2 way, speed reduction (M0050a and M0150)
  - 4. Divided roadway, 1 lane closure, speed reduction (M0050a and M0250)
- H. Communication at ESS site 26
  - 1. Design and install communication equipment at ESS site 26 to utilize existing cellular modem communication at the DMS site (or other approved equipment) to transmit data from the ITS cabinet to the DMS cabinet.

## VIII. PRICE DOCUMENTATION/BID SHEETS

- A. **Consultant Payment**
  - 1. Compensation for this project shall be made based on a pay item basis. **Vendors are required to structure their bid based on the attached bid sheets.** Compensation shall be divided into payments for a portion of the services (pay items) completed.
  - 2. Items listed as lump sum (LS) will be paid on a lump sum basis not to exceed the actual costs incurred.

All billings for services must be directed to MDOT and follow the current guidelines. The latest copy of the "Professional Engineering Service Reimbursement Guidelines for Bureau of Highways" is available on MDOT's website. This document contains instructions and forms that must be followed and used for billing. Payment may be delayed or decreased if the instructions are not followed.

Payment to the successful Vendor for Services rendered shall not exceed the maximum amount unless an increase is approved in accordance with the contract with the Consultant. Typically, billings must be submitted within 60 days after the completion

of services for the current billing. The final billing must be received within 60 days of the completion of services. Specific terms will be included in the final contract terms of the successful Vendor.

<b>JN 115175A - Bid Sheet PG 1 of 2</b>			
<b>Description</b>	<b>SUPERIOR REGION ESS EQUIPMENT INSTALLATION</b>		
<b>Control Section</b>	<b>84911</b>		
<b>Job Number</b>	<b>115175A</b>		
<b>NOTE:</b> Bid sheet developed for purposes of understanding the bid pricing structure developed by the Proposer. Bids shall be inclusive of items required to provide fully functioning systems as defined in the RFP and attached plans/special provisions. No Exceptions will be accepted at the time of bidding that may hinder the progress of the project or exclude items as indicated in the original plans and special provisions.			
<b>GENERAL</b>			
<b>ITEM OF WORK</b>	<b>QUANTITY</b>	<b>BID UNI</b>	<b>BID AMOUNT</b>
Project Management*	1	LS	\$
Quality Assurance / Control*	1	LS	\$
Mobilization*	1	LS	\$
Traffic Control*	1	LS	\$
Equipment Grounding and Bonding*	1	LS	\$
Communication Equipment at ESS site 26	1	LS	\$
Testing and Integration of Equipment*	1	LS	\$
<b>ITS Cabinet</b>			
<b>ITEM OF WORK</b>		<b>BID UNI</b>	<b>BID AMOUNT</b>
Cellular Modem	19	EA	\$
Cellular Modem, Supplied	2	EA	\$
Power Distribution Unit	20	EA	\$
Power Distribution Unit, Supplied	1	EA	\$
Managed Field Ethernet Switch, Layer 2	20	EA	\$
Managed Field Ethernet Switch, Layer 2, Supplied	1	EA	\$
Uninterruptible Power Supply, Environmental Sensor Station	20	EA	\$
Uninterruptible Power Supply, Environmental Sensor Station, Supplied	1	EA	\$
Remote Processing Unit	20	EA	\$
Remote Processing Unit, Supplied	1	EA	\$

\*All LS pay items will be paid for on a portion based on the number of sites completed.

**JN 115175A - Bid Sheet PG 2 of 2**

<b>Description</b>	<b>SUPERIOR REGION ESS EQUIPMENT INSTALLATION</b>
<b>Control Section</b>	<b>84911</b>
<b>Job Number</b>	<b>115175A</b>

**NOTE:** Bid sheet developed for purposes of understanding the bid pricing structure developed by the Proposer. Bids shall be inclusive of items required to provide fully functioning systems as defined in the RFP and attached plans/special provisions. No Exceptions will be accepted at the time of bidding that may hinder the progress of the project or exclude items as indicated in the original plans and special provisions.

**Environmental Equipment**

<b>ITEM OF WORK</b>		<b>BID UNIT</b>	<b>BID AMOUNT</b>
Visibility Sensor	14	EA	\$
Visibility Sensor, Supplied	2	EA	\$
Air Temperature/Humidity Sensor	14	EA	\$
Air Temperature/Humidity Sensor, Supplied	2	EA	\$
Ultrasonic Wind Sensor	14	EA	\$
Ultrasonic Wind Sensor, Supplied	2	EA	\$
Barometric Pressure Sensor	14	EA	\$
Barometric Pressure Sensor, Supplied	2	EA	\$
Precipitation Sensor	14	EA	\$
Precipitation Sensor, Supplied	2	EA	\$
Infrared Illuminator	15	EA	\$
Infrared Illuminator, Supplied	2	EA	\$
Pavement Condition Sensor, Invasive	27	EA	\$
Pavement Condition Sensor, Invasive, Supplied	3	EA	\$
Pavement Condition Sensor, Non-Invasive	3	EA	\$
Pavement Condition Sensor, Non-Invasive, Supplied	0	EA	\$
Pavement Temperature Sensor, Invasive	8	EA	\$
Pavement Temperature Sensor, Invasive, Supplied	1	EA	\$
Subsurface Temperature Probe	14	EA	\$
Subsurface Temperature Probe, Supplied	2	EA	\$

**OTHER ITS EQUIPMENT**

<b>ITEM OF WORK</b>		<b>BID UNIT</b>	<b>BID AMOUNT</b>
IP Surveillance System, ESS	19	EA	\$
IP Surveillance System, ESS, Supplied	2	EA	\$
Microwave Vehicle Detection System	21	EA	\$
Microwave Vehicle Detection System, Supplied	2	EA	\$
<b>Total Price</b>		<b>\$</b>	<b>\$</b>

Signature: \_\_\_\_\_

**IX. VENDOR SELECTION SCORING CRITERIA**

The following approach will be used in determining the best value proposal to the Department. The selected proposal will be the one considered to represent the best value to the Department based on the technical and price proposals, i.e., the highest combination of technical score and price.

	<b>Maximum Points</b>
<b>Technical Proposal</b>	
1. Understanding of Services	<b>40 pts</b>
2. Qualifications of Team	<b>30 pts</b>
▪ Team Organization	
▪ ESS Qualifications	
▪ Communications Systems Qualifications	
3. Equipment and Devices	<b>40 pts</b>
3. Past Performance	<b>30 pts</b>
4. Location	<b>5 pts</b>
5. Price	<b>50 pts*</b>
<b>Total</b>	<b>195 pts</b>

\*Points for the Proposal Price Score will be applied on a linear basis, calculated as follows. The lowest bidder will receive 50 points and the other bidders will receive a proportion of the point value based on their bid cost relative to the low bidder, using the following equation:

$$[\text{Low Bid}/\text{Bid}] \times 50 = \text{Proposal Price Score}$$

For the Location criteria, the guidelines for percentage of work performed in Michigan are as follows:

- 95-100%                    5 points
- 80-94%                    4 points
- 50-79%                    3 points
- 25-49%                    2 points
- 10-24%                    1 point
- Less than 10%            0 points

## ATTACHMENT A

### Proposed Equipment

<b>Equipment</b>	<b>Make</b>	<b>Model</b>
Cellular Modem		
Power Distribution Unit		
Managed Field Ethernet Switch, Layer 2		
Uninterruptible Power Supply, Environmental Sensor Station		
Remote Processing Unit		
Visibility Sensor		
Air Temperature/Humidity Sensor		
Ultrasonic Wind Sensor		
Barometric Pressure Sensor		
Precipitation Sensor		
Infrared Illuminator		
Pavement Condition Sensor, Invasive		
Pavement Condition Sensor, Non-Invasive		
Pavement Temperature Sensor, Invasive		
Subsurface Temperature Probe		
IP Surveillance System, ESS		
Microwave Vehicle Detection System		
Communication Equipment at ESS Site 26		

## ATTACHMENT B

### Locations to integrate into an existing traffic signal cabinet

**Location #1: CS 21022-01-01**  
**US-2/US-41M-35 (Lincoln) at US-2/US-41 (Ludington)**

**Location #2: CS 55011-01-01**  
**US-41 (10<sup>th</sup>) at US-41 (10<sup>th</sup>)**

**Location #3: CS 52041-01-07**  
**M-28 at 2<sup>nd</sup>**

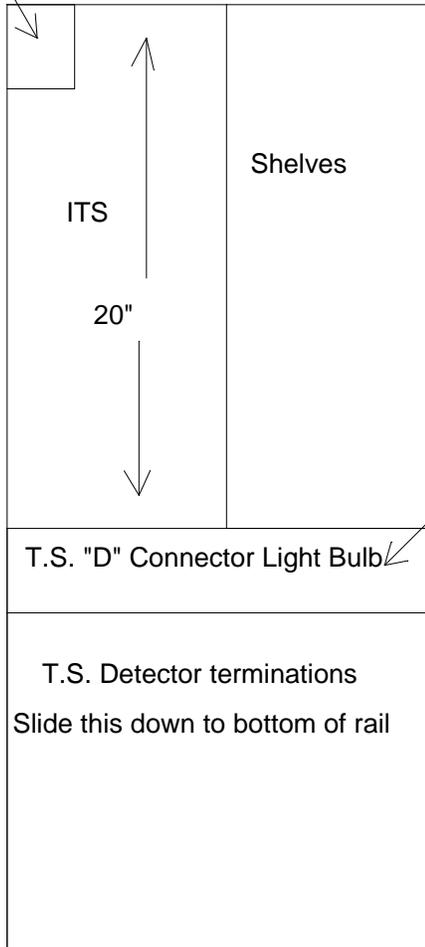
**Location #4: CS 17032-01-15**  
**I-75 BS (Ashmun) at 12<sup>th</sup>/Marquette**

Provide the following items:

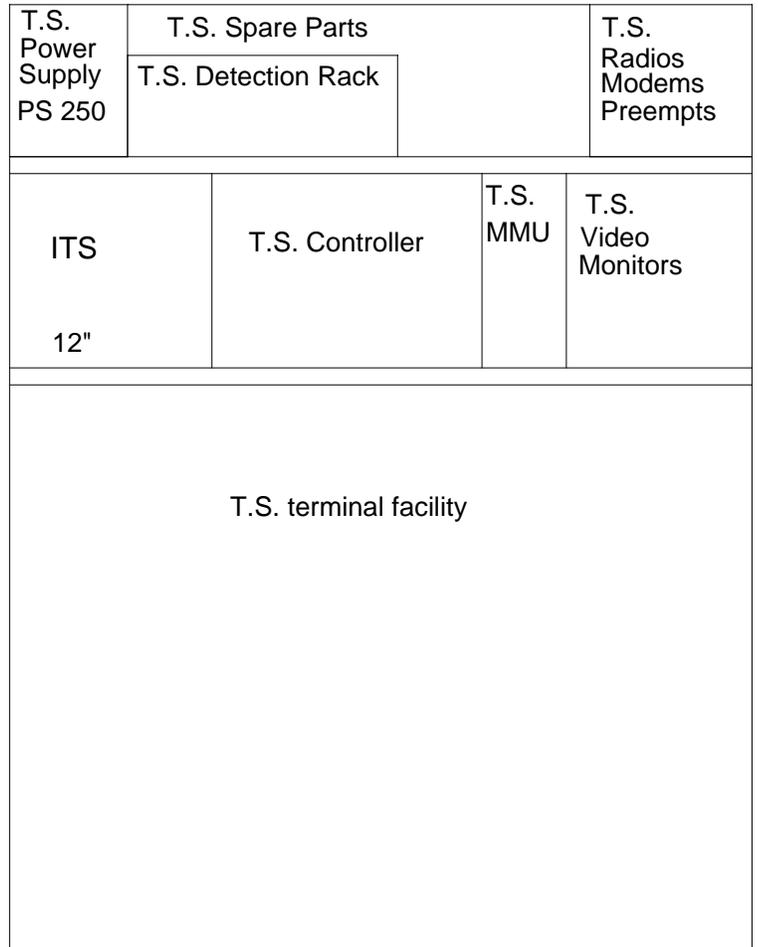
Cellular Modem, Power Distribution Unit, Managed Field Ethernet Switch, Layer 2, Environmental Sensor Station, Remote Processing Unit, Pavement Temperature Sensor, Invasive, IP Surveillance System, ESS, and Microwave Vehicle Detection System.

All equipment shall be approved by the MDOT Project Manager prior to installation. Region Election shall be contacted and present prior to any installation.

T.S. Thermostat Left Side of Cabinet Interior



Back Side of Cabinet Interior



Turn 90°  
Slide down

Right Side of Cabinet Interior Reserved For Power Distribution

THE IMPROVEMENTS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE MICHIGAN DEPARTMENT OF TRANSPORTATION 2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION.

PHYSICAL ROAD NUMBER (PR#) & MILEPOST (MP) DATA ARE FROM MICHIGAN GEOGRAPHIC FRAMEWORK VERSION #11.

# MICHIGAN DEPARTMENT OF TRANSPORTATION

US-2, US-41, US-45, M-28,  
M-35, M-38, M-94, M-95

CITY OF WAKEFIELD

BOHEMIA, CHASSELL, DAFTER, DUNCAN,  
MANISTIQUE, MASONVILLE, MUELLER, NEGAUNEE, OSCEOLA,  
REPUBLIC, ROCKLAND, ROCK RIVER AND SKANDIA TOWNSHIPS

ALGER, CHIPPEWA, DELTA, GOGEBIC, HOUGHTON,  
MARQUETTE, MENOMINEE ONTONAGON AND SCHOOLCRAFT COUNTIES



COUNTY

COUNTY KEY

**2010 TRAFFIC DATA**

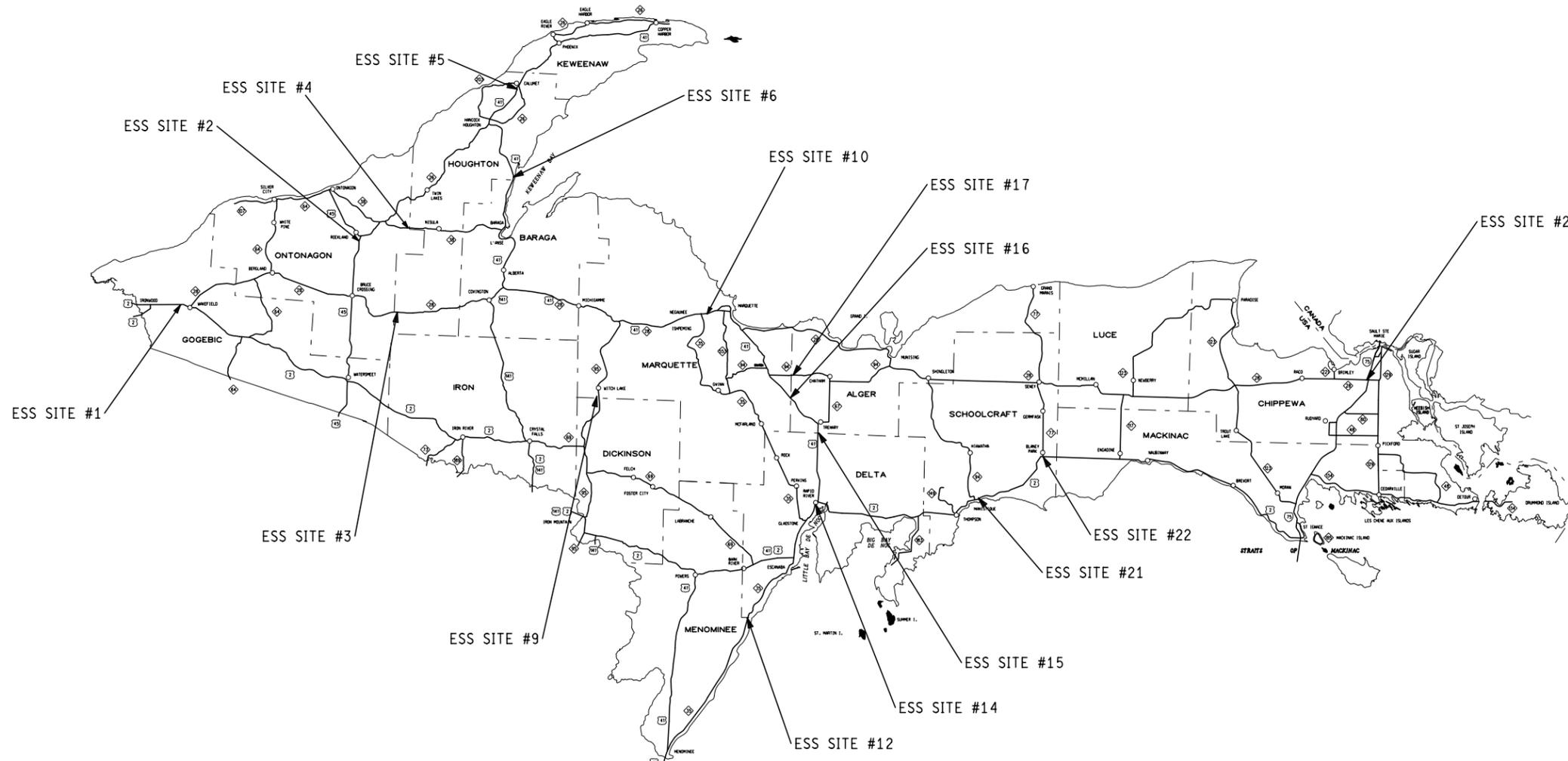
**SPEED DATA**

ROAD (SITE #)	A.D.T.	D.H.V.	COMM.	DESIGN	POSTED
US-2 (1)	5800	564	7%	40	40
US-45 (2)	1300	206	10%	55	55
M-28 (3)	1400	165	9%	55	55
M-38 (4)	600	117	8%	55	55
US-41 (5)	6600	612	2%	45	45
US-41 (6)	4100	500	7%	55	55
M-95 (9)	1700	179	15%	55	55
US-41 (10)	8300	926	3%	55	55
M-35 (12)	2800	340	19%	55	55
US-2 (14)	4300	516	10%	55	55
US-41 (15)	2200	254	11%	55	55
US-41 (16)	1900	201	8%	55	55
M-94 (17)	1400	180	7%	55	55
US-2 (21)	7100	742	9%	55	55
US-2 (22)	3800	602	14%	55	55
M-28 (26)	3500	456	5%	55	55

SECTION	CONTROL SEC	JOB NO.	FEDERAL PROJECT	ITEM
1	84911	115175A		

CS:84911

JN:115175A



**APPROVALS**

RECOMMENDED FOR APPROVAL BY: AL ANDERSON, P.E. - DELIVERY ENGINEER DATE \_\_\_\_\_

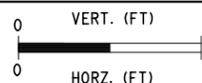
RECOMMENDED FOR APPROVAL BY: DAWN GUSTAFSON, P.E. - TRAFFIC AND SAFETY ENGINEER DATE \_\_\_\_\_

**MICHIGAN DEPARTMENT OF TRANSPORTATION**  
KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: MARK A. VAN PORT FLEET, P.E. - ENGINEER OF DEVELOPMENT DATE \_\_\_\_\_

MILES:  
CONTRACT FOR:  
ELECTRICAL COMPLETION OF 16 ENVIRONMENTAL SENSOR STATIONS

NO.	DATE	AUTH	DESCRIPTION



FILE: 115175 Title.dgn

DATE:  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

CS: 84911  
JN: 115175A

DRAWING SHEET  
CONST



**PUBLIC UTILITIES**

The existing utilities listed below and shown on these plans represent the best information available as obtained on our surveys. This information does not relieve the contractor of the responsibility to be satisfied as to it's accuracy and the location of existing utilities.

<u>Name Of Owner</u>	<u>Type Of Utility</u>
<b>ESS SITE #1, CS 27021</b>	
City of Wakefield Attention: John Granato 311 Sunday Lake Street Wakefield, MI 49968 Phone: (906) 299-5132	Sewer, Electric
ATT Attention: Marsha Bertoldi 211 East B Street Iron Mountain, MI 49801 Phone: (906) 779-2744 Email: <a href="mailto:mb8983@att.com">mb8983@att.com</a>	Telephone
Xcel Energy Attention: Stacey Westeen 101 Alfred Wright Blvd. Ironwood, MI 49938 Phone: (906) 932-2848	Gas, Electric
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x 1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
<b>ESS SITE #2, CS 66032</b>	
Ontonagon County Telephone Company Attention: Fred Lundberg 618 River Street Ontonagon, MI 49953 Phone: (906) 884-9911	Telephone
Upper Peninsula Power Co. Attention: Mike Mickus 18494 E. Canal Road P.O. Box 130 Houghton, MI 49931 Phone: (906) 483-4543	Electric
<b>ESS SITE #3, CS 31021</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Midway Telephone Attention: Steve Rajala 11697 HWY M-28 Watton, Michigan 49970 Phone: (906) 355-2300	Telephone
Ontonagon County Rural Electrification Association Attention: Debbie Miles P. O. Box 97 Ontonagon, Michigan 49953 Phone: (906) 884-4151	Electric

**ESS SITE #4, CS 66041**

AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Ontonagon County Rural Electrification Association Attention: Debbie Miles P. O. Box 97 Ontonagon, Michigan 49953 Phone: (906) 884-4151	Electric
Ontonagon County Telephone Company Attention: Fred Lundberg 618 River Road Ontonagon, MI 49953 Phone: (906) 884-9911	Telephone
<b>ESS SITE #5, CS 31052</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
<b>ESS SITE #6, CS 31051</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a> Phone: (906) 475-0107 x1039	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
Baraga Telephone Company Attention: Paul Stark 204 State Street Baraga, Michigan 49908 Phone: (906) 353-6644	Telephone

**ESS SITE #9, CS 52011**

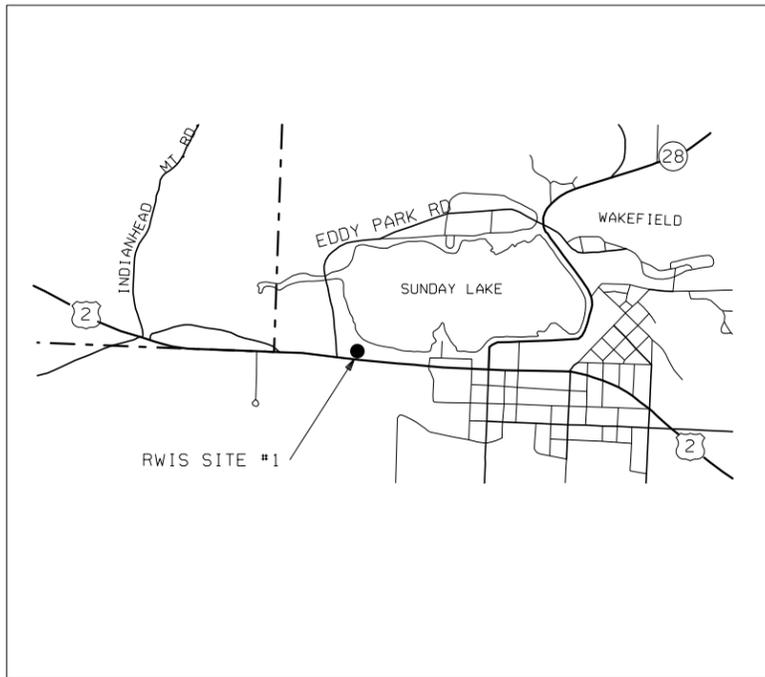
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
<b>ESS SITE #10, CS 52042</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Marquette Board of Light and Power Attention: Karl Benstrom 2200 Wright Street. Marquette, Michigan 49855 Phone: (906) 228-0320	Electric
Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a>	Gas
Negaunee Township Attention: Mike Adams 42 M-35 Negaunee, MI 49866 Phone: (906) 475-7869	Water
<b>ESS SITE #12, CS 55031</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric
ATT Attention: Marsha Bertoldi 211 East B Street Iron Mountain, MI 49801 Phone: (906) 779-2744 Email: <a href="mailto:mb8983@att.com">mb8983@att.com</a>	Telephone

Time Warner Cable Attention: Vince Albin 3520 Destination Drive Appleton ,WI 54915 Phone: (920) 831-9249 Email: <a href="mailto:vince.albin@twcable.com">vince.albin@twcable.com</a>	CATV
Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcouineau@upppo.com">mjcouineau@upppo.com</a>	Electric
Upper Peninsula Telephone Co. Attention: Dirk Macco 397 US-41,P.O. Box 86 Carney, MI 49812 Phone: (906) 639-2111 Email: <a href="mailto:dirk.macco@alphacomm.net">dirk.macco@alphacomm.net</a>	Telephone
WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergys.com">bruce.clark@weenergys.com</a>	Electric
Wisconsin Public Service Corporation Attention: Robert Falash 1717 10th Ave, P.O. Box 187 Menominee ,MI 49858 Phone: (906)863-4319 Email: <a href="mailto:rfalash@wisconsinpublicservice.com">rfalash@wisconsinpublicservice.com</a>	Electric
Wisconsin Public Service Corporation Attention: Howard Sorenson 1717 10th Ave, P.O. Box 187 Menominee ,MI 49858 Phone: (906)863-4359 Email: <a href="mailto:hsorens@wisconsinpublicservice.com">hsorens@wisconsinpublicservice.com</a>	Gas
<b>ESS SITE #14, CS 21025</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric
AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone
Charter Communications Attention: Scott Beaster 385 Woodward Avenue Kingsford ,MI 49802 Phone: (906) 630-7795 Email: <a href="mailto:scott.beaster@chartercom.com">scott.beaster@chartercom.com</a>	CATV
DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas

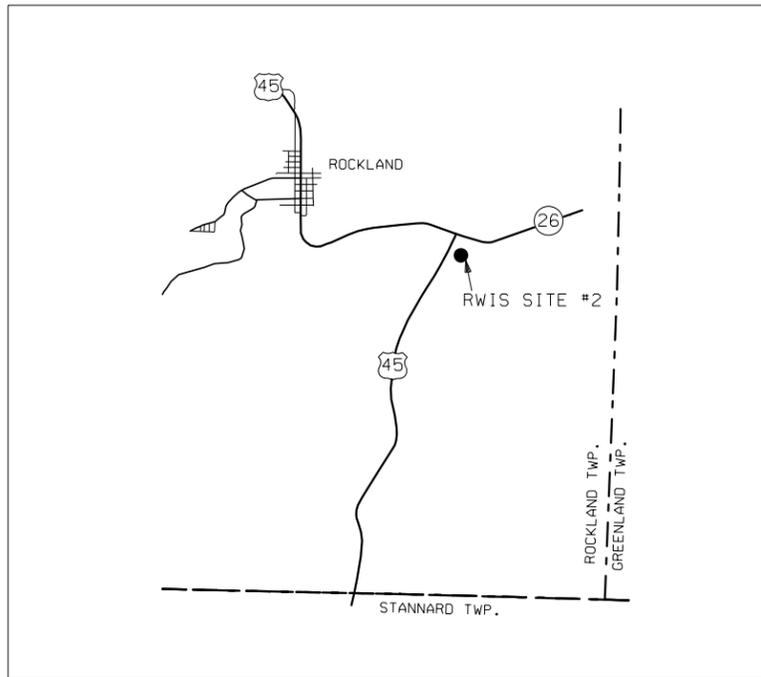
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NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION						PROJ	CONST		

Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a>	Electric	WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergies.com">bruce.clark@weenergies.com</a>	Electric	Hiawatha Telephone Co. Attention: Richard Kirmo 108 W. Superior Street Munising, MI 49862 Phone: (906) 387-9911	Telephone	Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a>	Electric
WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergies.com">bruce.clark@weenergies.com</a>	Electric	<b>ESS SITE #16, CS 52043</b>  Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric	TDS Telecom (Chatham Telephone) Attention: Bruce Kallio E3708 Marquette Street Chatham, MI 49816 Phone: (906) 439-5008 Email: <a href="mailto:bruce.kallio@tdstelecom.com">bruce.kallio@tdstelecom.com</a>	Telephone	Pentland Township Attention: Gary Fahler 13105 CR 400 Newberry, MI 49868 Ph. (906) 293-8755 Cell (906) 440-2581 Fax (906) 293-8894 Email: <a href="mailto:penttwp@up.net">penttwp@up.net</a>	Water & Sewer
<b>ESS SITE #15, CS 21051</b>  Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric	AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone	Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a>	Electric	Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a>	Gas
American Transmission Company Attention: Matt Ernst 801 O'Keefe Road, P.O. Box 6113 DePere, WI 54115-4928 Phone: (920) 338-6573 Email: <a href="mailto:mernst@atcllc.com">mernst@atcllc.com</a>	Electric	Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV	<b>ESS SITE #21 and #22, CS 75022</b>  AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone	<b>ESS SITE #26, CS 17063</b>  AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone
AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone	Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a>	Gas	CenturyLink Attention: Mike Bergeron 100 Second Street, P.O.Box 389 Pinconning ,MI 48650-0389 Phone: (989) 879-8798 Email: <a href="mailto:michael.bergeron@centurytel.com">michael.bergeron@centurytel.com</a>	Telephone	Charter Communications Attention: John Randazzo 2682 Ashmun Street Sault Ste. Marie, MI 49783 Ph. (906) 635-3102 Fax (906) 635-1520 Email: <a href="mailto:randazzo@chartercom.com">randazzo@chartercom.com</a>	Cable
Charter Communications Attention: Scott Beaster 385 Woodward Avenue Kingsford ,MI 49802 Phone: (906) 630-7795 Email: <a href="mailto:scott.beaster@chartercom.com">scott.beaster@chartercom.com</a>	CATV	Upper Peninsula Power Co. Attention: William Hereford P.O. Box 357 500 N. Washington Street Ishpeming, MI 49949-0357 Phone: (906) 485-2434	Electric	Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV	Cloverland Electric Cooperative Attention: Johanna Wiltfong 2916 West M-28 Dafter, MI 49724 Ph. (906) 632-5191 Fax (906) 635-6815 Email: <a href="mailto:jwiltfong@cloverland.com">jwiltfong@cloverland.com</a>	Electric
DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas	TDS Telecom (Chatham Telephone) Attention: Dave Moore P.O. Box 197 Chatham, MI 49816 Phone: (906) 439-5008	Telephone	City of Manistique Attention: Nick Bosanic P.O. Box 515 Manistique, MI 49854 Phone: (906) 341-5346 Email: <a href="mailto:saldrich@chartermi.net">saldrich@chartermi.net</a>	Water	Chippewa County Telephone Co. Attention: Ron Deneve, Jr P.O. Box 155 Brimley, MI 49715 Ph. (906) 248-3211 Fax (906) 248-6815 Email: <a href="mailto:rdeneve@jamadots.net">rdeneve@jamadots.net</a>	Telephone
Great Lakes Gas Transmission Attention: Kitty Martin 5250 Corporate Drive Troy, MI 48098 Phone: (248) 205-7596 Email: <a href="mailto:kitty_martin@transcanada.com">kitty_martin@transcanada.com</a>	Gas	<b>ESS SITE #17, CS 02021</b>  Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric	Cloverland Electric Cooperative Attention: James Tennyson 335 Chippewa Ave, P.O. Box 338 Manistique ,MI 49854 Phone: (906) 341-5426 Email: <a href="mailto:itennyson@edisonsault.com">itennyson@edisonsault.com</a>	Electric		
TDS Telecom (Chatham Telephone) Attention: Bruce Kallio E3708 Marquette Street Chatham, MI 49816 Phone: (906) 439-5008 Email: <a href="mailto:bruce.kallio@tdstelecom.com">bruce.kallio@tdstelecom.com</a>	Telephone	Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV	Great Lakes Gas Transmission Attention: Kitty Martin 5250 Corporate Drive Troy, MI 48098 Phone: (248) 205-7596 Email: <a href="mailto:kitty_martin@transcanada.com">kitty_martin@transcanada.com</a>	Gas		
Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a>	Electric	DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas	Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a>	Gas		

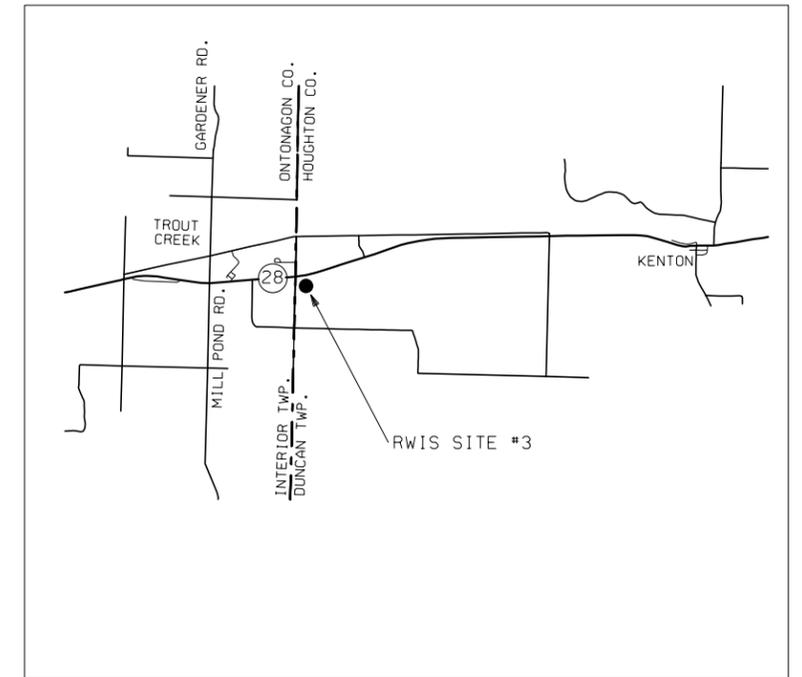
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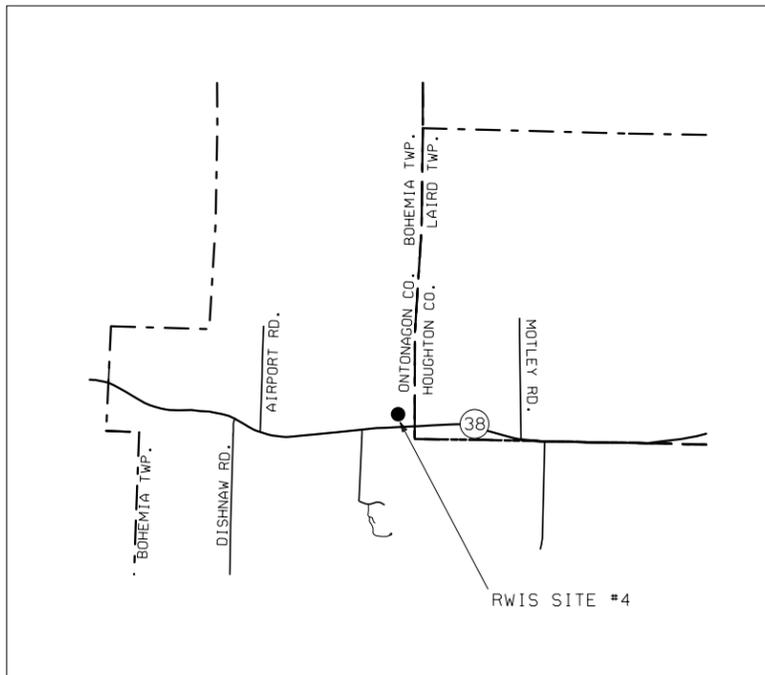
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GOGEBIC COUNTY  
CS 27021, CS MP 12.030



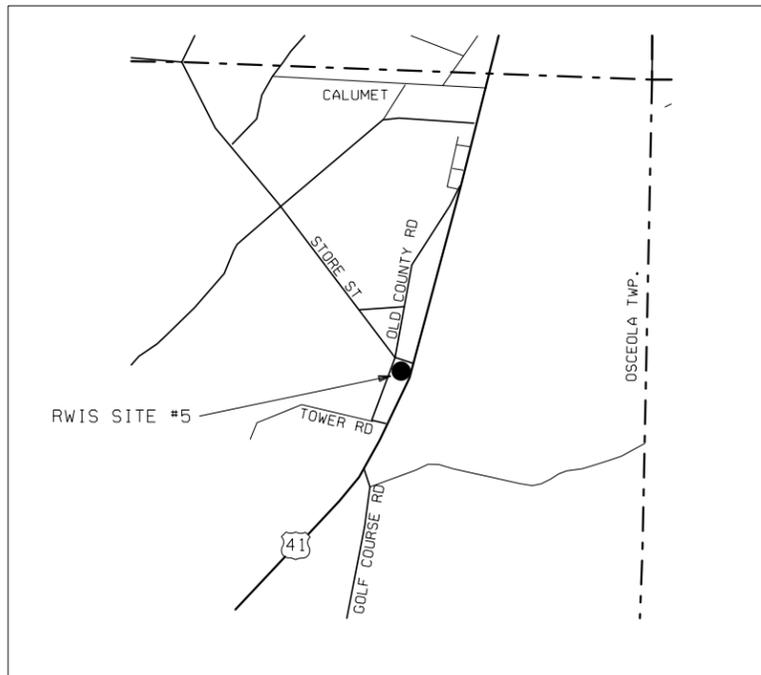
RWIS SITE #2: US-45 AT M-26  
ONTONAGON COUNTY  
CS 66032, CS MP 13.427



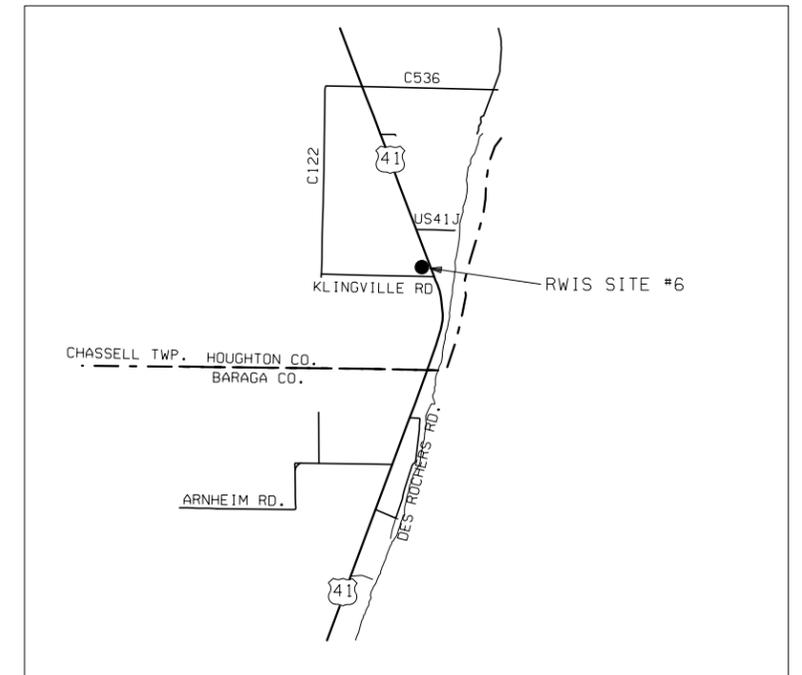
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HOUGHTON COUNTY  
CS 31021, CS MP 0.042



RWIS SITE #4: M-38 AT THE HOUGHTON/ONTONAGON CO. LINE  
ONTONAGON COUNTY  
CS 66041, CS MP 5.306

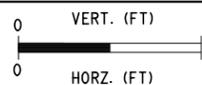


RWIS SITE #5: US-41 AT STORE ST.  
HOUGHTON COUNTY  
CS 31052, CS MP 10.795



RWIS SITE #6: US-41 AT KLINGVILLE RD.  
HOUGHTON COUNTY  
CS 31051, CS MP 1.022

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



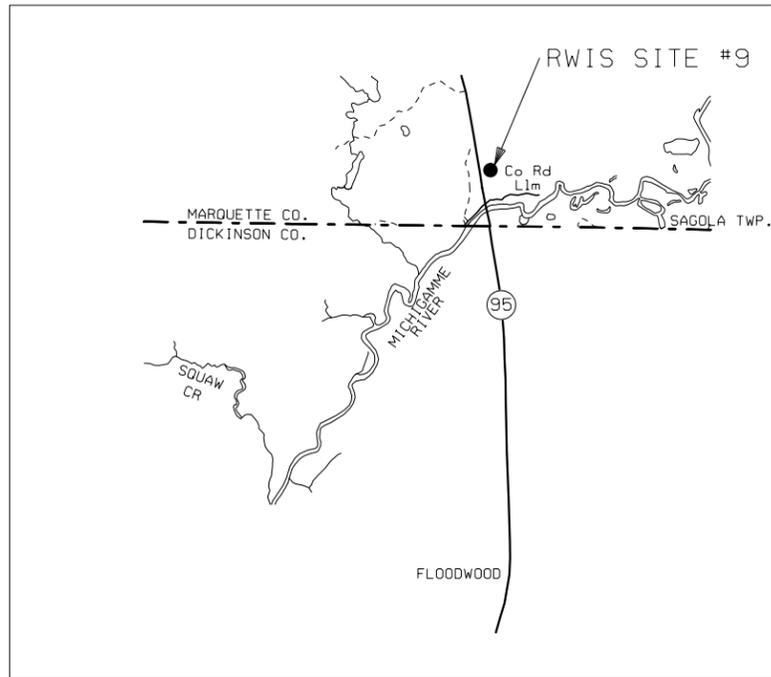
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TSC:ISHPEMING

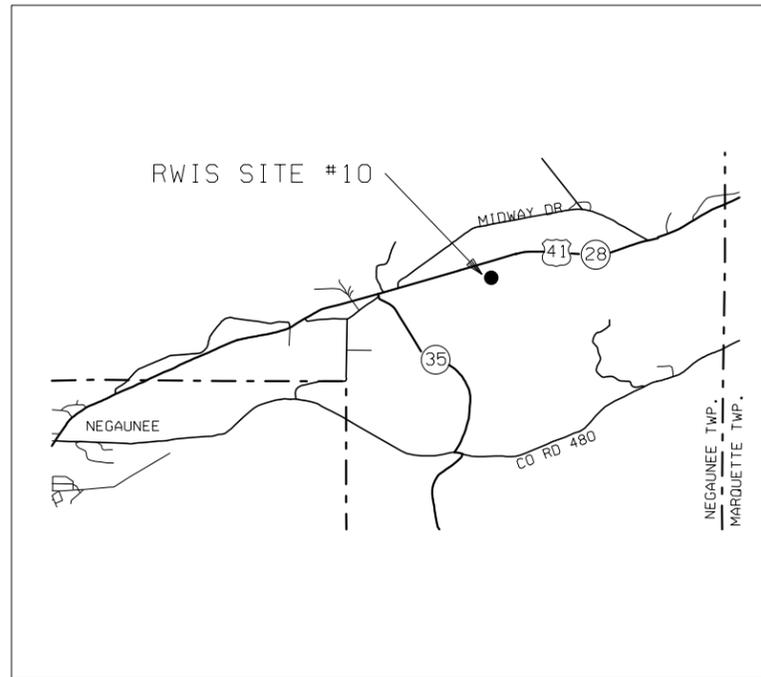
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VICINITY MAP

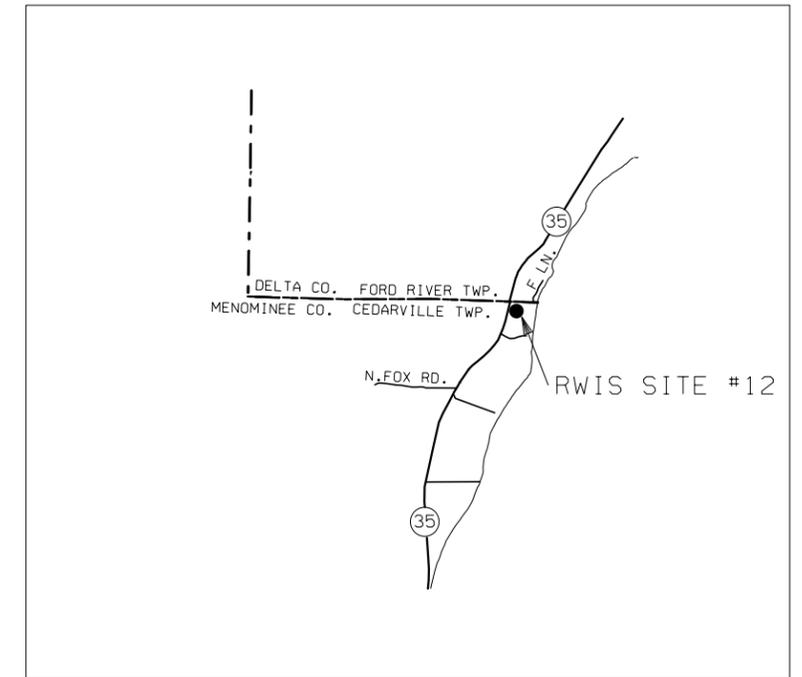
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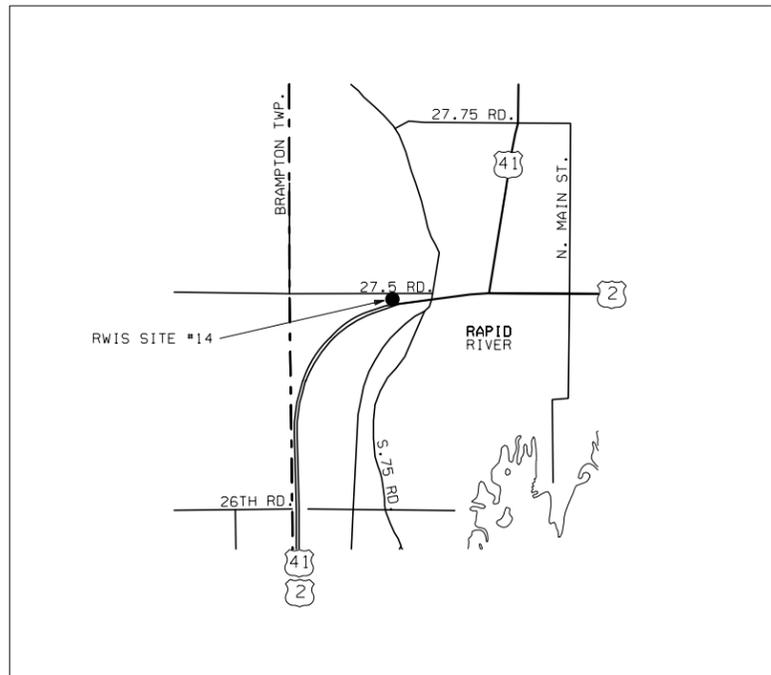
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MARQUETTE COUNTY  
CS 52011, CS MP 0.221



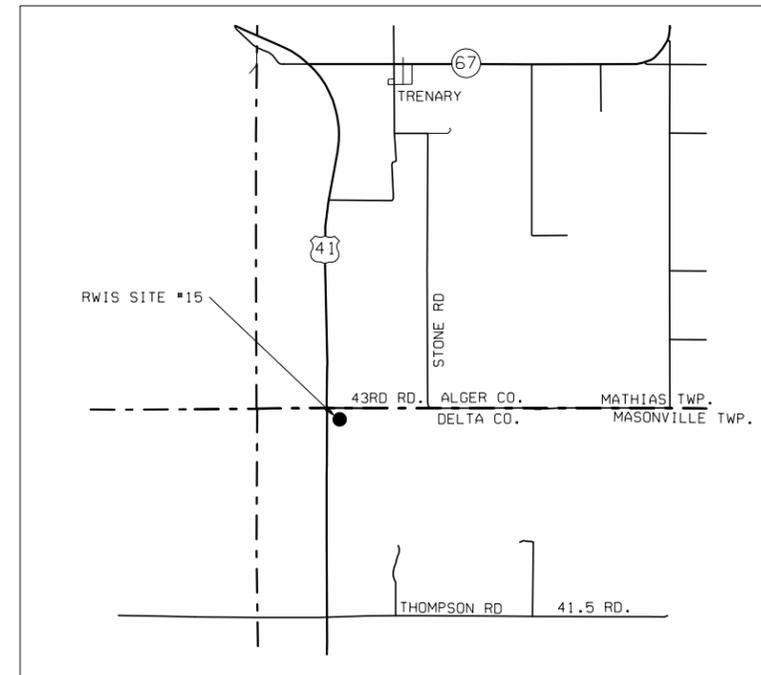
RWIS SITE #10: US-41 NEAR M-35  
MARQUETTE COUNTY  
CS 52042, CS MP 11.184



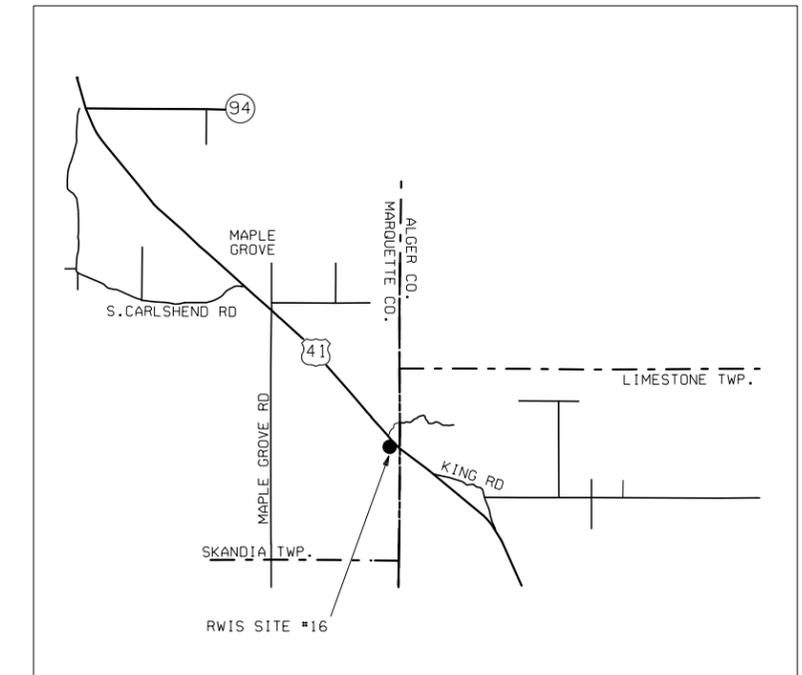
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MENOMINEE COUNTY  
CS 55031, CS MP 34.575



RWIS SITE #14: US-2 IN RAPID RIVER  
DELTA COUNTY  
CS 21025, CS MP 5.80

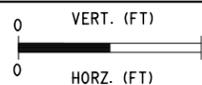


RWIS SITE #15: US-41 AT DELTA/ALGER CO LINE  
DELTA COUNTY  
CS 21051, CS MP 16.170



RWIS SITE #16: US-41 AT MARQUETTE/ALGER CO LINE  
MARQUETTE COUNTY  
CS 52043, CS MP 0.100

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



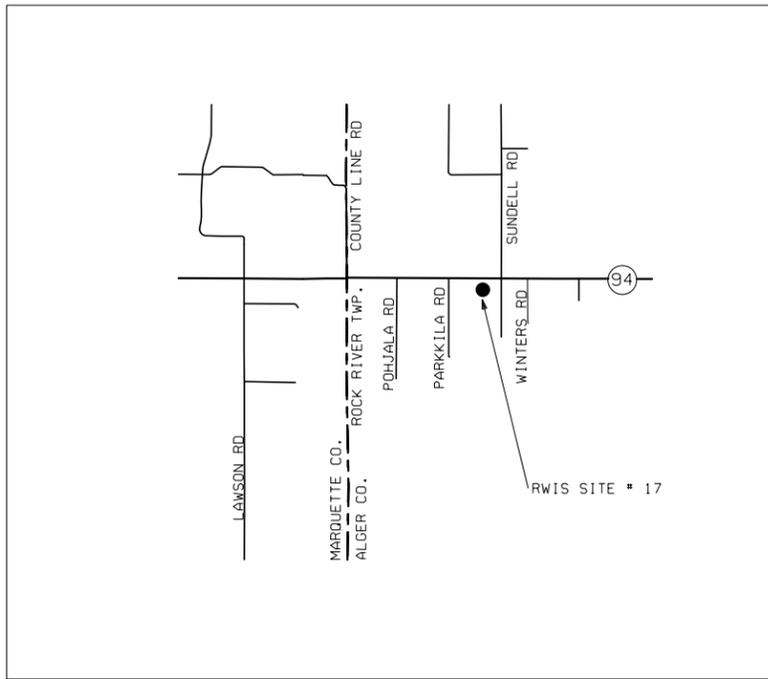
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TSC:ISHPEMING

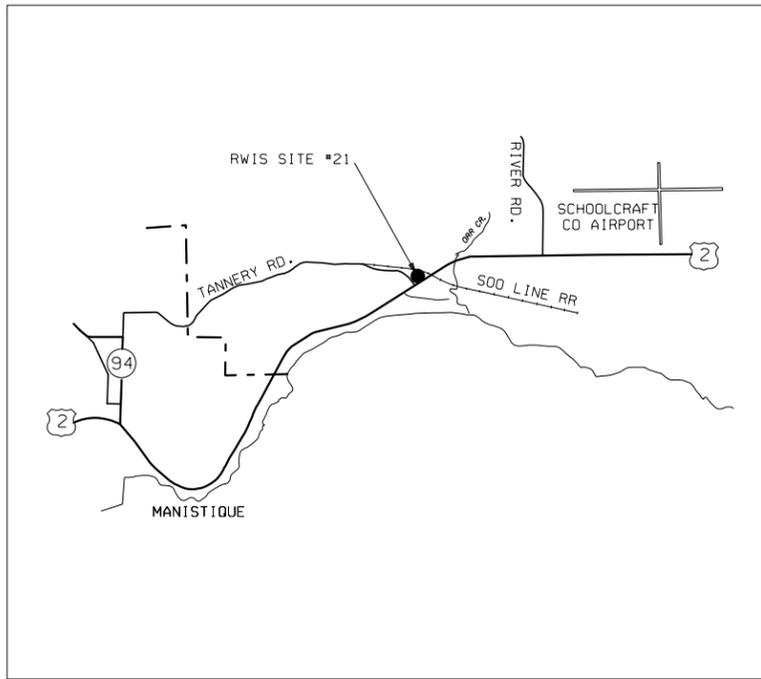
CS:84911  
JN: 115175A

VICINITY MAP

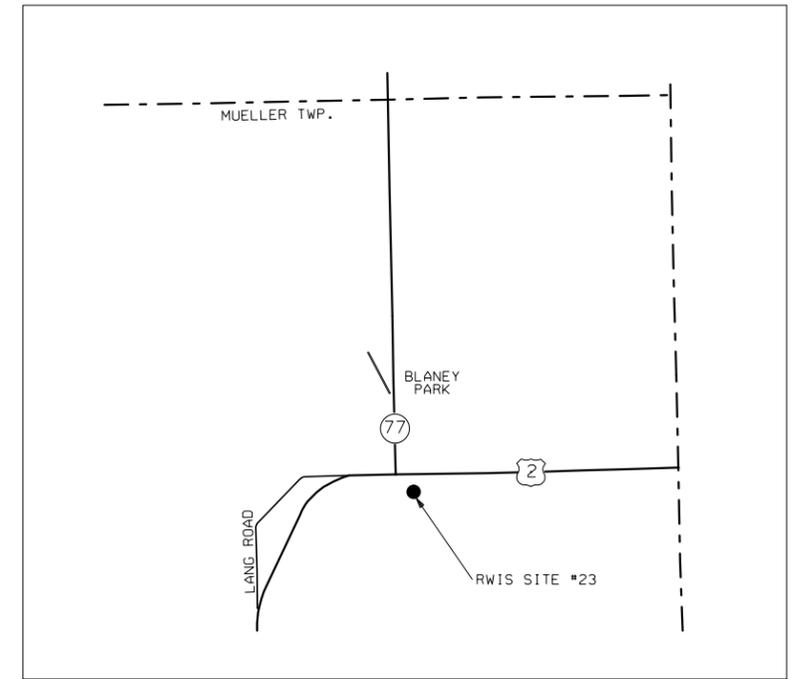
DRAWING SHEET  
2 CONST  
6



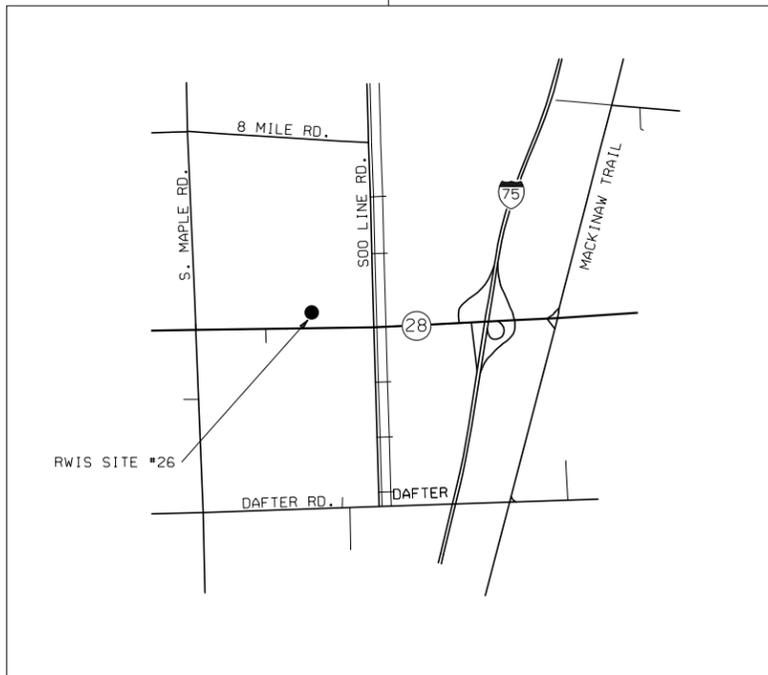
RWIS SITE #17: M-94 IN RUMLEY/SUNDELL  
ALGER COUNTY  
CS 02021, CS MP 0.100



RWIS SITE #21: US-2 EAST OF MANISTIQUE  
SCHOOLCRAFT COUNTY  
CS 75022, CS MP 4.095



RWIS SITE #22: US-2 AT M-77  
SCHOOLCRAFT COUNTY  
CS 75022, CS MP 22.920



RWIS SITE #26: M-28 WEST OF SOO LINE RD.  
CHIPPEWA COUNTY  
CS 17063, CS MP 6.581

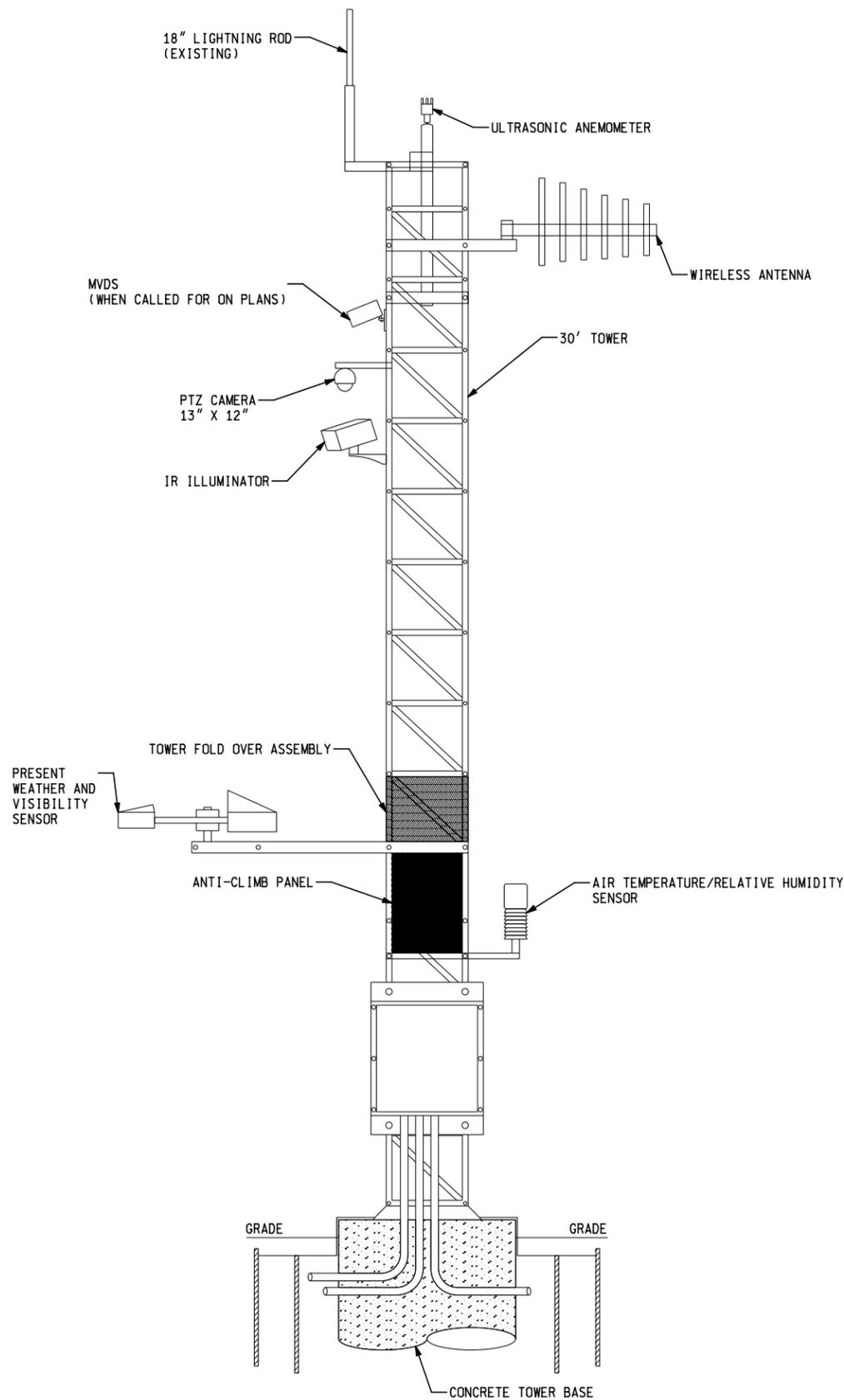
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DATE: 4/9/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPERING  
FILE: 107425 Vicinity Map.dgn

CS: 84911  
JN: 115175A

VICINITY MAP  
DRAWING 3  
SHEET 7



RWIS TOWER DETAIL  
SCALE: NTS

NOTES:

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO INSTALL PTZ CAMERA TO PROVIDE BEST VIEWING ANGLE OF BOTH DIRECTIONS OF TRAFFIC AND SENSORS ON ROADWAY. FINAL PLACEMENT SHALL BE APPROVED BY THE ENGINEER.
2. IR ILLUMINATOR SHALL BE ALIGNED TO PROVIDE BEST VIEW OF ROADWAY AND PAVEMENT SENSORS. FINAL PLACEMENT SHALL BE APPROVED BY THE ENGINEER.
3. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
4. ALL HARDWARE SHALL BE STAINLESS STEEL.
5. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.

Equipment	Recommended Mounting	Horiz Offset from Twr	Weight
Air Temperature Sensor	Tower, at approx 8' height	approx 12"	2 lb
Relative Humidity Sensor	Tower, at approx 8' height		incl
Barometric Pressure Sensor	In RPU cabinet	0 (inside RPU cabinet)	1 lb
Present Weather Sensor and Visibility Sensor	Tower, at approx 8'7" height	approx 12"	34 lb
Ultrasonic Anemometer	Tower, on top	0-6"	2 lb
PTZ Camera	Tower, near top	approx 12"	10 lb
Power & Incidental Cabinets	Tower, on or near RPU cabinet	0 (bolts to tower/cabinet)	incl
Microwave Vehicle Detection System High Resolution (MVDS)	Tower, at 20' to 30' height (site specific)	0 (bolts directly to tower)	5 lb
Wireless Antenna	Tower, Near Top		5 lb
IR Illuminator	Below Camera		3-4 lb

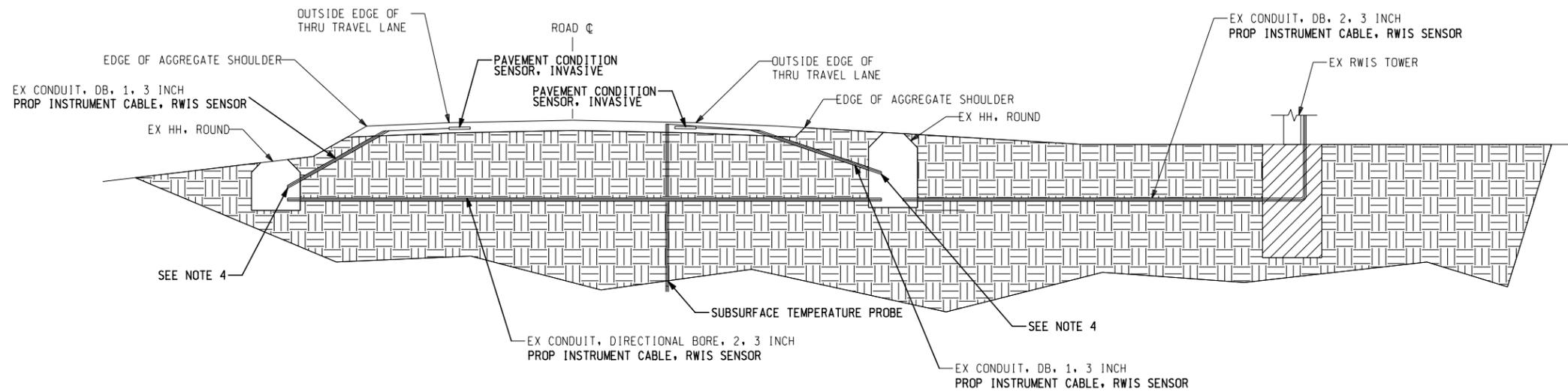
AS-LET PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

DATE: 4/11/12	CS: 84911
DESIGN UNIT:	JN: 115175A
FILE: \$FILE\$\$	TSC: ISHPEMING

TYPICAL RWIS TOWER DETAIL SHEET		DRAWING	SHEET
MISCELLANEOUS DETAILS			8



TYPICAL RWIS ROADWAY DETAIL

SCALE: NTS

NOTES:

1. THE CONDITIONS OF THE MATERIALS UNDERNEATH THE ROADWAY SURFACE ARE UNKNOWN AND ANY COSTS INCURRED WHILE INSTALLING EQUIPMENT IN THE ROADWAY SHALL BE PAID FOR UNDER THE SITE, RWIS, BASIC ESS PAY ITEM.
2. TYPICAL RWIS ROAD DETAIL SHOWN ABOVE. EXACT SIZE AND QUANTITIES OF CONDUIT FROM RWIS TOWER AND ACROSS ROADWAY SHALL BE VERIFIED WITH PLANS.
3. INSTRUMENT CABLE, RWIS SENSOR SHALL BE PAID FOR UNDER THE SITE, RWIS, BASIC ESS PAY ITEM.
4. PLUG CAULK (DUCT SEAL) AROUND WIRES TO KEEP SEALANT FROM ENTERING CONDUIT.
5. TOP OF HANDHOLE SHALL BE SET AT 1" BELOW GRADE.

AS-LET PLAN REVISIONS

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DATE: 4/11/12

DESIGN UNIT: GUSTAFSON

TSC: ISHPEMING

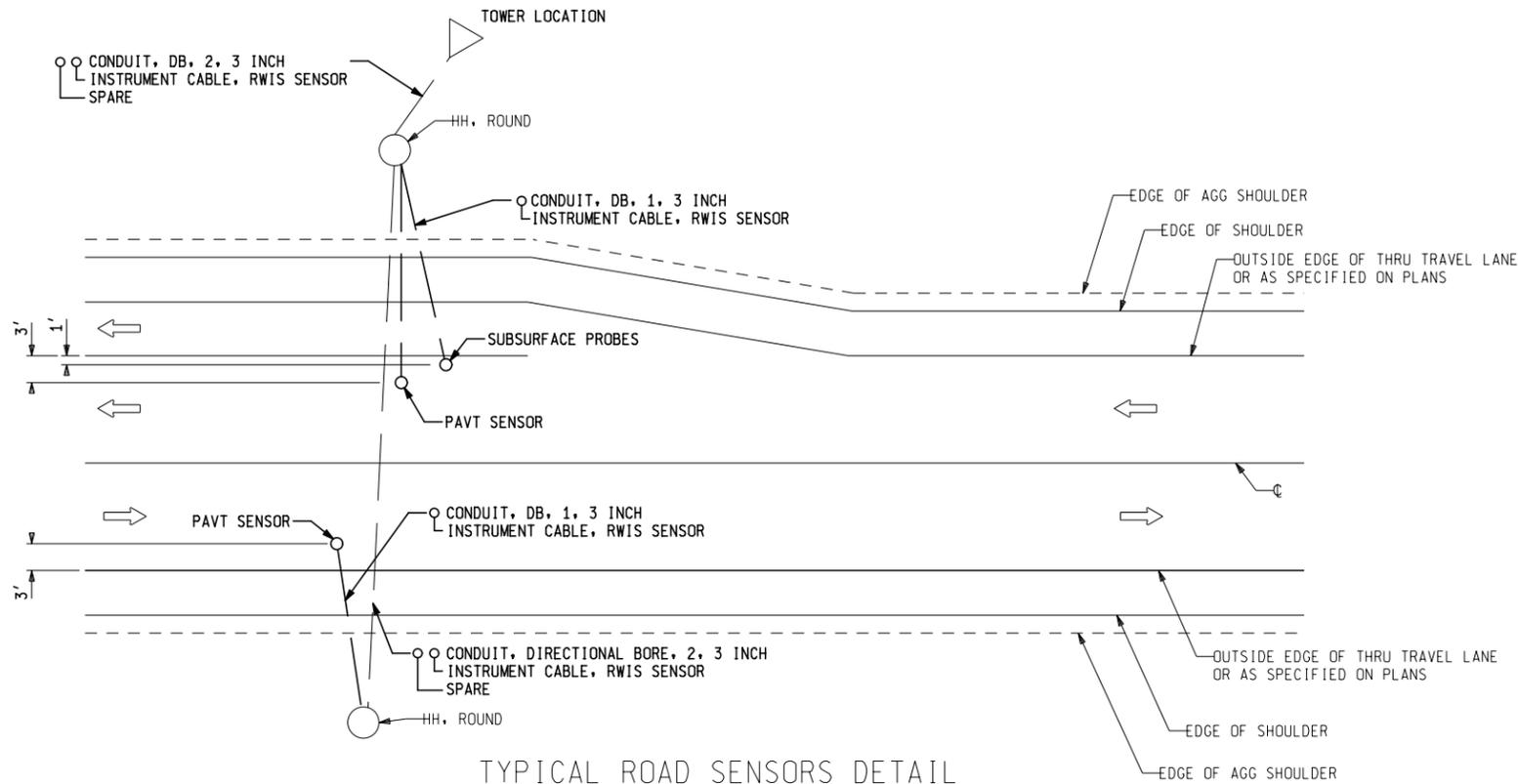
CS: 84911

JN: 115175A

TYPICAL RWIS ROADWAY AND HANDHOLE DETAIL SHEET

MISCELLANEOUS DETAILS

DRAWING SHEET



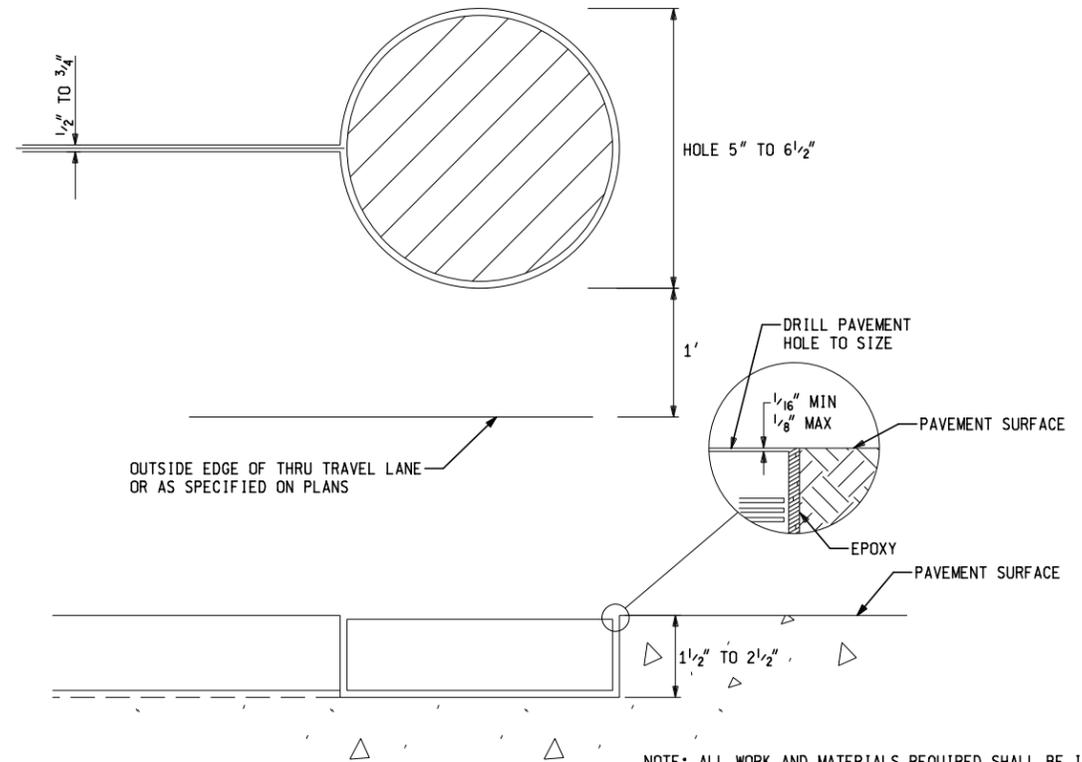
TYPICAL ROAD SENSORS DETAIL

SCALE: NTS

NOTE: EXACT LOCATIONS AND QUANTITIES OF SENSORS WILL VARY. ALL FINAL LOCATIONS WILL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.

NOTES:

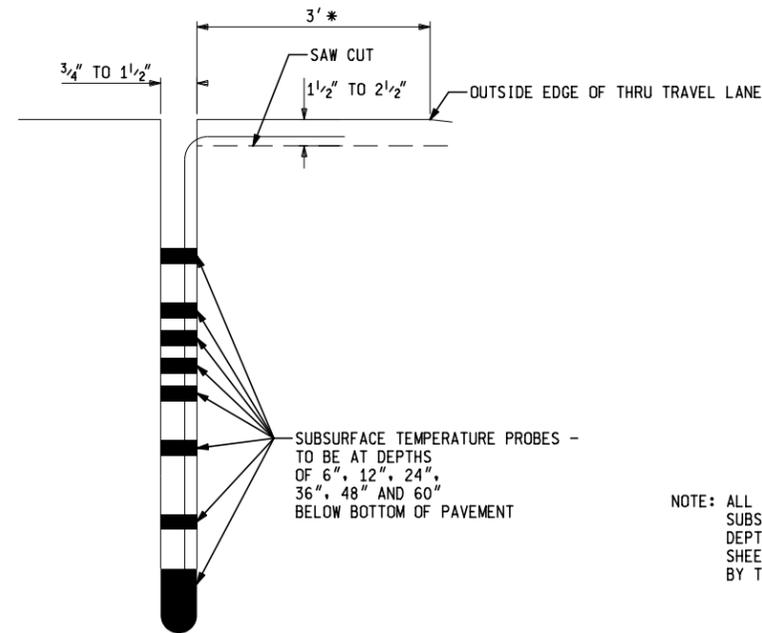
1. SENSOR CABLES SHALL RUN FROM RPU CABINET TO SENSOR WITHOUT SPLICES. HH, ROUND TO BE USED AS PULL BOXES FOR EASY INSTALLATION AND MAINTENANCE.
2. IF SPLICES ARE REQUIRED, THE NEARBY HANDHOLES MAY BE USED AS A SPLICE POINT. ALL SPLICES SHALL BE SEALED USING DUCT SEAL. ALL SPLICES SHALL BE APPROVED BY THE ENGINEER.
3. PAVEMENT CUT TO BE NORMAL SAW BLADE SIZE TO HOLD SENSOR CABLE. PAVEMENT CUT SHALL BE FILLED WITH APPROPRIATE FLEXIBLE SEALANT AS RECOMMENDED BY MANUFACTURER (3M DBR-6 OR APPROVED EQUAL). PAVEMENT CUT AND SEALANT SHALL BE PAID FOR UNDER THE PAVEMENT CONDITION SENSOR, INVASIVE PAY ITEM
4. THE CONDITIONS OF THE MATERIALS UNDERNEATH THE ROADWAY SURFACE ARE UNKNOWN AND ANY COSTS INCURRED WHILE INSTALLING EQUIPMENT IN ROADWAY SHALL BE PAID FOR UNDER THE PAY ITEM FOR EACH SENSOR.
5. PAVEMENT SENSORS SHALL BE PLACED 1' FROM THE OUTSIDE EDGE OF THE THRU TRAVEL LANE. FINAL PLACEMENT SHALL BE APPROVED BY THE ENGINEER.
6. ALL PAVEMENT SENSORS AND CABLING SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDED PROCEDURE.
7. A PAVEMENT CORE SHALL BE RETAINED WHEN PLACING EACH PAVEMENT CONDITION SENSOR, INVASIVE. CORES SHALL BE CLEARLY LABELED AND PROVIDED TO THE ENGINEER.



TYPICAL PAVEMENT CONDITION SENSOR, INVASIVE

SCALE: NTS

NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE PAVEMENT CONDITION SENSOR, INVASIVE PAY ITEM.



TYPICAL SUBSURFACE TEMPERATURE PROBE

SCALE: NTS

NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE SUBSURFACE TEMPERATURE PROBE PAY ITEM. EXACT LOCATION, DEPTH AND QUANTITY OF SENSORS WILL VARY. SEE EACH PLAN SHEET FOR DETAILS. ALL FINAL LOCATIONS WILL BE APPROVED BY THE ENGINEER PRIOR TO INSTALLATION.

\* INSTALL IN OUTSIDE WHEEL PATH

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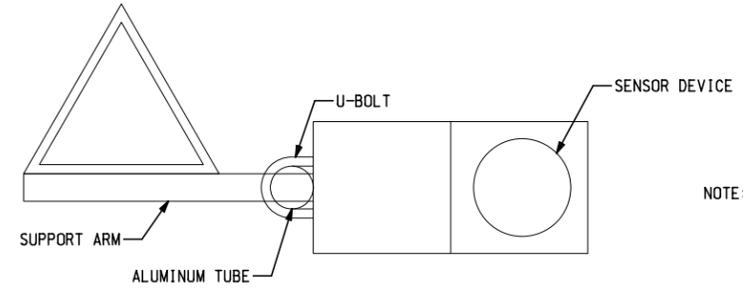
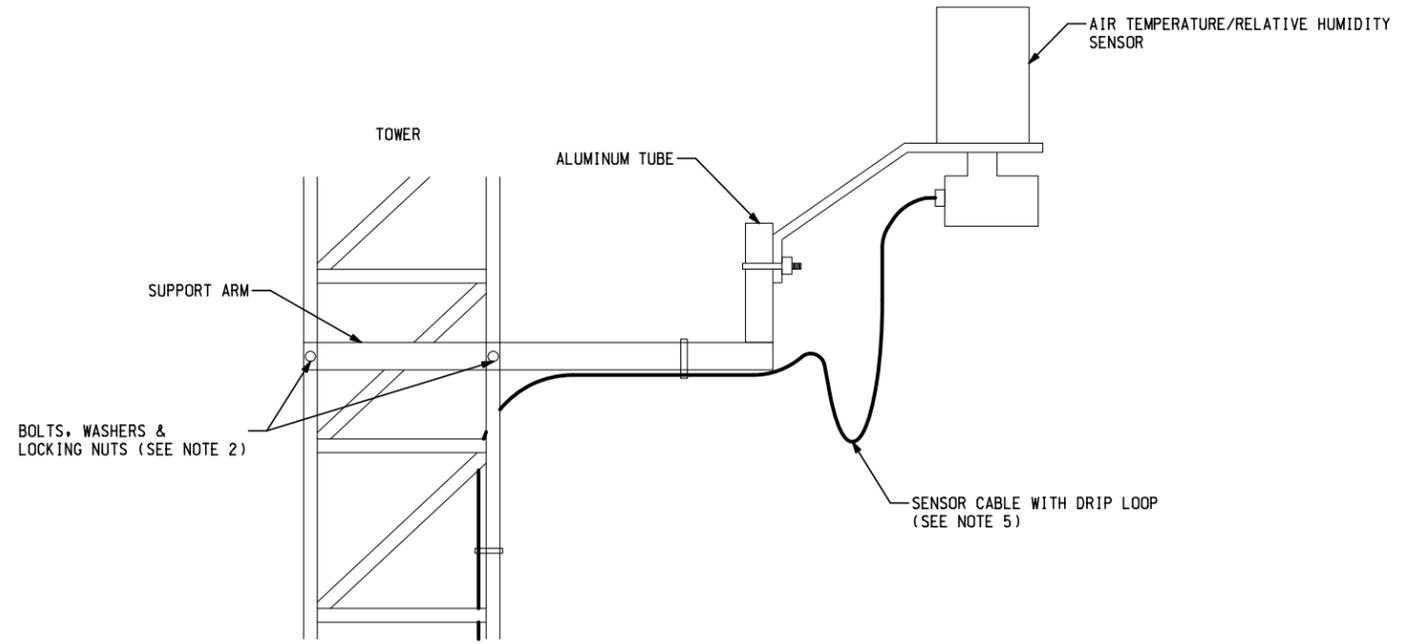
TSC: ISHP/EMING

CS: 84911

JN: 115175A

TYPICAL ROAD SENSOR DETAIL SHEET  
MISCELLANEOUS DETAILS

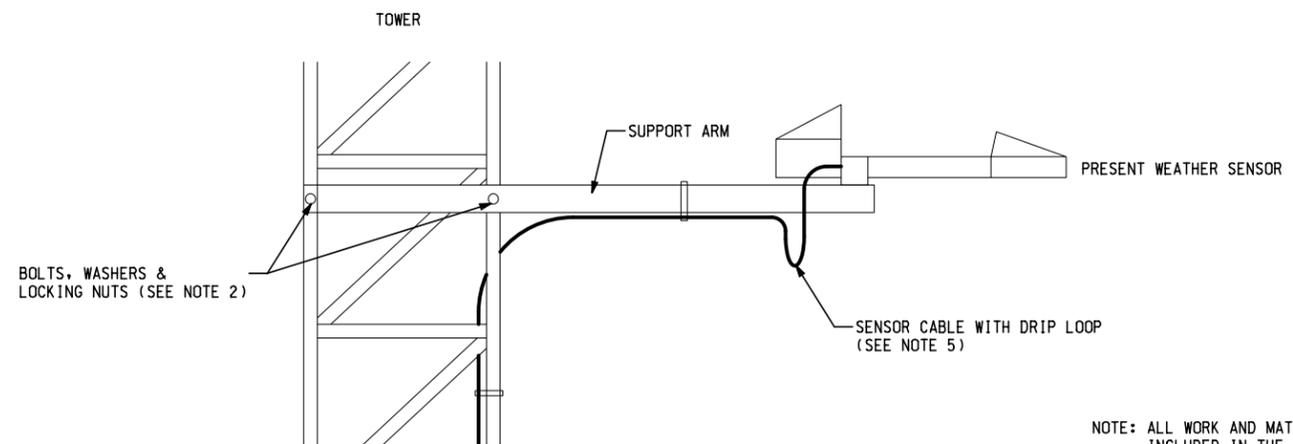
DRAWING SHEET



NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE AIR TEMPERATURE/HUMIDITY SENSOR PAY ITEMS.

TYPICAL AIR TEMPERATURE/HUMIDITY SENSORS DETAIL

SCALE: NTS



NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE PRECIPITATION SENSOR PAY ITEM.

TYPICAL PRESENT WEATHER SENSOR

SCALE: NTS

NOTES:

1. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
2. ALL HARDWARE SHALL BE STAINLESS STEEL.
3. SUPPORT ARM SHALL BE ANGLE ALUMINUM.
4. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.
5. EACH TOWER-MOUNTED SENSOR CABLE SHALL HAVE QUICK DISCONNECTS AT THE TOP AND BOTTOM OF THE TOWER.
6. ALL TIE WRAPS SHALL BE INSTALLED TO ENSURE THE CABLES ARE SECURELY TIED TO THE TOWER. TIE WRAPS SHALL BE WEATHER RESISTANT.
7. TYPICAL DETAILS PROVIDED FOR INFORMATION ONLY. ACTUAL INSTALLATION MAY VARY DEPENDING ON SPECIFIC EQUIPMENT INSTALLED.

AS-LET PLAN REVISIONS

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DATE: 4/11/12

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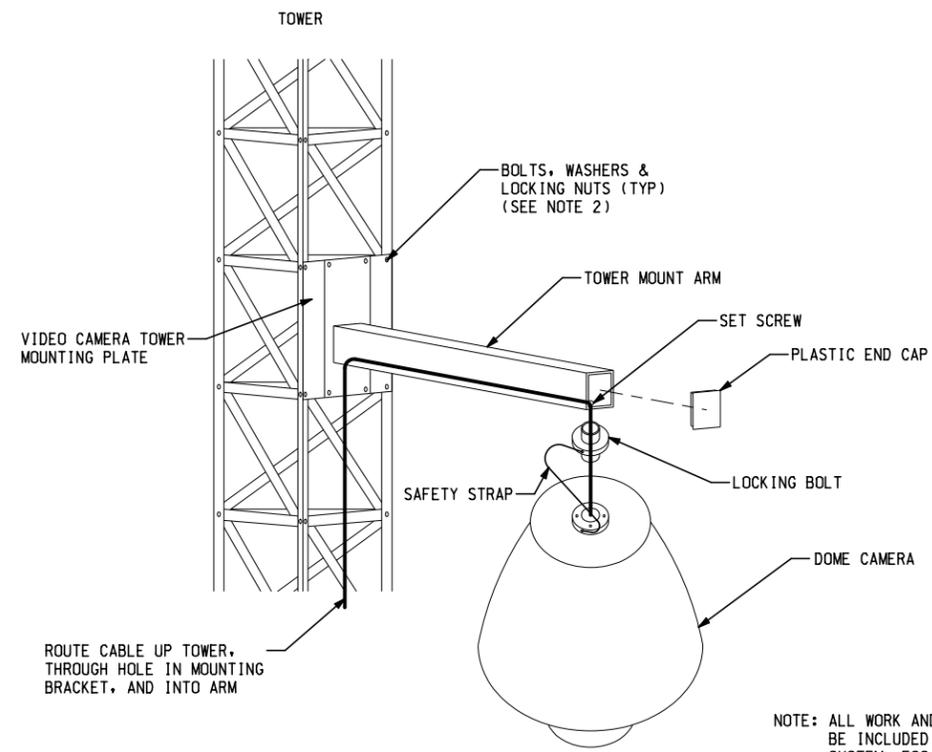
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JN: 115175A

TYPICAL RWIS SENSOR DETAIL SHEET 1

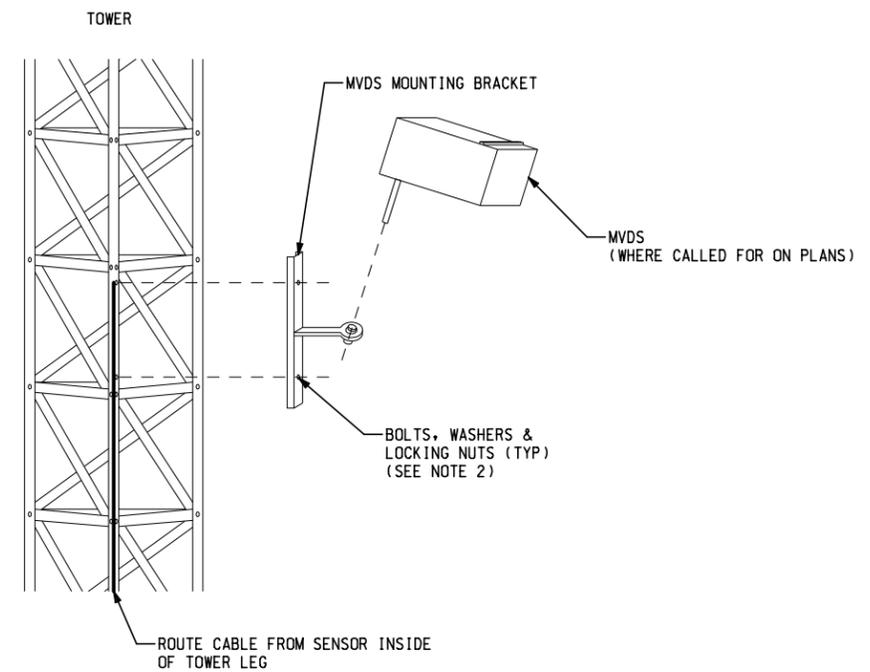
MISCELLANEOUS DETAILS

DRAWING SHEET



NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE IP SURVEILLANCE SYSTEM, ESS PAY ITEM.

TYPICAL VIDEO CAMERA MOUNTING DETAIL  
SCALE: NTS

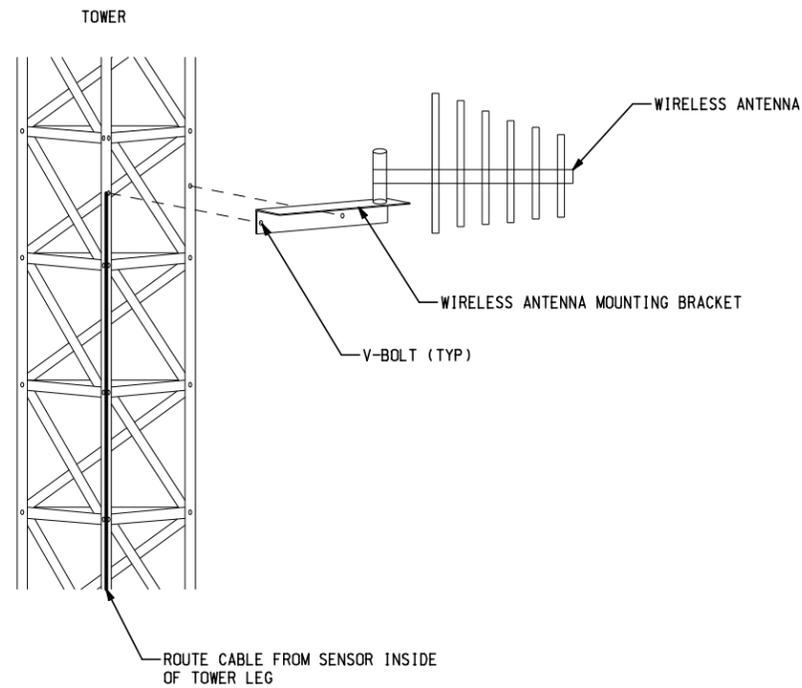


NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE MICROWAVE VEHICLE DETECTION SYSTEM PAY ITEM.

TYPICAL MICROWAVE VEHICLE DETECTION SYSTEM (MVDS) MOUNTING DETAIL  
SCALE: NTS

- NOTES:
1. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
  2. ALL HARDWARE SHALL BE STAINLESS STEEL.
  3. MOUNTING PLATE SHALL BE SIZED ACCORDINGLY FOR FLUSH INSTALL ON TOWER FACE.
  4. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.
  5. ALL TIE WRAPS SHALL BE INSTALLED TO ENSURE THE CABLES ARE SECURELY TIED TO THE TOWER. TIE WRAPS SHALL BE WEATHER RESISTANT.
  6. TYPICAL DETAILS PROVIDED FOR INFORMATION ONLY. ACTUAL INSTALLATION MAY VARY DEPENDING ON SPECIFIC EQUIPMENT INSTALLED.

AS-LET PLAN REVISIONS									NO SCALE	DATE: 4/11/12	CS: 84911	TYPICAL RWIS SENSOR DETAIL SHEET 2	DRAWING	SHEET	
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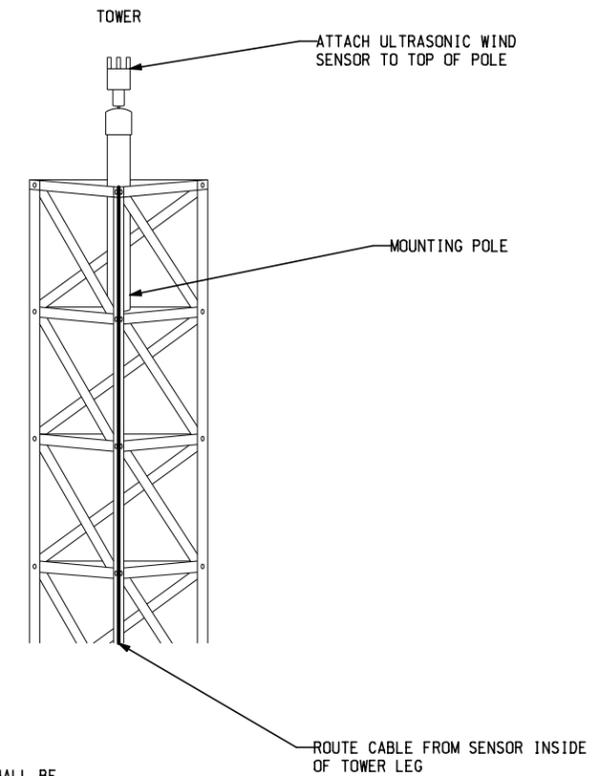
NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE CELLULAR MODEM PAY ITEM.

TYPICAL WIRELESS ANTENNA MOUNTING DETAIL

SCALE: NTS

NOTES:

1. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
2. ALL HARDWARE SHALL BE STAINLESS STEEL.
3. MOUNTING PLATE SHALL BE SIZED ACCORDINGLY FOR FLUSH INSTALL ON TOWER FACE.
4. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.
5. ANTENNA SHALL BE INSTALLED TO MAXIMIZE THE CELLULAR SERVICE QUALITY. ANTENNA CAN BE MOUNTED HORIZONTALLY OR VERTICALLY. FINAL INSTALLATION SHALL BE APPROVED BY THE ENGINEER.
6. TYPICAL DETAILS PROVIDED FOR INFORMATION ONLY. ACTUAL INSTALLATION MAY VARY DEPENDING ON SPECIFIC EQUIPMENT INSTALLED.



NOTE: ALL WORK AND MATERIALS REQUIRED SHALL BE INCLUDED IN THE ULTRASONIC WIND SENSOR PAY ITEM.

TYPICAL ULTRASONIC WIND SENSOR MOUNTING DETAIL

SCALE: NTS

AS-LET PLAN REVISIONS

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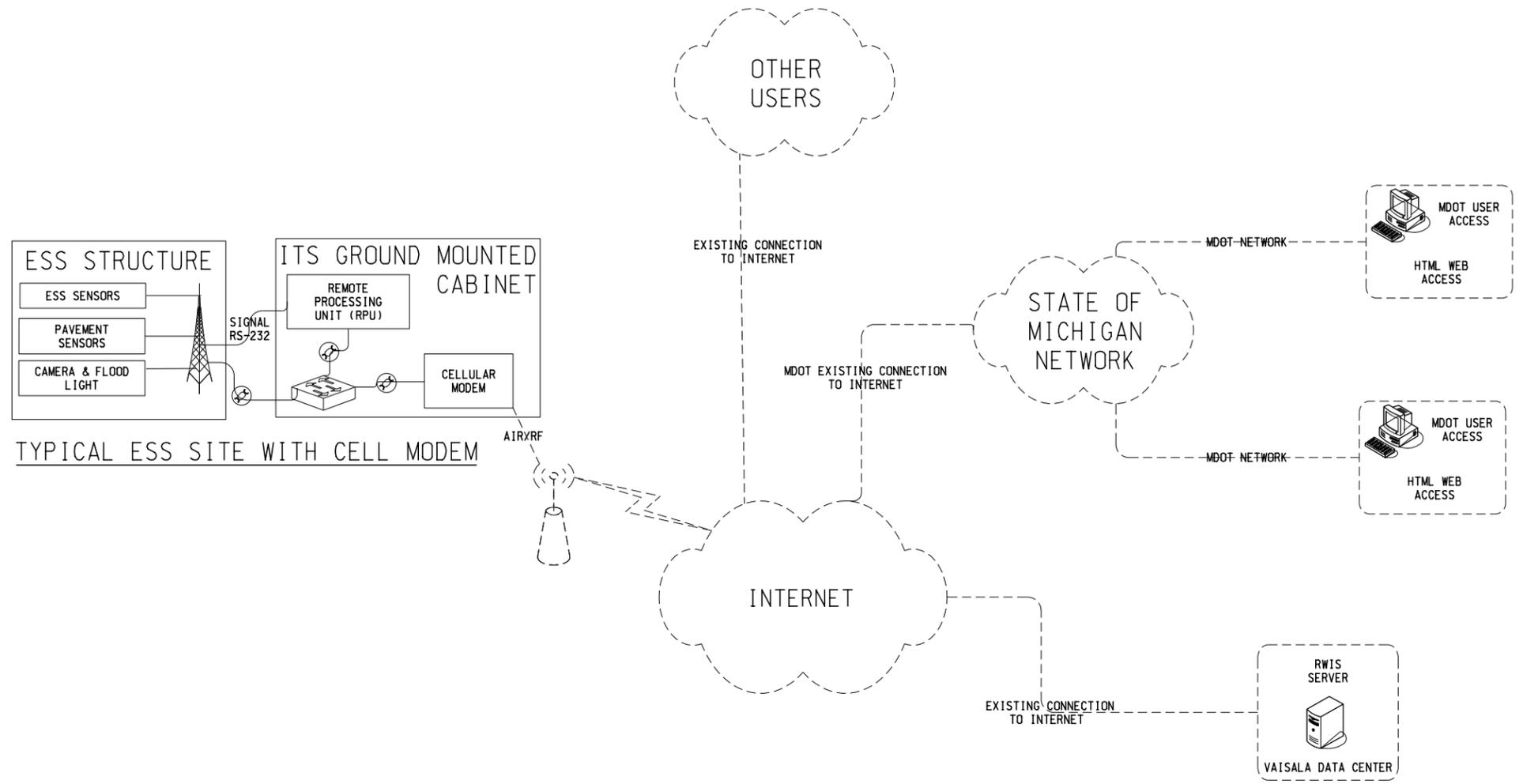
CS: 84911

JN: 115175A

TYPICAL RWIS SENSOR DETAIL SHEET 3

MISCELLANEOUS DETAILS

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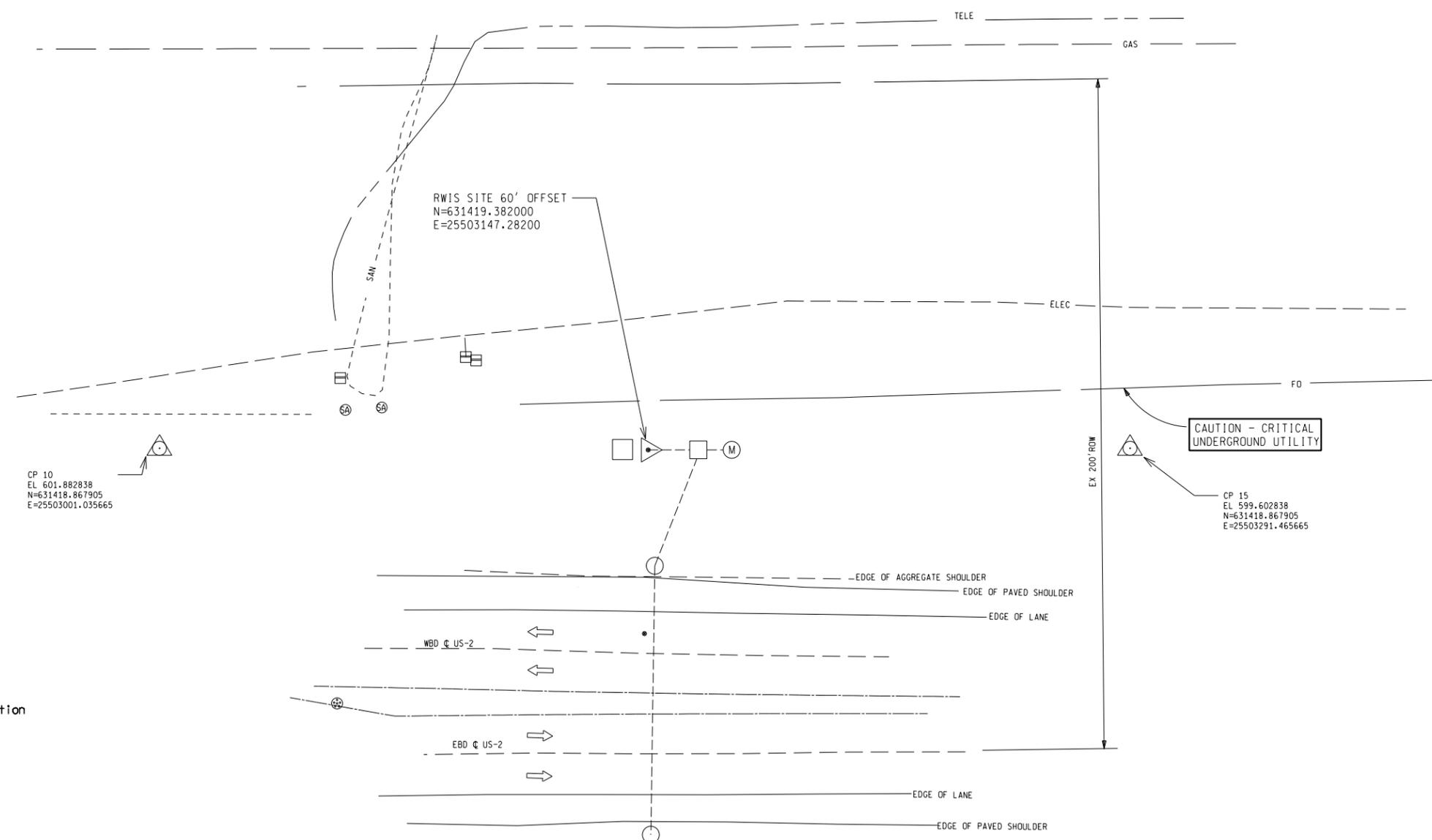


MDOT RWIS COMMUNICATION DIAGRAM  
SCALE: NTS

NOTES:

1. THIS DIAGRAM DEPICTS THE MINIMUM EQUIPMENT NECESSARY TO PROVIDE THE COMMUNICATIONS DESIGN. ACTUAL EQUIPMENT AND SITE SPECIFIC DETAILS MAY CHANGE BASED ON THE TYPE OF EQUIPMENT THE CONTRACTOR SUBMITS. THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A CONNECTIVITY DIAGRAM THAT ILLUSTRATES IN DETAIL THE CONTRACTOR'S PROPOSED EQUIPMENT AND CONNECTIONS THAT CORRESPOND WITH THIS DIAGRAM.
2. THE CONTRACTOR IS REQUIRED TO COORDINATE WITH MDOT'S CURRENT SOFTWARE VENDOR, VAISALA TO INTEGRATE THE SIXTEEN (16) ESS AND ASSOCIATED DEVICES INTO THE EXISTING SOFTWARE.
3. VAISALA, OR THE CURRENT MDOT SOFTWARE VENDOR, WILL POLL THE DATA FROM EACH SITE USING A STATIC IP ADDRESS. THE IP ADDRESS SHALL BE ASSIGNED BY THE INTERNET PROVIDER AT EACH SITE WHEN THE MODEM IS PROVISIONED.
4. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT SENSOR DATA IS ACCESSIBLE THROUGH THE INTERNET. CONTRACT SHALL BE REQUIRED TO TEST THIS CAPABILITY DURING FINAL SYSTEM ACCEPTANCE.

AS-LET PLAN REVISIONS									NO SCALE	DATE: 4/11/12	CS: 84911	TYPICAL RWIS COMMUNICATION DETAIL SHEET	DRAWING	SHEET
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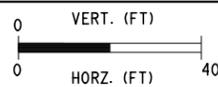


CONSTRUCTION QUANTITIES THIS SHEET

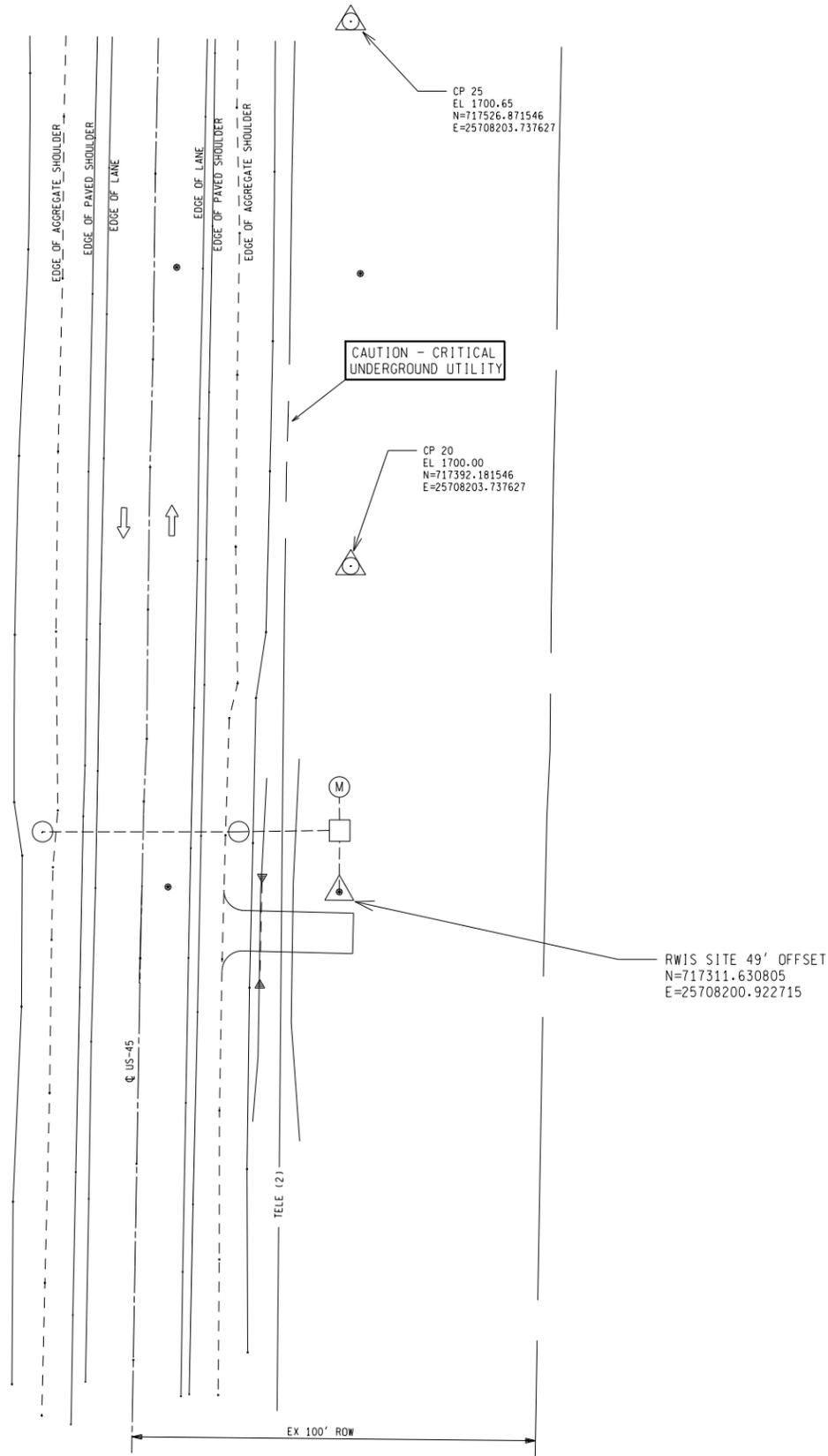
- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit



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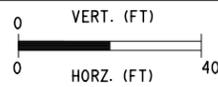
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	TSC: ISHPEMING				15



CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

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DATE: 8/10/12  
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TSC: ISHPERING

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JN: 115175A

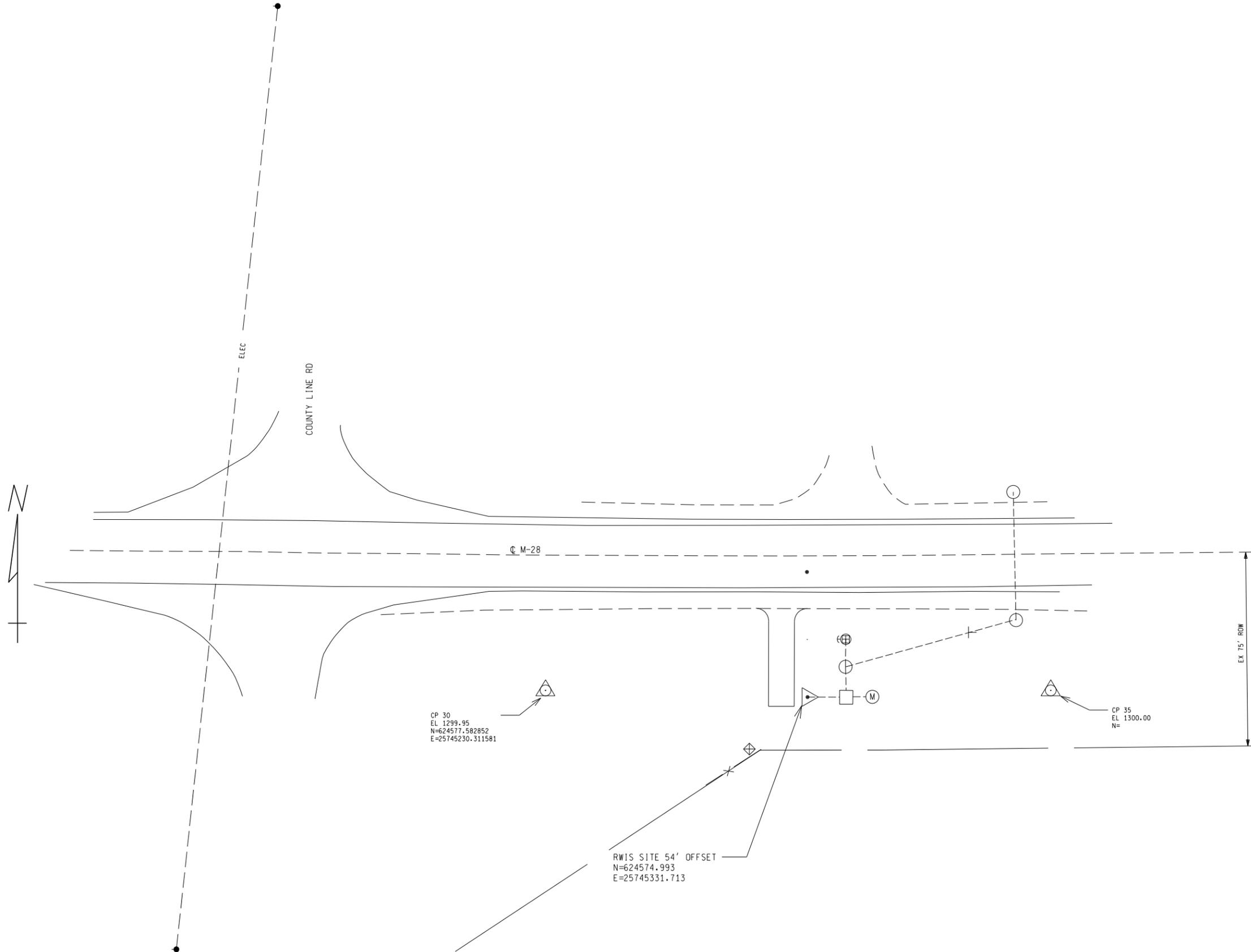
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US-45, ONTONAGON COUNTY

DRAWING	SHEET
	16

SECTION 7  
T47N-R37W  
DUNCAN TOWNSHIP

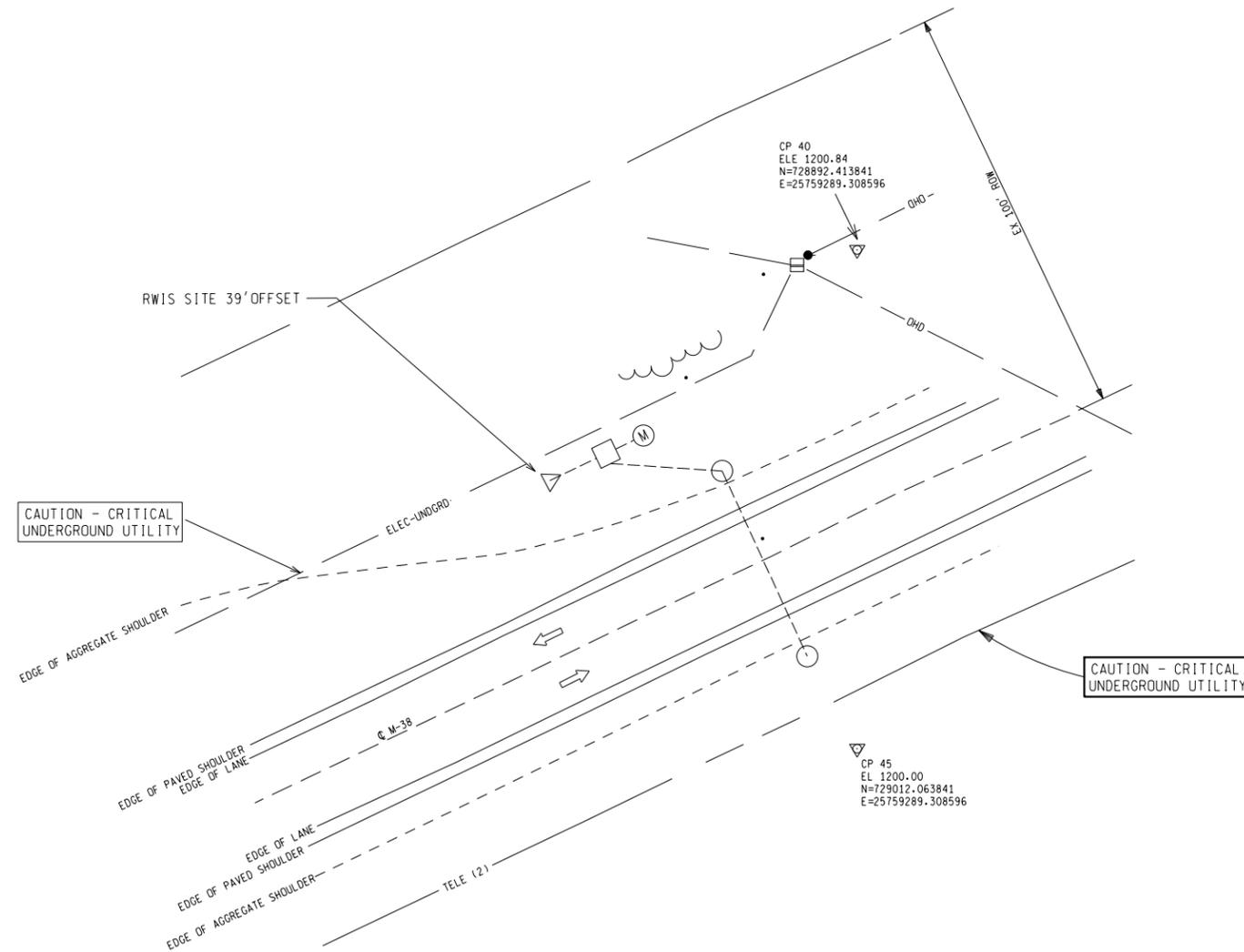
CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Temperature Sensor, Invasive
- 1 Ea Pavement Condition Sensor, Non-Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit



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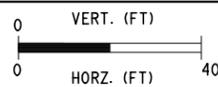
SECTION 36  
T51N, R37W  
BOHEMIA TOWNSHIP



CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

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FILE: 4 CF M38.dgn

DATE: 8/10/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

CS: 84911  
JN: 115175A

ESS SITE #4 CONSTRUCTION SHEET  
M-38, ONTONAGON COUNTY

DRAWING	SHEET
	CONST
	18

SECTION 26  
T56N.R33W  
OSCEOLA TOWNSHIP

CP 55  
ELEV 1001.145995  
N=891728.976709  
E=25884405.552000

STORE ST.

RWIS SITE, 55' OFFSET  
N=891636.7725  
E=25884409.7417

CP 50  
ELEV 1000.00  
N=891587.545000  
E=25884405.552000

EX 75' ROW

EDGE OF AGGREGATE SHOULDER

EDGE OF AGGREGATE SHOULDER

EDGE OF PAVED SHOULDER

EDGE OF LANE

EDGE OF LANE

EDGE OF PAVED SHOULDER

US-41

CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



DATE: 8/10/12	CS: 84911
DESIGN UNIT: GUSTAFSON	JN: 115175A
TSC: ISHPEMING	FILE: 5 ISH US41.dgn

ESS SITE #5 CONSTRUCTION SHEET		DRAWING	SHEET
US-41, HOUGHTON COUNTY			
			19

SECTION 26  
T53N, R33W  
CHASSELL TOWNSHIP

CP 65  
EL 614.51  
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E=25883879.0000

RWIS SITE, 101' OFFSET  
N=794759.905288  
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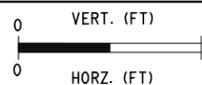
CAUTION - CRITICAL  
UNDERGROUND UTILITY

CP 60  
EL 614.00  
N=794701.92000  
E=25883879.00000

CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

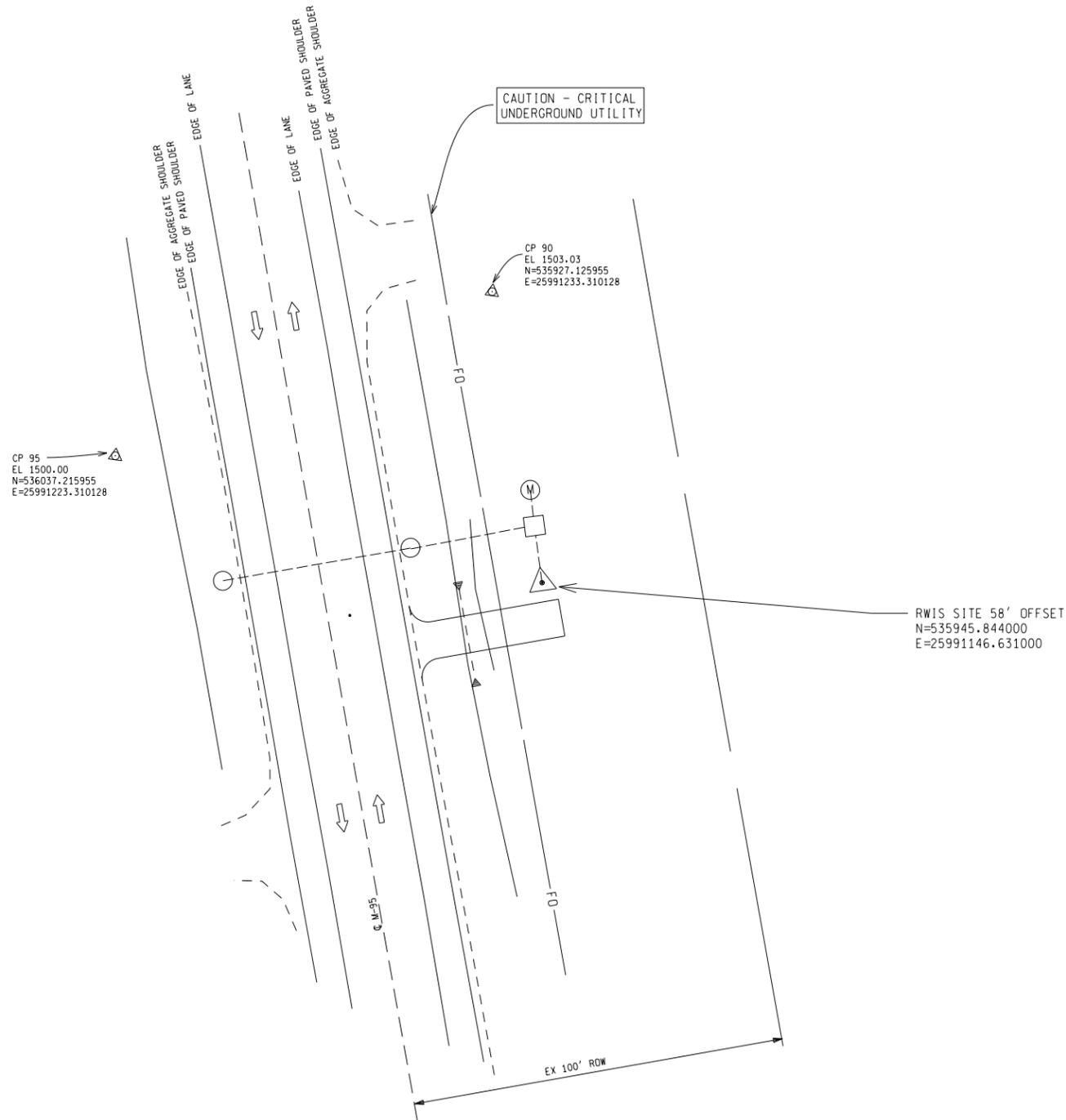
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



DATE: 8/10/12	CS: 84911
DESIGN UNIT: GUSTAFSON	JN: 115175A
TSC: ISHPEMING	FILE: 6 ISH US41.dgn

ESS SITE #6 CONSTRUCTION SHEET	DRAWING	SHEET
US-41, HOUGHTON COUNTY		CONST
		20

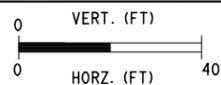
SECTION 36  
T45N,R30W  
REPUBLIC TOWNSHIP



CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 9 ISH M95.dgn

DATE: 8/10/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPERING

CS: 84911  
JN: 115175A

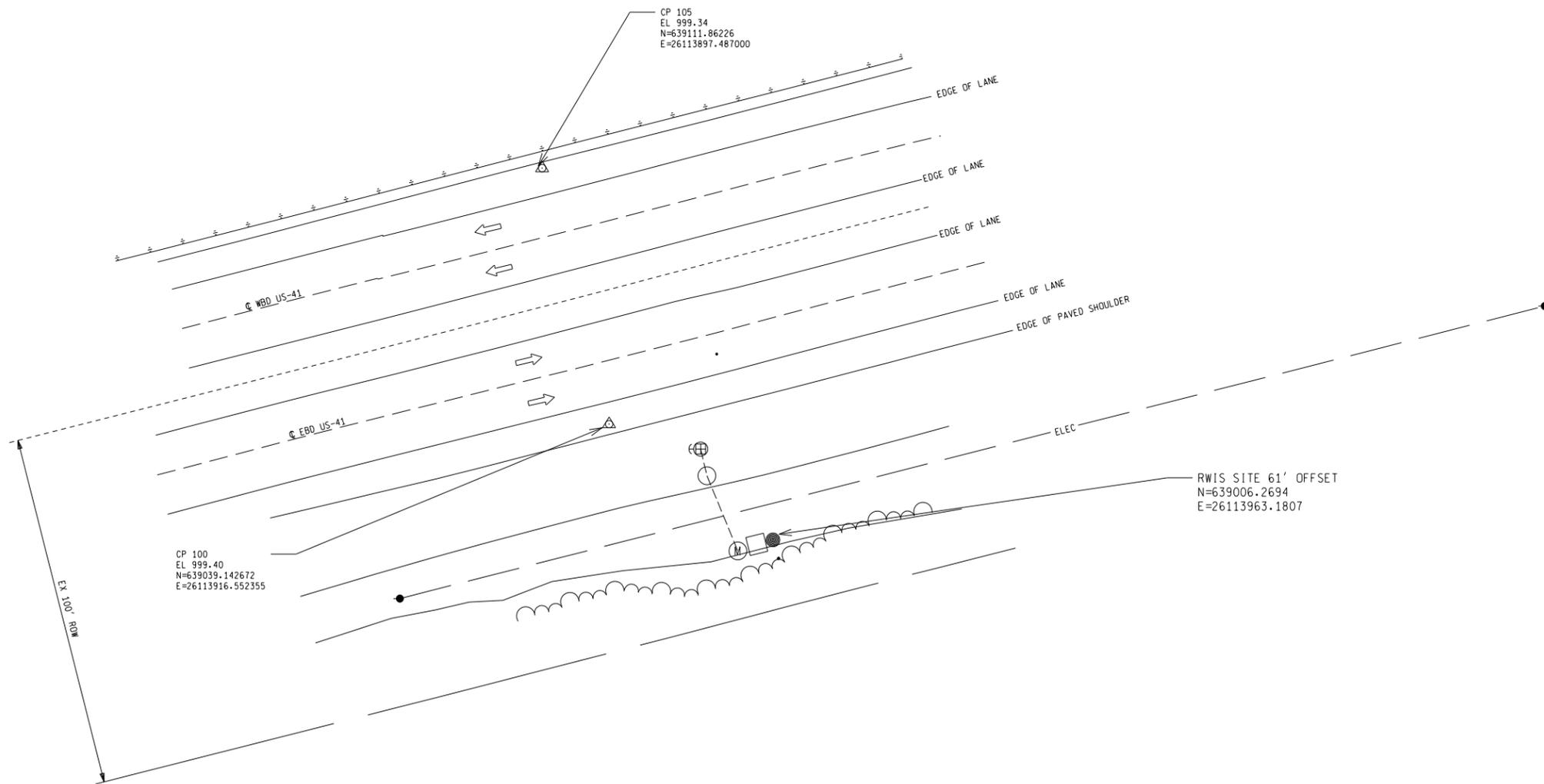
ESS SITE # 9 CONSTRUCTION SHEET  
M-95, MARQUETTE COUNTY

DRAWING	SHEET
	21

SECTION 26  
T48N.R26W  
NEGAUNEE TOWNSHIP

CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 1 Ea Pavement Condition Sensor, Non-Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 10 ISHUS41.dgn

DATE: 8/10/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPERING

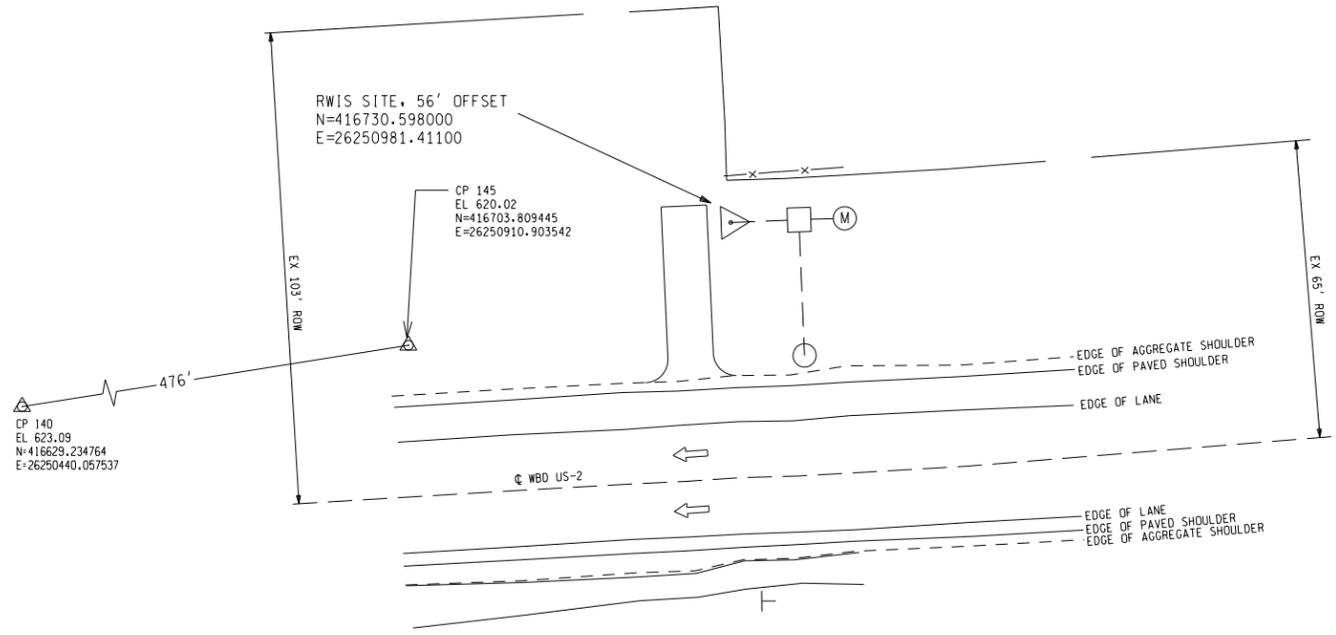
CS: 84911  
JN: 115175A

ESS SITE #10 CONSTRUCTION SHEET  
US-41, MARQUETTE COUNTY

DRAWING SHEET  
CONST 22



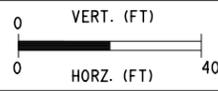
SECTION 30  
T41N.R21W  
MASONVILLE TOWNSHIP



CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 1 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DATE: 8/10/12	CS: 84911	ESS SITE #14 CONSTRUCTION SHEET	DRAWING	SHEET
									DESIGN UNIT: GUSTAFSON	JN: 115175A	US-2, DELTA COUNTY		CONST
									TSC: ISHPEMING				

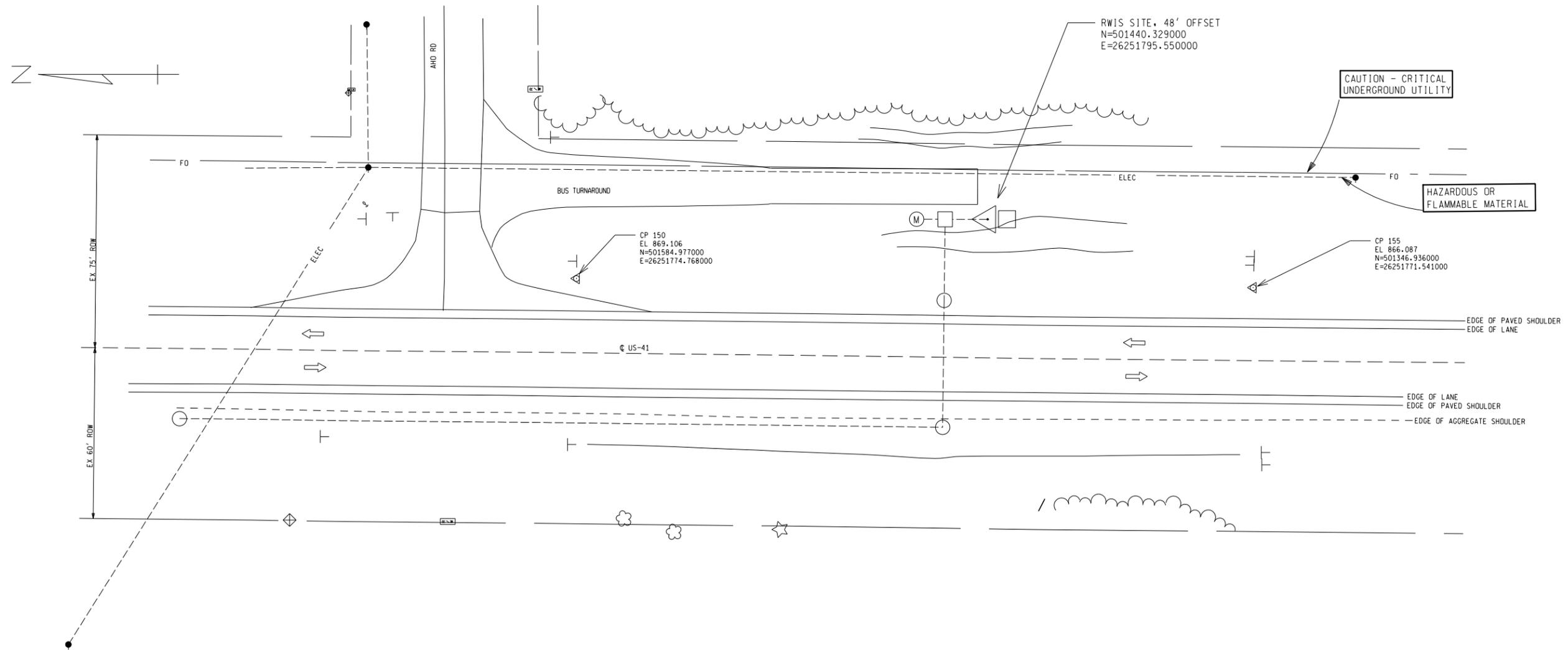


FILE: 14 ESC US2.dgn

SECTION 6  
T43N,R21W  
MASONVILLE TOWNSHIP

CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



DATE: 8/10/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPERING  
FILE: 15 ESC US41.dgn

CS: 84911  
JN: 115175A

ESS SITE #15 CONSTRUCTION SHEET  
US-41, DELTA COUNTY

DRAWING SHEET  
CONST  
25

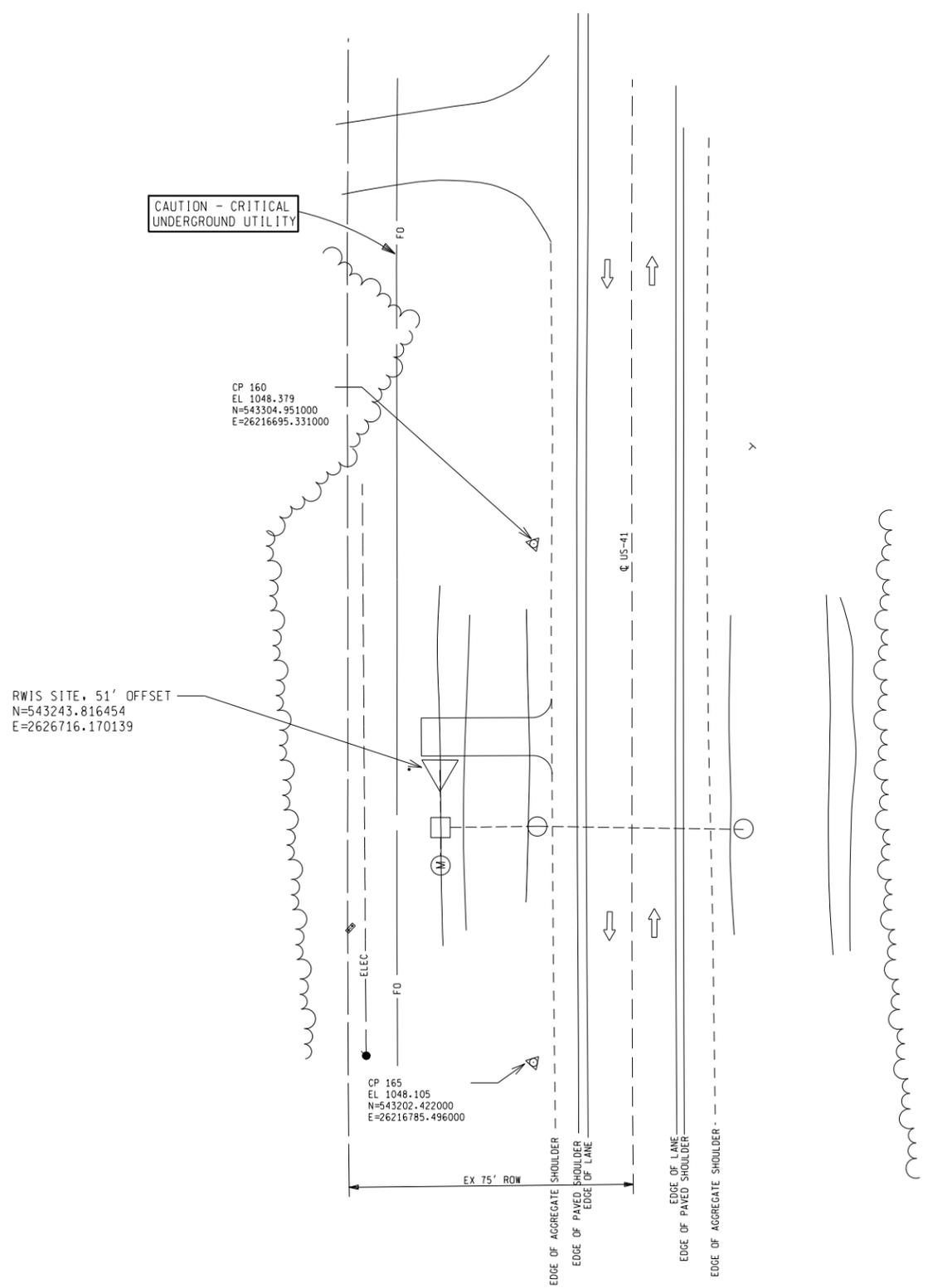
SECTION 25  
T45N.R23W  
SKANDIA TOWNSHIP

CAUTION - CRITICAL  
UNDERGROUND UTILITY

CP 160  
EL 1048.379  
N=543304.951000  
E=26216695.331000

RWIS SITE, 51' OFFSET  
N=543243.816454  
E=2626716.170139

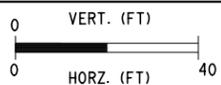
CP 165  
EL 1048.105  
N=543202.422000  
E=26216785.496000



CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

NO.	DATE	AUTH	DESCRIPTION



FILE: 16 ESC US41.dgn

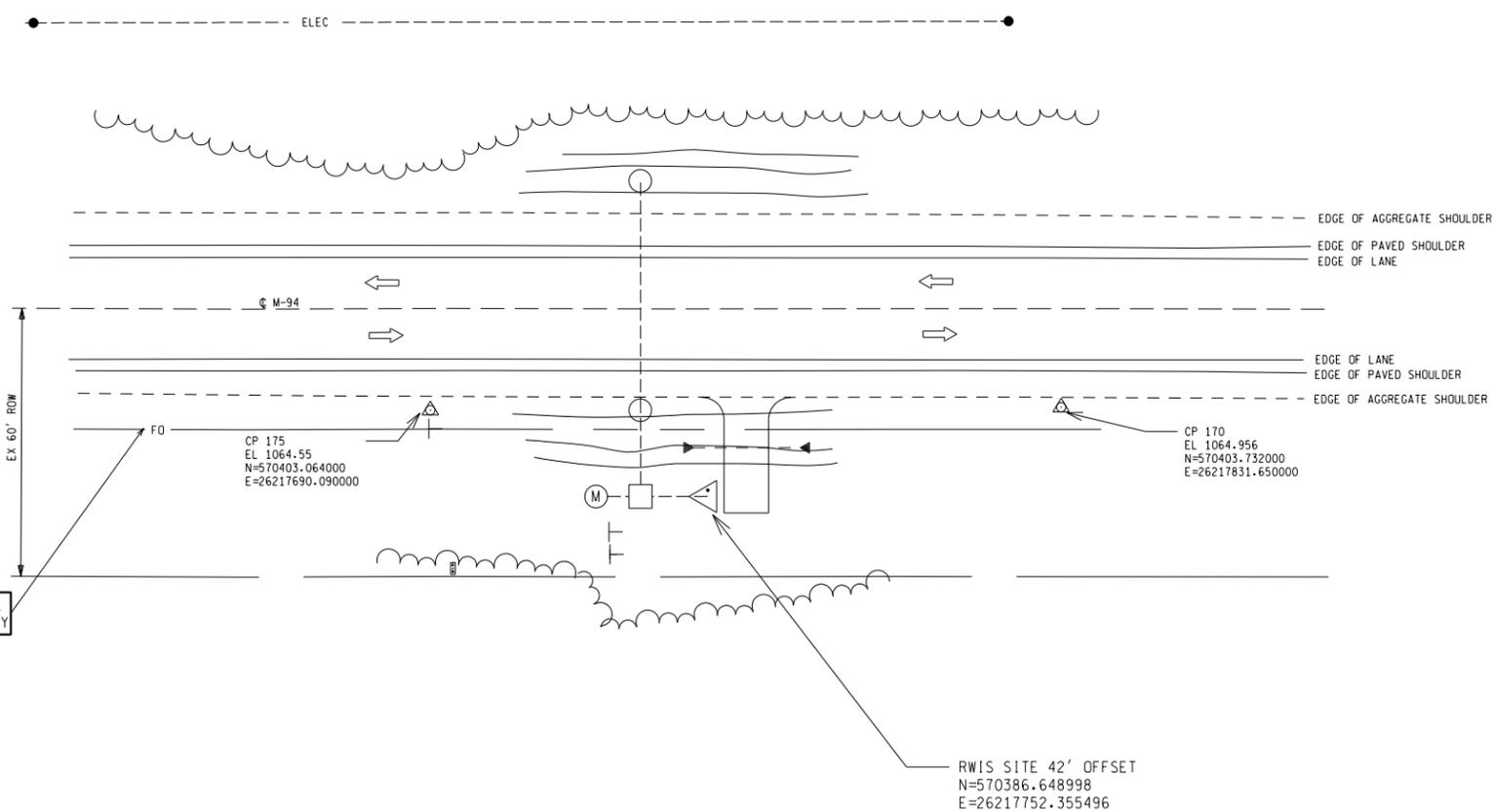
DATE: 8/10/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

CS: 84911  
JN: 115175A

ESS SITE #16 CONSTRUCTION SHEET  
US-41, MARQUETTE COUNTY

DRAWING	SHEET
	26

SECTION 31  
T46N.R22W  
ROCK RIVER TOWNSHIP



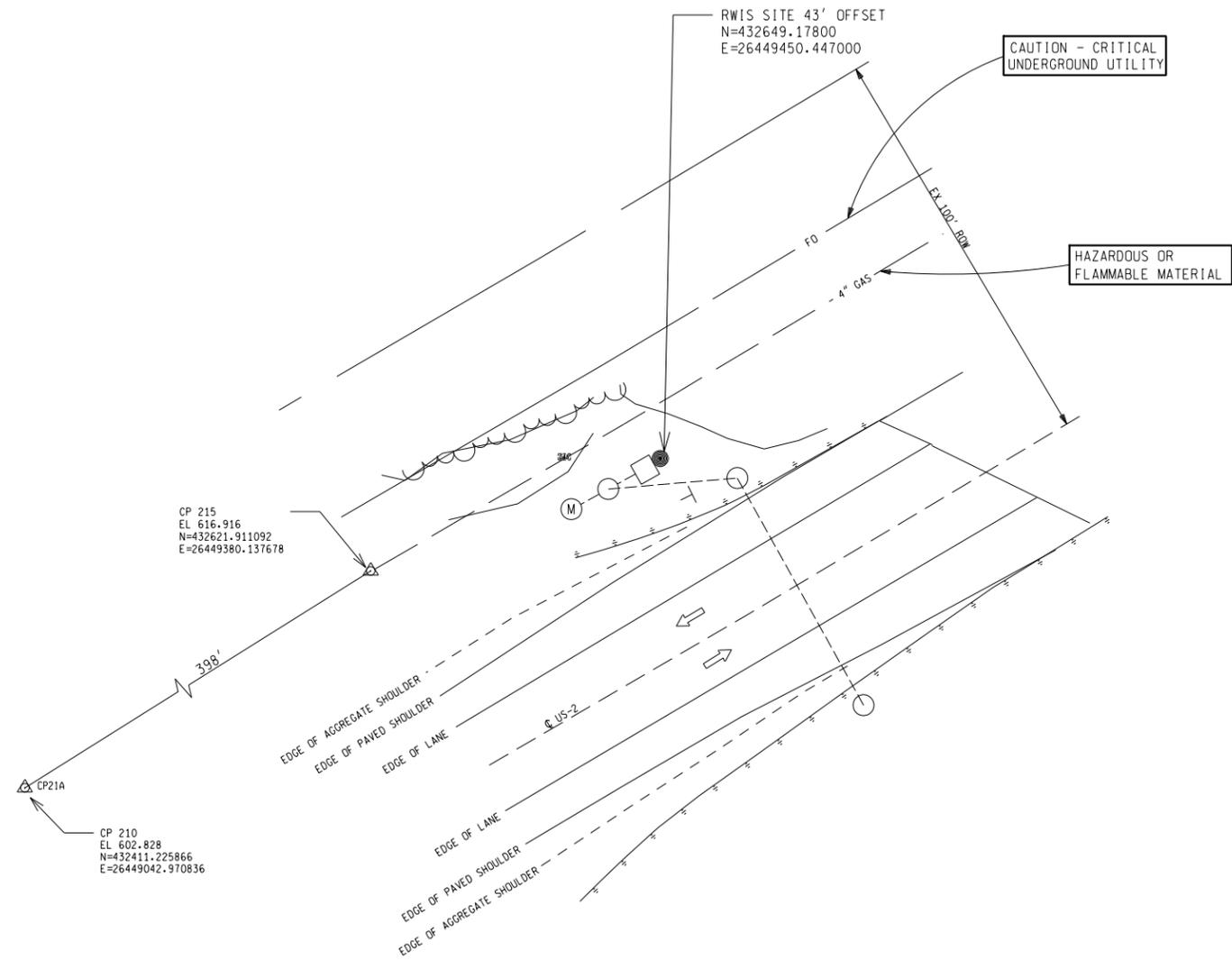
CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 2 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 8/10/12	CS: 84911	ESS SITE #17 CONSTRUCTION SHEET	DRAWING	SHEET
								0	VERT. (FT)	DESIGN UNIT: GUSTAFSON	JN: 115175A	M-94, ALGER COUNTY		CONST
								0	HORZ. (FT)	TSC: ISHPERING				27
										FILE: 17 ESC M94.dgn				

CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 1 Ea Microwave Vehicle Detection System
- 1 Ea Pavement Condition Sensor, Invasive
- 2 Ea Pavement Temperature Sensor, Invasive
- 1 Ea Pavement Condition Sensor, Non-Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 21\_ESC\_US2.dgn

DATE: 8/10/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPERING

CS: 84911  
JN: 115175A

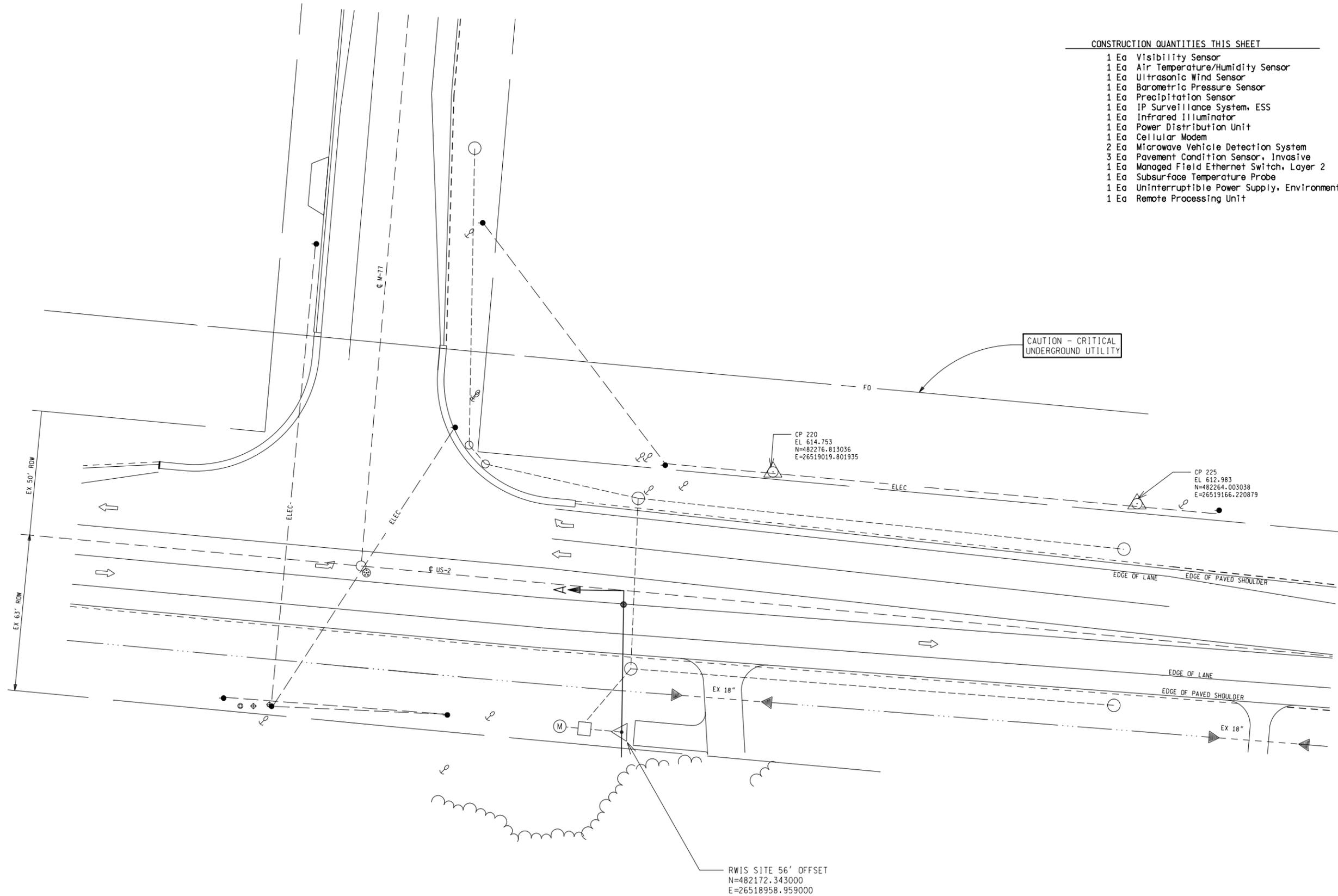
ESS SITE #21 CONSTRUCTION SHEET  
US-2, SCHOOLCRAFT COUNTY

DRAWING SHEET  
CONST 28

CONSTRUCTION QUANTITIES THIS SHEET

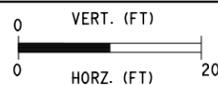
- 1 Ea Visibility Sensor
- 1 Ea Air Temperature/Humidity Sensor
- 1 Ea Ultrasonic Wind Sensor
- 1 Ea Barometric Pressure Sensor
- 1 Ea Precipitation Sensor
- 1 Ea IP Surveillance System, ESS
- 1 Ea Infrared Illuminator
- 1 Ea Power Distribution Unit
- 1 Ea Cellular Modem
- 2 Ea Microwave Vehicle Detection System
- 3 Ea Pavement Condition Sensor, Invasive
- 1 Ea Managed Field Ethernet Switch, Layer 2
- 1 Ea Subsurface Temperature Probe
- 1 Ea Uninterruptible Power Supply, Environmental Sensor Station
- 1 Ea Remote Processing Unit

CAUTION - CRITICAL  
UNDERGROUND UTILITY



RWIS SITE 56' OFFSET  
N=482172.343000  
E=26518958.959000

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE:22 ESC M77.dgn

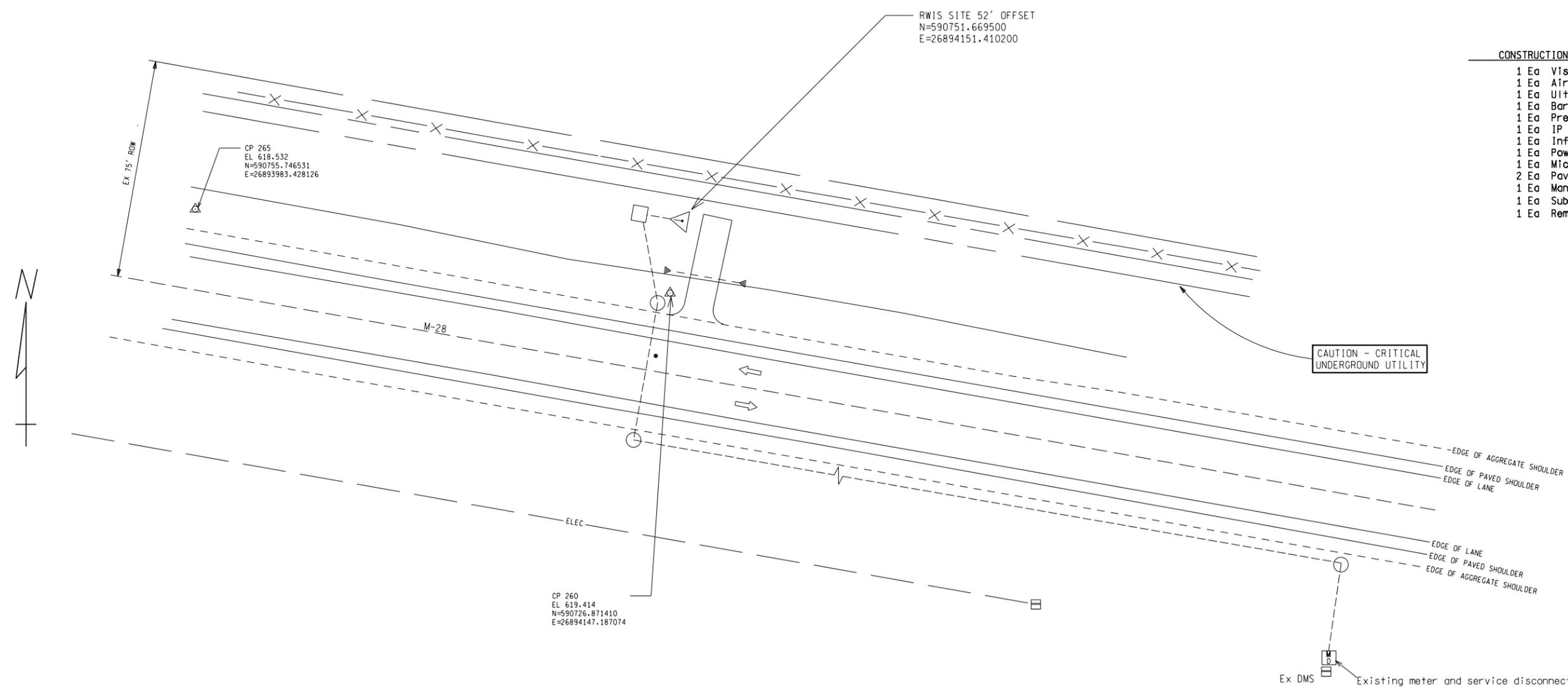
DATE:8/10/12  
DESIGN UNIT:GUSTAFSON  
TSC:ISHPEMING

CS:84911  
JN: 115175A

ESS SITE #22 CONSTRUCTION SHEET  
US-2, SCHOOLCRAFT COUNTY

DRAWING SHEET  
CROWN 29

SECTION 16  
T46N.R1W  
DAFTER TOWNSHIP



- CONSTRUCTION QUANTITIES THIS SHEET**
- 1 Ea Visibility Sensor
  - 1 Ea Air Temperature/Humidity Sensor
  - 1 Ea Ultrasonic Wind Sensor
  - 1 Ea Barometric Pressure Sensor
  - 1 Ea Precipitation Sensor
  - 1 Ea IP Surveillance System, ESS
  - 1 Ea Infrared Illuminator
  - 1 Ea Power Distribution Unit
  - 1 Ea Microwave Vehicle Detection System
  - 2 Ea Pavement Condition Sensor, Invasive
  - 1 Ea Managed Field Ethernet Switch, Layer 2
  - 1 Ea Subsurface Temperature Probe
  - 1 Ea Remote Processing Unit

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 8/10/12	CS: 84911	ESS SITE #26 CONSTRUCTION SHEET	DRAWING	SHEET
								0 VERT. (FT)	FILE: 26 NB M28.dgn	DESIGN UNIT: GUSTAFSON	JN: 115175A	M-28, CHIPPEWA COUNTY		30
								0 HORZ. (FT) 40		TSC: ISHPEMING				

THE IMPROVEMENTS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE MICHIGAN DEPARTMENT OF TRANSPORTATION 2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION.  
 PHYSICAL ROAD NUMBER (PR#) & MILEPOST (MP) DATA ARE FROM MICHIGAN GEOGRAPHIC FRAMEWORK VERSION #11.

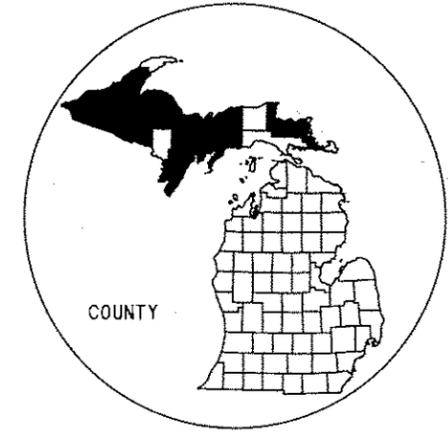
# MICHIGAN DEPARTMENT OF TRANSPORTATION

US-2, US-41, US-45, M-28,  
 M-35, M-38, M-94, M-95

CITY OF WAKEFIELD

BOHEMIA, CHASSELL, DAFTER, DUNCAN, MANISTIQUE,  
 MASONVILLE, MUELLER, NEGAUNEE, OSCEOLA,  
 REPUBLIC, ROCKLAND, ROCK RIVER AND SKANDIA TOWNSHIPS

ALGER, CHIPPEWA, DELTA, GOGEBIC, HOUGHTON,  
 MARQUETTE, MENOMINEE ONTONAGON AND SCHOOLCRAFT COUNTIES



COUNTY

COUNTY KEY

### 2010 TRAFFIC DATA

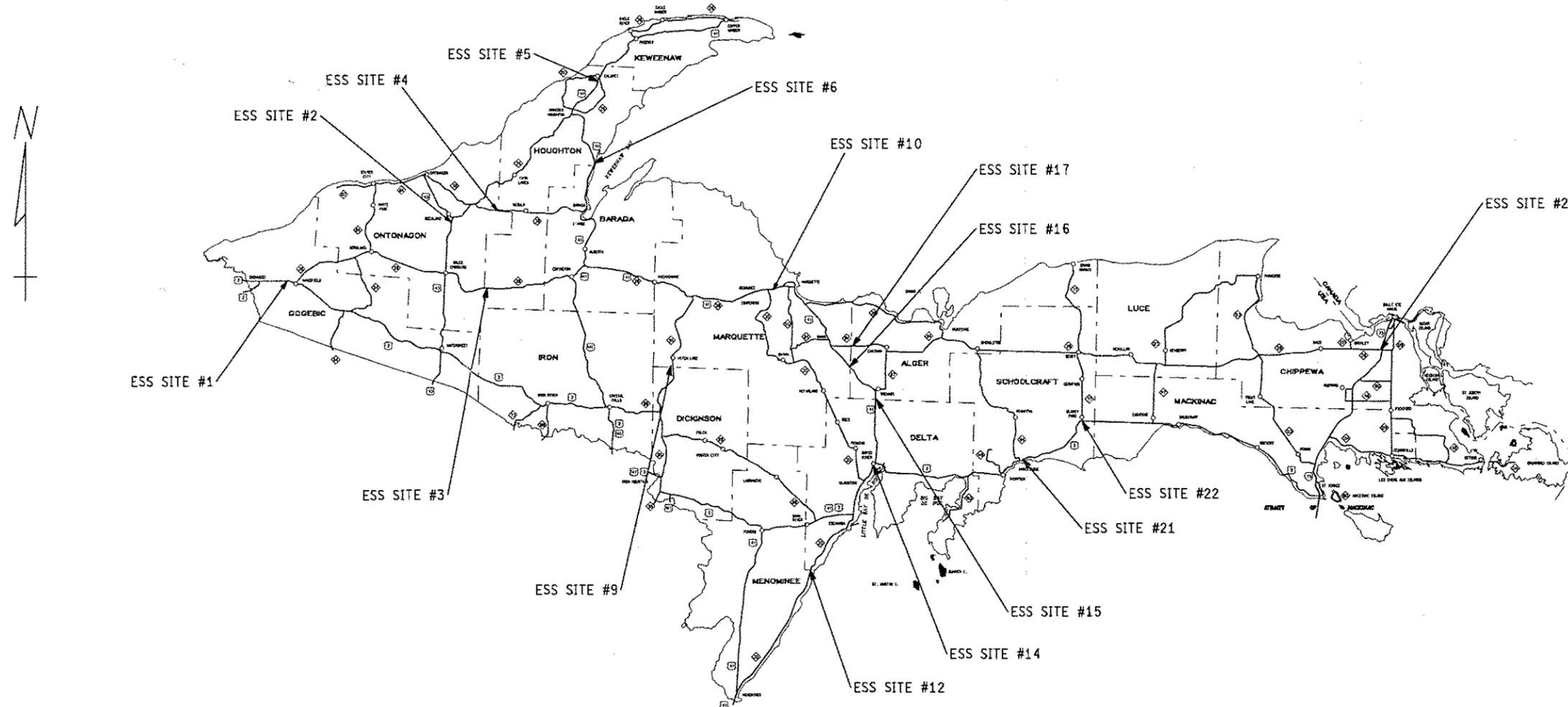
### SPEED DATA

ROAD (SITE #)	A.D.T.	D.H.V.	COMM.	DESIGN	POSTED
US-2 (1)	5800	564	7%	40	40
US-45 (2)	1300	206	10%	55	55
M-28 (3)	1400	165	9%	55	55
M-38 (4)	600	117	8%	55	55
US-41 (5)	6600	612	2%	45	45
US-41 (6)	4100	500	7%	55	55
M-95 (9)	1700	179	15%	55	55
US-41 (10)	8300	926	3%	55	55
M-35 (12)	2800	340	19%	55	55
US-2 (14)	4300	516	10%	55	55
US-41 (15)	2200	254	11%	55	55
US-41 (16)	1900	201	8%	55	55
M-94 (17)	1400	180	7%	55	55
US-2 (21)	7100	742	9%	55	55
US-2 (22)	3800	602	14%	55	55
M-28 (26)	3500	456	5%	55	55

SECTION	CONTROL SEC	JOB NO.	FEDERAL PROJECT	ITEM
1	84911	107425A		

CS:84911

JN:107425A



### APPROVALS

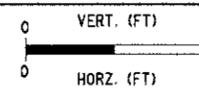
RECOMMENDED FOR APPROVAL BY: *Al Anderson* 4/11/12  
 AL ANDERSON, P.E. - DELIVERY ENGINEER DATE  
 RECOMMENDED FOR APPROVAL BY: *Dawn Gustafson* 4-3-12  
 DAWN GUSTAFSON, P.E. - TRAFFIC AND SAFETY ENGINEER DATE

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: *Mark A. Van Port Fleet*  
 MARK A. VAN PORT FLEET, P.E. - ENGINEER OF DEVELOPMENT DATE

MILES:  
 CONTRACT FOR:  
 CONSTRUCTION OF 16 ENVIRONMENTAL SENSOR STATIONS

NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE	AUTH.	DESCRIPTION



DATE: CS:84911  
 DESIGN UNIT: GUSTAFSON  
 TSC: ISHPEWING  
 FILE: 107425 Title.dgn

DATE: CS:84911  
 DESIGN UNIT: GUSTAFSON  
 TSC: ISHPEWING  
 FILE: 107425 Title.dgn

DRAWING SHEET  
 CONST



**PUBLIC UTILITIES**

The existing utilities listed below and shown on these plans represent the best information available as obtained on our surveys. This information does not relieve the contractor of the responsibility to be satisfied as to it's accuracy and the location of existing utilities.

<u>Name Of Owner</u>	<u>Type Of Utility</u>
<b>ESS SITE #1, CS 27021</b>	
City of Wakefield Attention: John Granato 311 Sunday Lake Street Wakefield, MI 49968 Phone: (906) 299-5132	Sewer, Electric
ATT Attention: Marsha Bertoldi 211 East B Street Iron Mountain, MI 49801 Phone: (906) 779-2744 Email: <a href="mailto:mb8983@att.com">mb8983@att.com</a>	Telephone
Xcel Energy Attention: Stacey Westeen 101 Alfred Wright Blvd. Ironwood, MI 49938 Phone: (906) 932-2848	Gas, Electric
<b>ESS SITE #2, CS 66032</b>	
Ontonagon County Telephone Company Attention: Fred Lundberg 618 River Street Ontonagon, MI 49953 Phone: (906) 884-9911	Telephone
Upper Peninsula Power Co. Attention: Mike Mickus 18494 E. Canal Road P.O. Box 130 Houghton, MI 49931 Phone: (906) 483-4543	Electric
<b>ESS SITE #3, CS 31021</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Midway Telephone Attention: Steve Rajala 11697 HWY M-28 Watton, Michigan 49970 Phone: (906) 355-2300	Telephone
Ontonagon County Rural Electrification Association Attention: Debbie Miles P. O. Box 97 Ontonagon, Michigan 49953 Phone: (906) 884-4151	Electric
<b>ESS SITE #4, CS 66041</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone

Ontonagon County Rural Electrification Association Attention: Debbie Miles P. O. Box 97 Ontonagon, Michigan 49953 Phone: (906) 884-4151	Electric
Ontonagon County Telephone Company Attention: Fred Lundberg 618 River Road Ontonagon, MI 49953 Phone: (906) 884-9911	Telephone
<b>ESS SITE #5, CS 31052</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
<b>ESS SITE #6, CS 31051</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a> Phone: (906) 475-0107 x1039	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
Baraga Telephone Company Attention: Paul Stark 204 State Street Baraga, Michigan 49908 Phone: (906) 353-6644	Telephone
<b>ESS SITE #9, CS 52011</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone

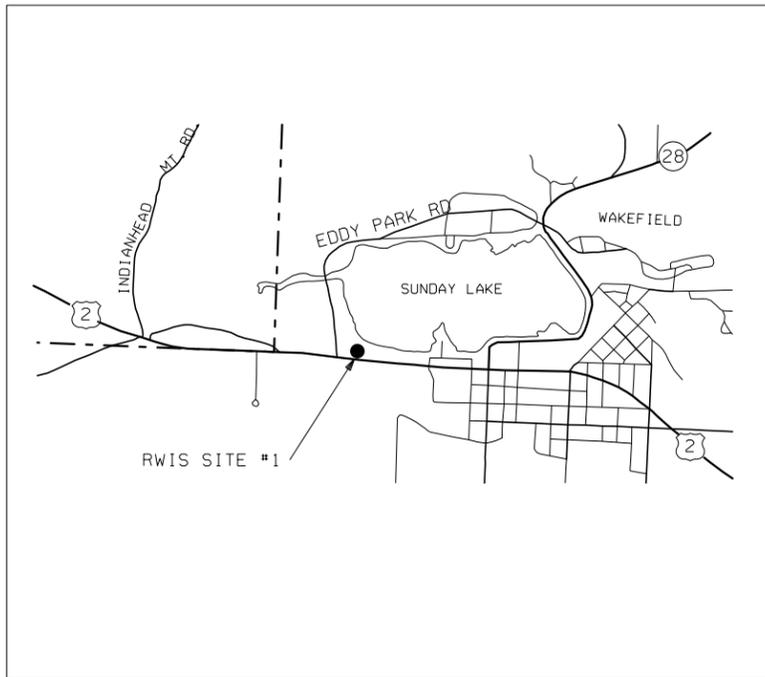
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
<b>ESS SITE #10, CS 52042</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Marquette Board of Light and Power Attention: Karl Benstrom 2200 Wright Street. Marquette, Michigan 49855 Phone: (906) 228-0320	Electric
Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a>	Gas
Negaunee Township Attention: Mike Adams 42 M-35 Negaunee, MI 49866 Phone: (906) 475-7869	Water
<b>ESS SITE #12, CS 55031</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric
ATT Attention: Marsha Bertoldi 211 East B Street Iron Mountain, MI 49801 Phone: (906) 779-2744 Email: <a href="mailto:mb8983@att.com">mb8983@att.com</a>	Telephone
<b>ESS SITE #14, CS 21025</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric

AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone
Charter Communications Attention: Scott Beaster 385 Woodward Avenue Kingsford ,MI 49802 Phone: (906) 630-7795 Email: <a href="mailto:scott.beaster@chartercom.com">scott.beaster@chartercom.com</a>	CATV
DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas
Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjousineau@upppo.com">mjousineau@upppo.com</a>	Electric
WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergies.com">bruce.clark@weenergies.com</a>	Electric
<b>ESS SITE #15, CS 21051</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric
American Transmission Company Attention: Matt Ernst 801 O'Keefe Road, P.O. Box 6113 DePere, WI 54115-4928 Phone: (920) 338-6573 Email: <a href="mailto:mernst@atcllc.com">mernst@atcllc.com</a>	Electric
AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone
Charter Communications Attention: Scott Beaster 385 Woodward Avenue Kingsford ,MI 49802 Phone: (906) 630-7795 Email: <a href="mailto:scott.beaster@chartercom.com">scott.beaster@chartercom.com</a>	CATV
DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas

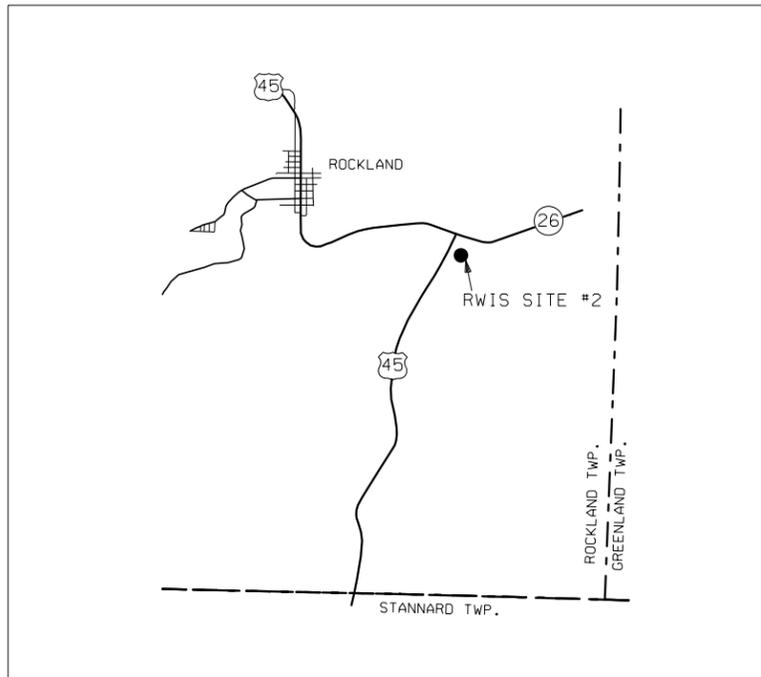
<p>Great Lakes Gas Transmission Attention: Kitty Martin 5250 Corporate Drive Troy, MI 48098 Phone: (248) 205-7596 Email: <a href="mailto:kitty_martin@transcanada.com">kitty_martin@transcanada.com</a></p> <p>TDS Telecom (Chatham Telephone) Attention: Bruce Kallio E3708 Marquette Street Chatham, MI 49816 Phone: (906) 439-5008 Email: <a href="mailto:bruce.kallio@tdstelecom.com">bruce.kallio@tdstelecom.com</a></p> <p>Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a></p> <p>WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergies.com">bruce.clark@weenergies.com</a></p> <p><b>ESS SITE #16, CS 52043</b></p> <p>Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a></p> <p>AT&amp;T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168</p> <p>Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a></p> <p>Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a></p> <p>Upper Peninsula Power Co. Attention: William Hereford P.O. Box 357 500 N. Washington Street Ishpeming, MI 49949-0357 Phone: (906) 485-2434</p> <p>TDS Telecom (Chatham Telephone) Attention: Dave Moore P.O. Box 197 Chatham, MI 49816 Phone: (906) 439-5008</p>	<p>Gas</p> <p>Telephone</p> <p>Electric</p> <p>Electric</p> <p>Electric</p> <p>Electric</p> <p>Telephone</p> <p>CATV</p> <p>Gas</p> <p>Electric</p> <p>Telephone</p>	<p><b>ESS SITE #17, CS 02021</b></p> <p>Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a></p> <p>Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a></p> <p>DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a></p> <p>Hiawatha Telephone Co. Attention: Richard Kirmo 108 W. Superior Street Munising, MI 49862 Phone: (906) 387-9911</p> <p>TDS Telecom (Chatham Telephone) Attention: Bruce Kallio E3708 Marquette Street Chatham, MI 49816 Phone: (906) 439-5008 Email: <a href="mailto:bruce.kallio@tdstelecom.com">bruce.kallio@tdstelecom.com</a></p> <p>Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a></p> <p><b>ESS SITE #21 and #22, CS 75022</b></p> <p>AT&amp;T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a></p> <p>CenturyLink Attention: Mike Bergeron 100 Second Street, P.O.Box 389 Pinconning ,MI 48650-0389 Phone: (989) 879-8798 Email: <a href="mailto:michael.bergeron@centurytel.com">michael.bergeron@centurytel.com</a></p> <p>Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a></p>	<p>Electric</p> <p>CATV</p> <p>Gas</p> <p>Telephone</p> <p>Telephone</p> <p>CATV</p>	<p>City of Manistique Attention: Nick Bosanic P.O. Box 515 Manistique, MI 49854 Phone: (906) 341-5346 Email: <a href="mailto:saldrich@chartermi.net">saldrich@chartermi.net</a> Cloverland Electric Cooperative</p> <p>Attention: James Tennyson 335 Chippewa Ave, P.O. Box 338 Manistique ,MI 49854 Phone: (906) 341-5426 Email: <a href="mailto:jtennyson@edisonsault.com">jtennyson@edisonsault.com</a></p> <p>Great Lakes Gas Transmission Attention: Kitty Martin 5250 Corporate Drive Troy, MI 48098 Phone: (248) 205-7596 Email: <a href="mailto:kitty_martin@transcanada.com">kitty_martin@transcanada.com</a></p> <p>Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a></p> <p>Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a></p> <p>Pentland Township Attention: Gary Fahler 13105 CR 400 Newberry, MI 49868 Ph. (906) 293-8755 Cell (906) 440-2581 Fax (906) 293-8894 Email: <a href="mailto:pentwp@up.net">pentwp@up.net</a></p> <p>Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a></p> <p><b>ESS SITE #26, CS 17063</b></p> <p>AT&amp;T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a></p> <p>Charter Communications Attention: John Randazzo 2682 Ashmun Street Sault Ste. Marie, MI 49783 Ph. (906) 635-3102 Fax (906) 635-1520 Email: <a href="mailto:jrandazzo@chartercom.com">jrandazzo@chartercom.com</a></p>	<p>Water</p> <p>Electric</p> <p>Gas</p> <p>Gas</p> <p>Electric</p> <p>Water &amp; Sewer</p> <p>Gas</p> <p>Telephone</p> <p>Cable</p>	<p>Cloverland Electric Cooperative Attention: Johanna Wiltfong 2916 West M-28 Dafer, MI 49724 Ph. (906) 632-5191 Fax (906) 635-6815 Email: <a href="mailto:jwiltfong@cloverland.com">jwiltfong@cloverland.com</a></p> <p>Chippewa County Telephone Co. Attention: Ron Deneve, Jr P.O. Box 155 Brimley, MI 49715 Ph. (906) 248-3211 Fax (906) 248-6815 Email: <a href="mailto:rdeneve@jamadots.net">rdeneve@jamadots.net</a></p>	<p>Electric</p> <p>Telephone</p>
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<p>REVISIONS</p> <table border="1"> <thead> <tr> <th>NO.</th> <th>DATE</th> <th>AUTH</th> <th>DESCRIPTION</th> <th>NO.</th> <th>DATE</th> <th>AUTH</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td> </td> </tr> </tbody> </table>								NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION									<p>Insert Logo</p> 	<p>NO SCALE</p>	<p>DATE 4/4/12</p> <p>DESIGN UNIT: Gustafson</p> <p>TSC: ISHPEMING</p>	<p>CS: 84911</p> <p>JN: 107425A</p>	<p>PROJECT INFORMATION SHEET</p>	<p>DRAWING</p> <p>PROJ</p>	<p>SHEET</p> <p>CONST</p>
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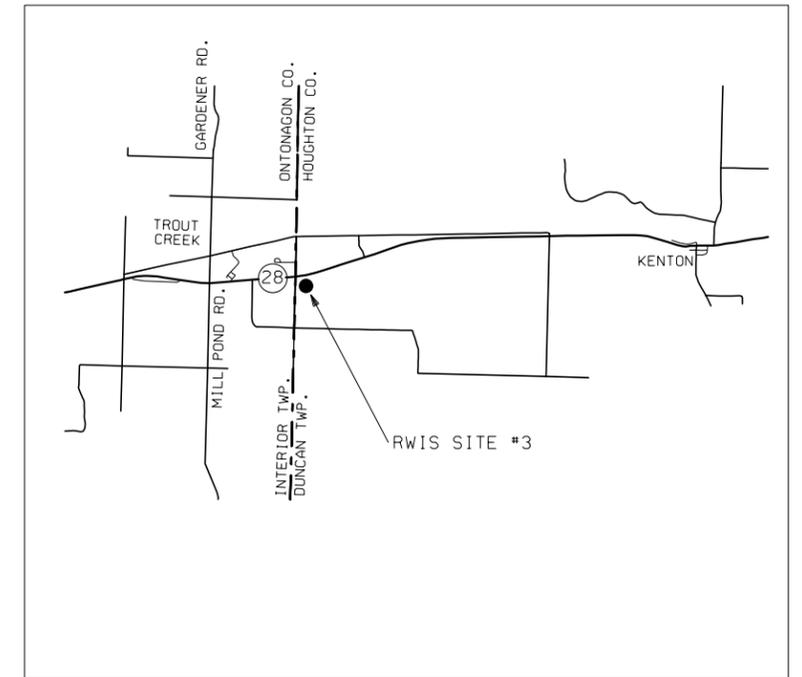
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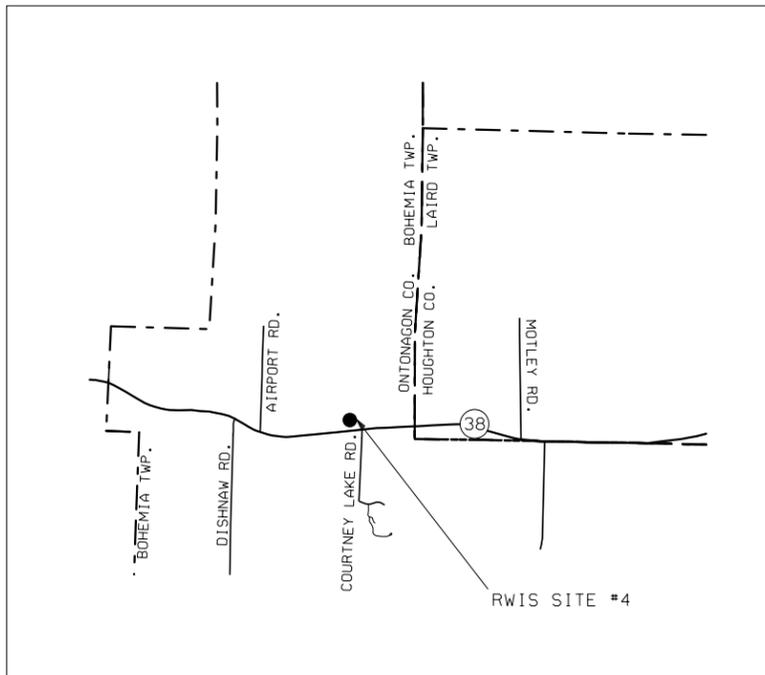
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GOGEBIC COUNTY  
CS 27021, CS MP 12.030



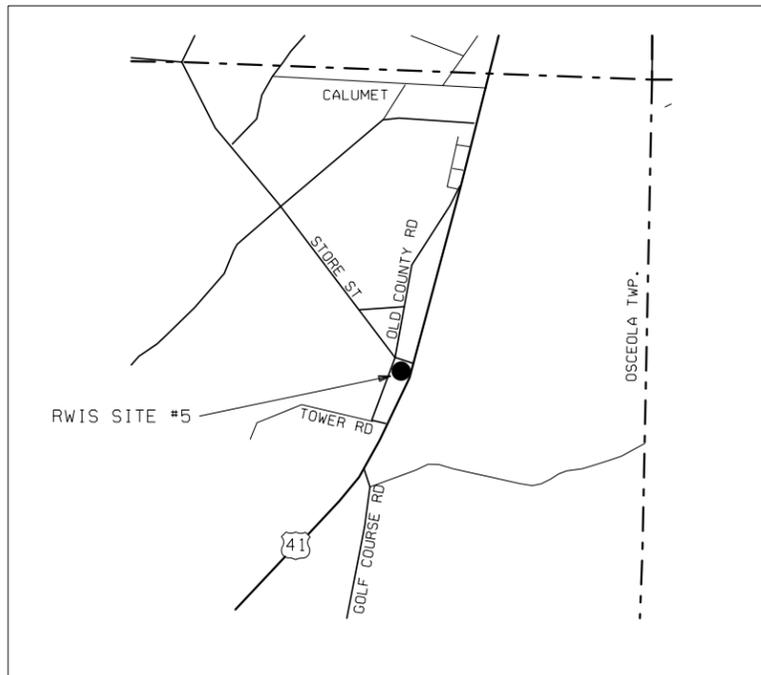
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ONTONAGON COUNTY  
CS 66032, CS MP 13.427



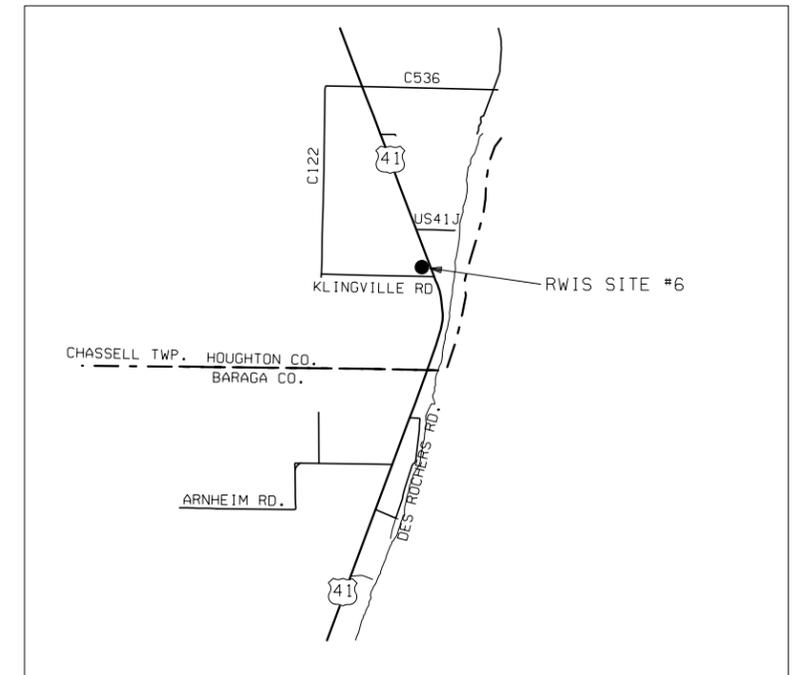
RWIS SITE #3: M-28 AT THE HOUGHTON/ONTONAGON CO. LINE  
HOUGHTON COUNTY  
CS 31021, CS MP 0.042



RWIS SITE #4: M-38 AT THE HOUGHTON/ONTONAGON CO. LINE  
ONTONAGON COUNTY  
CS 66041, CS MP 5.306



RWIS SITE #5: US-41 AT STORE ST.  
HOUGHTON COUNTY  
CS 31052, CS MP 10.795



RWIS SITE #6: US-41 AT KLINGVILLE RD.  
HOUGHTON COUNTY  
CS 31051, CS MP 1.022

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



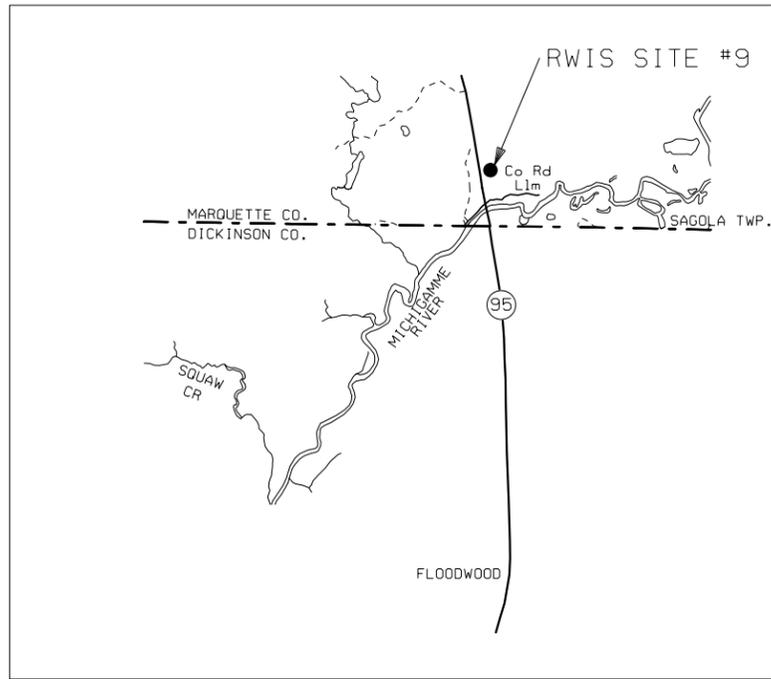
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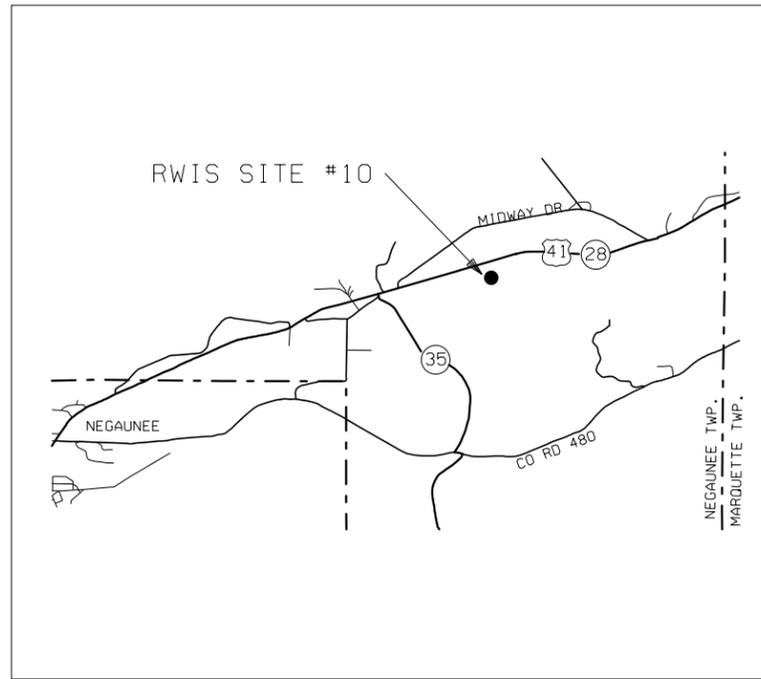
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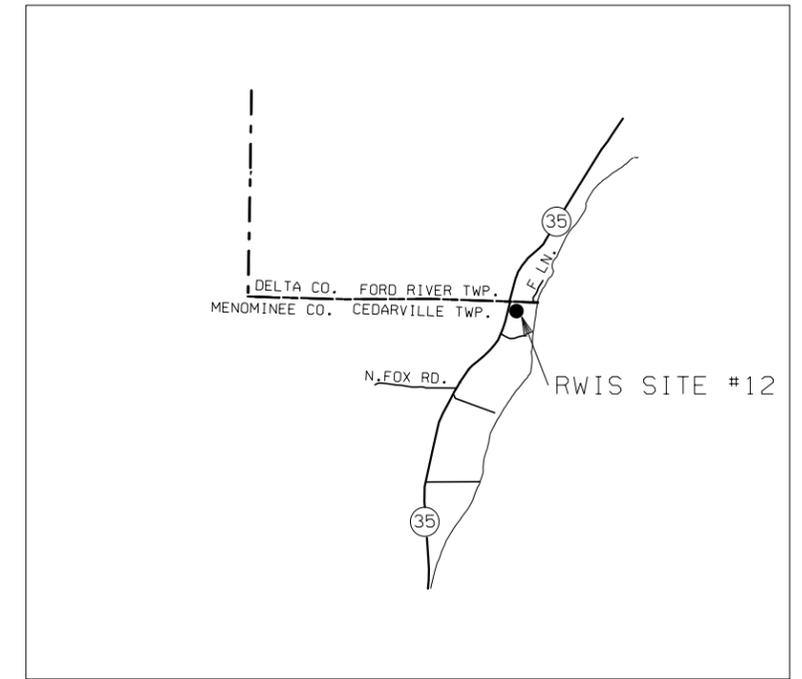
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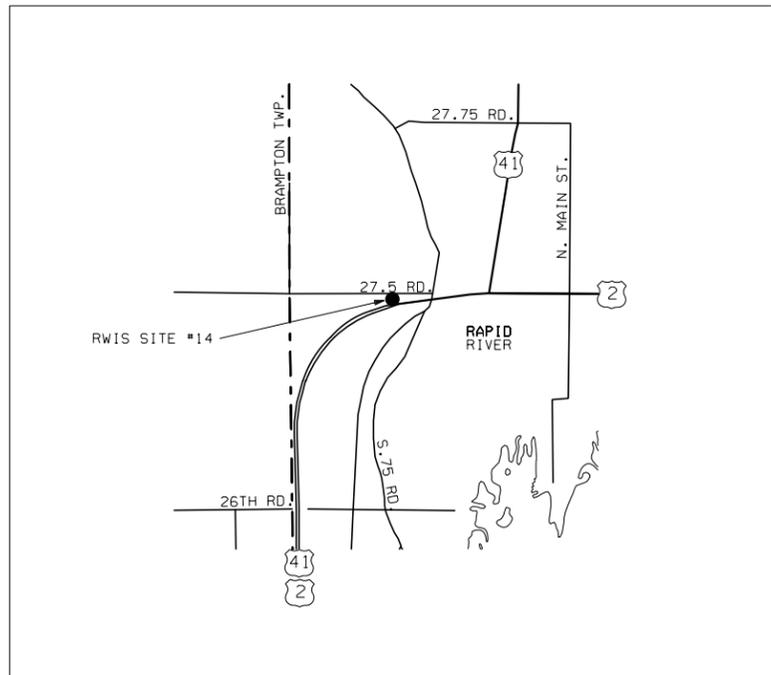
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MARQUETTE COUNTY  
CS 52011, CS MP 0.221



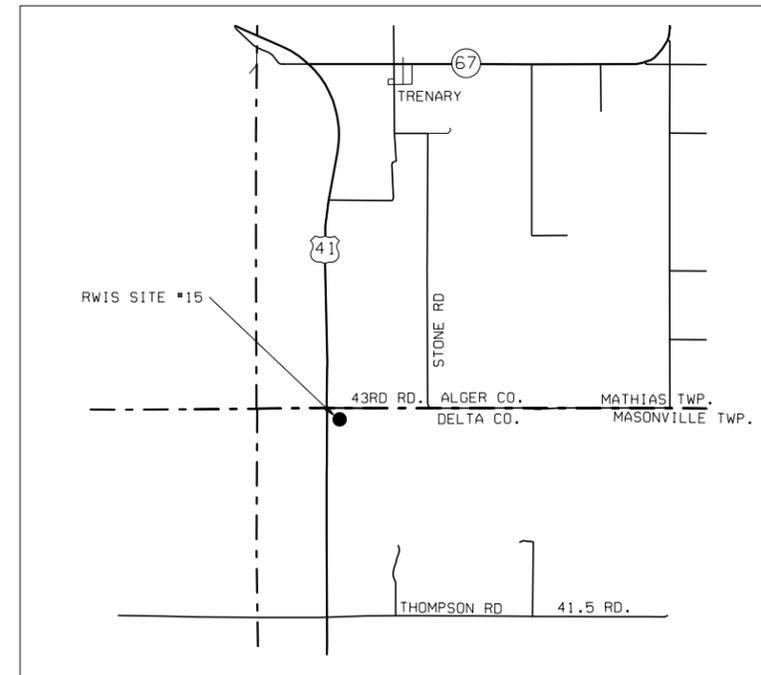
RWIS SITE #10: US-41 NEAR M-35  
MARQUETTE COUNTY  
CS 52042, CS MP 11.184



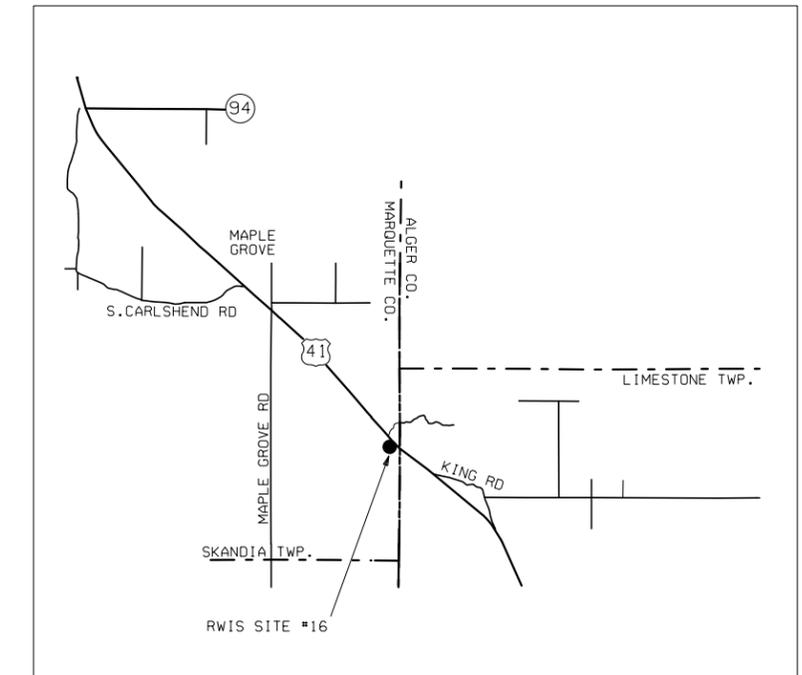
RWIS SITE #12: M-35 AT MENOMINEE/DELTA CO. LINE  
MENOMINEE COUNTY  
CS 55031, CS MP 34.575



RWIS SITE #14: US-2 IN RAPID RIVER  
DELTA COUNTY  
CS 21025, CS MP 5.80



RWIS SITE #15: US-41 AT DELTA/ALGER CO LINE  
DELTA COUNTY  
CS 21051, CS MP 16.170



RWIS SITE #16: US-41 AT MARQUETTE/ALGER CO LINE  
MARQUETTE COUNTY  
CS 52043, CS MP 0.100

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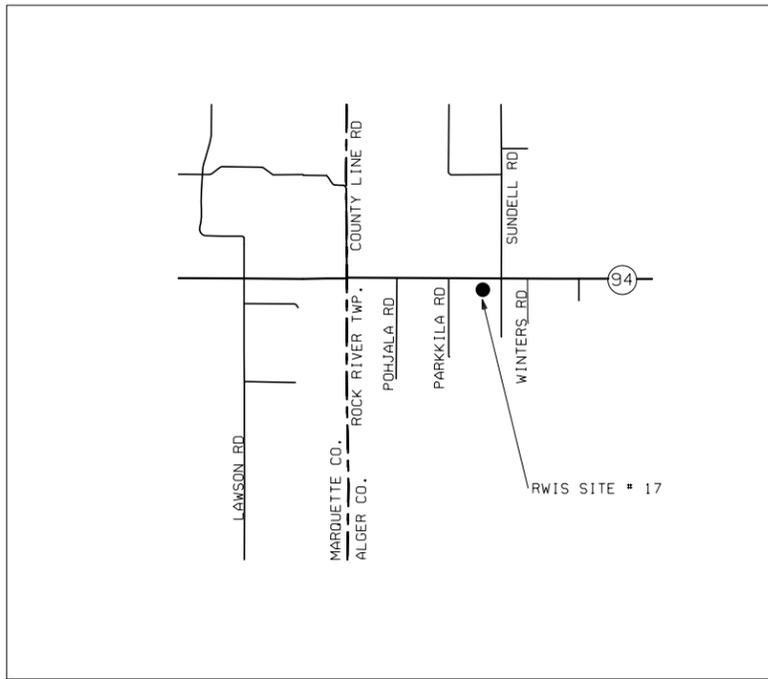
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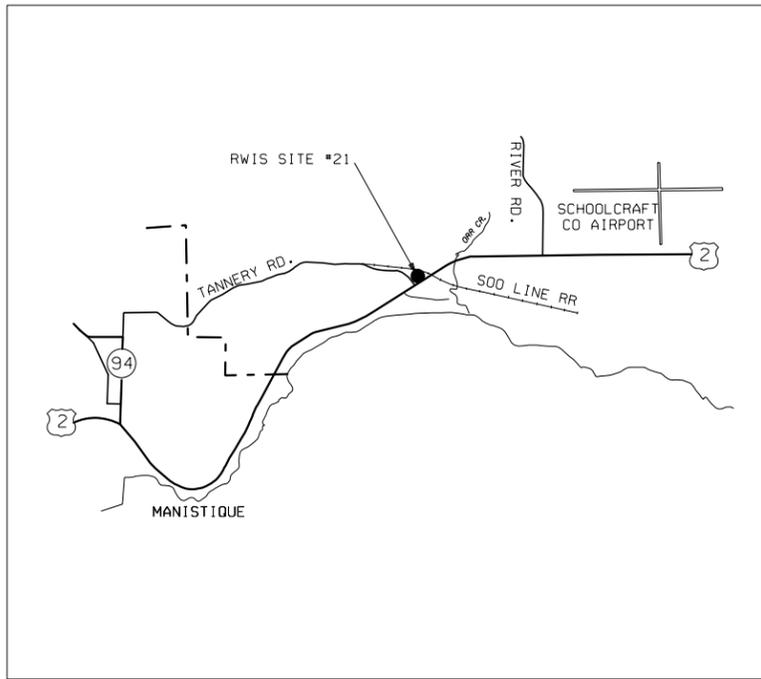
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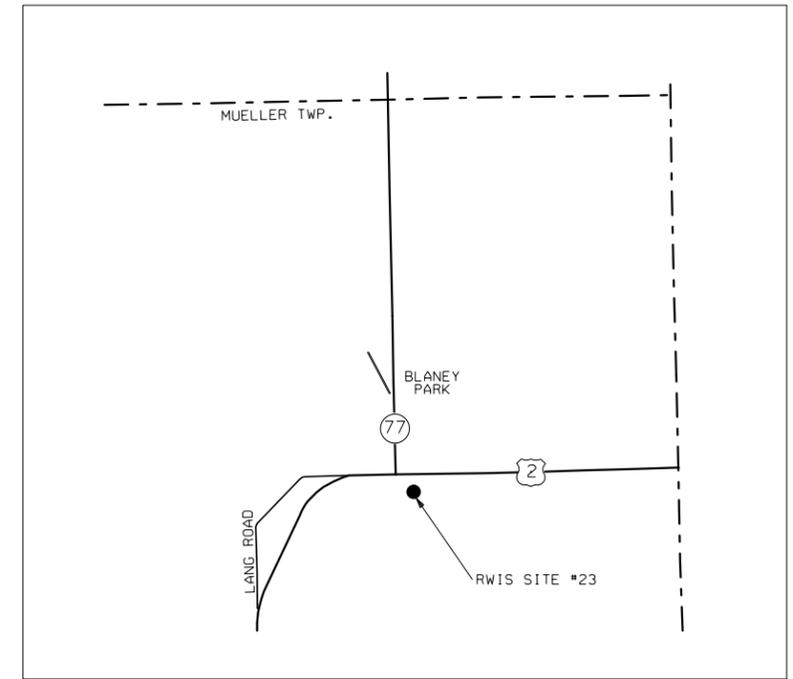
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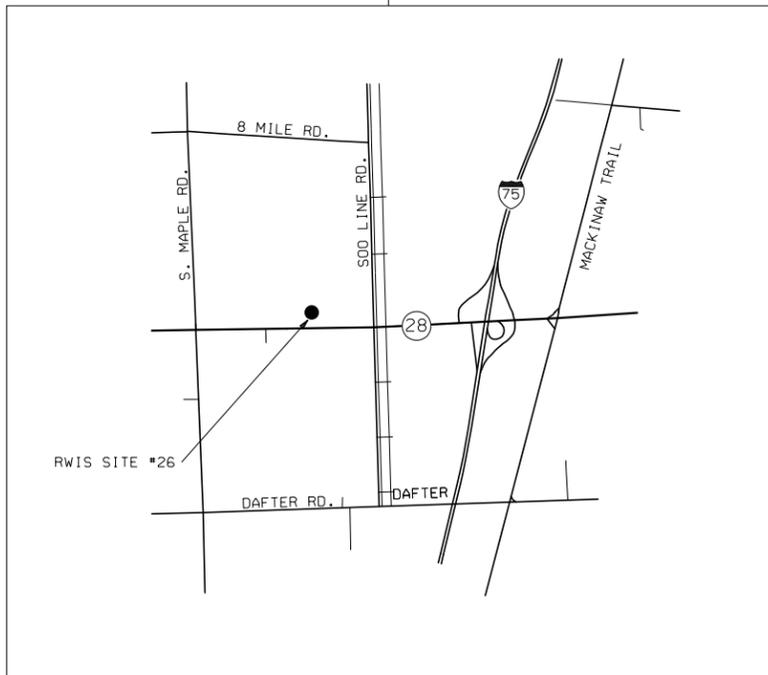
RWIS SITE #17: M-94 IN RUMLEY/SUNDELL  
ALGER COUNTY  
CS 02021, CS MP 0.100



RWIS SITE #21: US-2 EAST OF MANISTIQUE  
SCHOOLCRAFT COUNTY  
CS 75022, CS MP 4.095

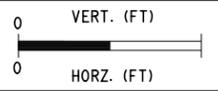


RWIS SITE #22: US-2 AT M-77  
SCHOOLCRAFT COUNTY  
CS 75022, CS MP 22.920



RWIS SITE #26: M-28 WEST OF SOO LINE RD.  
CHIPPEWA COUNTY  
CS 17063, CS MP 6.581

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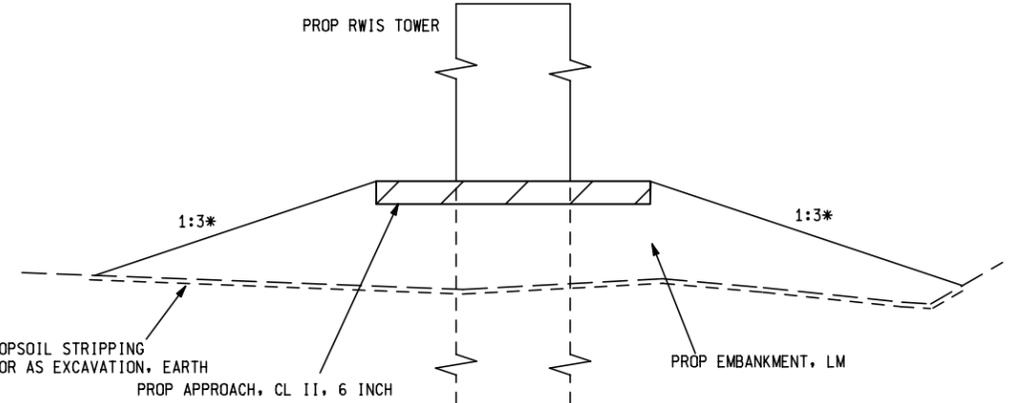
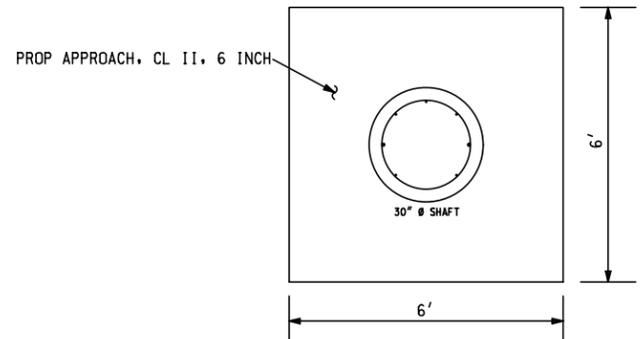
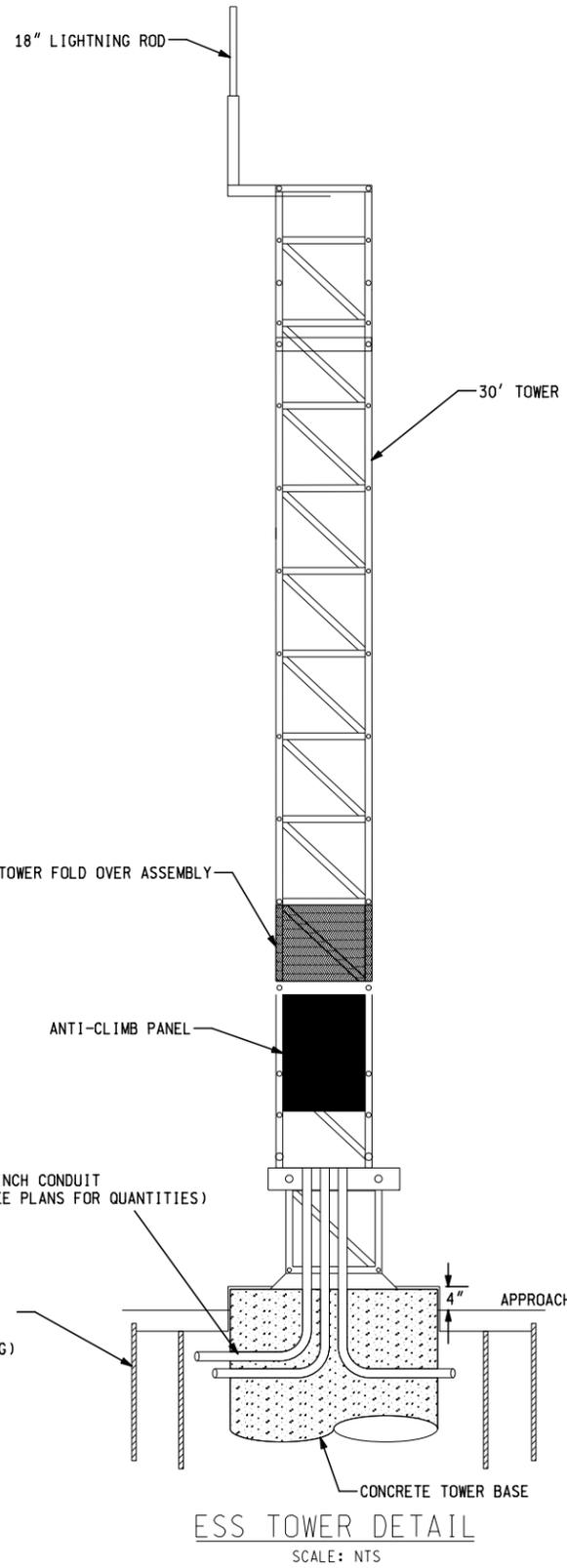
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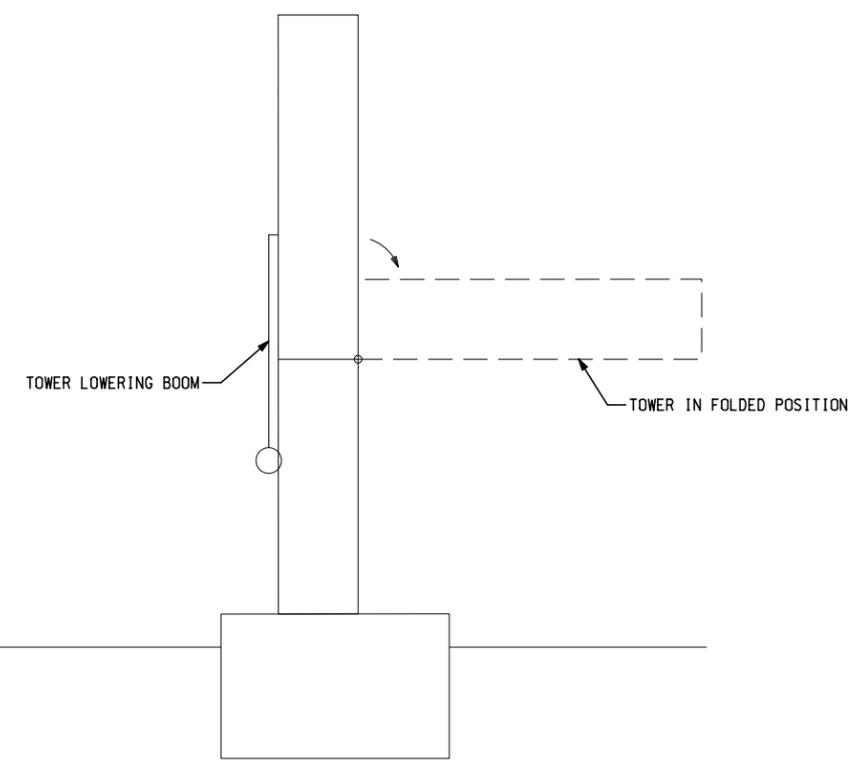
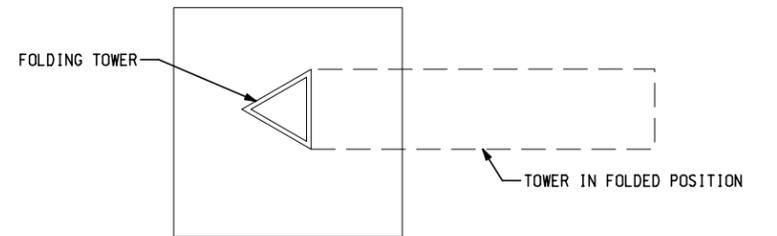
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VICINITY MAP

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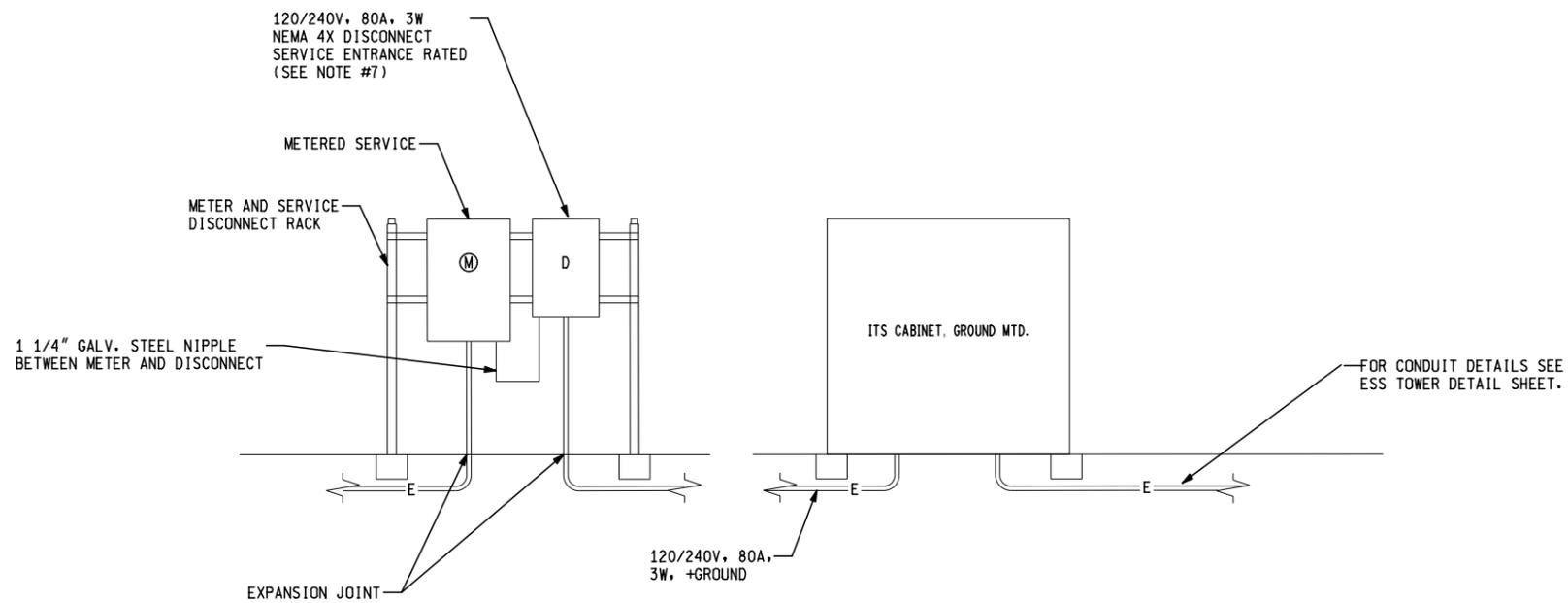
\*1:3 OUTSIDE THE CLEAR ZONE OR AS SHOWN ON THE PLANSHEET.



NOTES:

1. LIGHTNING ROD MUST BE MOUNTED TO PROTECT ESS EQUIPMENT AS DETAILED IN THE SPECIAL PROVISION FOR GROUNDING AND BONDING ITS.
2. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
3. ALL HARDWARE SHALL BE STAINLESS STEEL.
4. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.

AS-LET PLAN REVISIONS								MDOT Michigan Department of Transportation	NO SCALE	DATE: 4/4/12	CS: 84911	TYPICAL ESS TOWER DETAIL SHEET		DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION			DESIGN UNIT:	JN: 107425A	MISCELLANEOUS DETAILS			
								FILE: MISC TOWER DETAIL	TSC: ISHPEMING						8

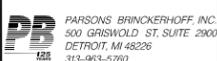


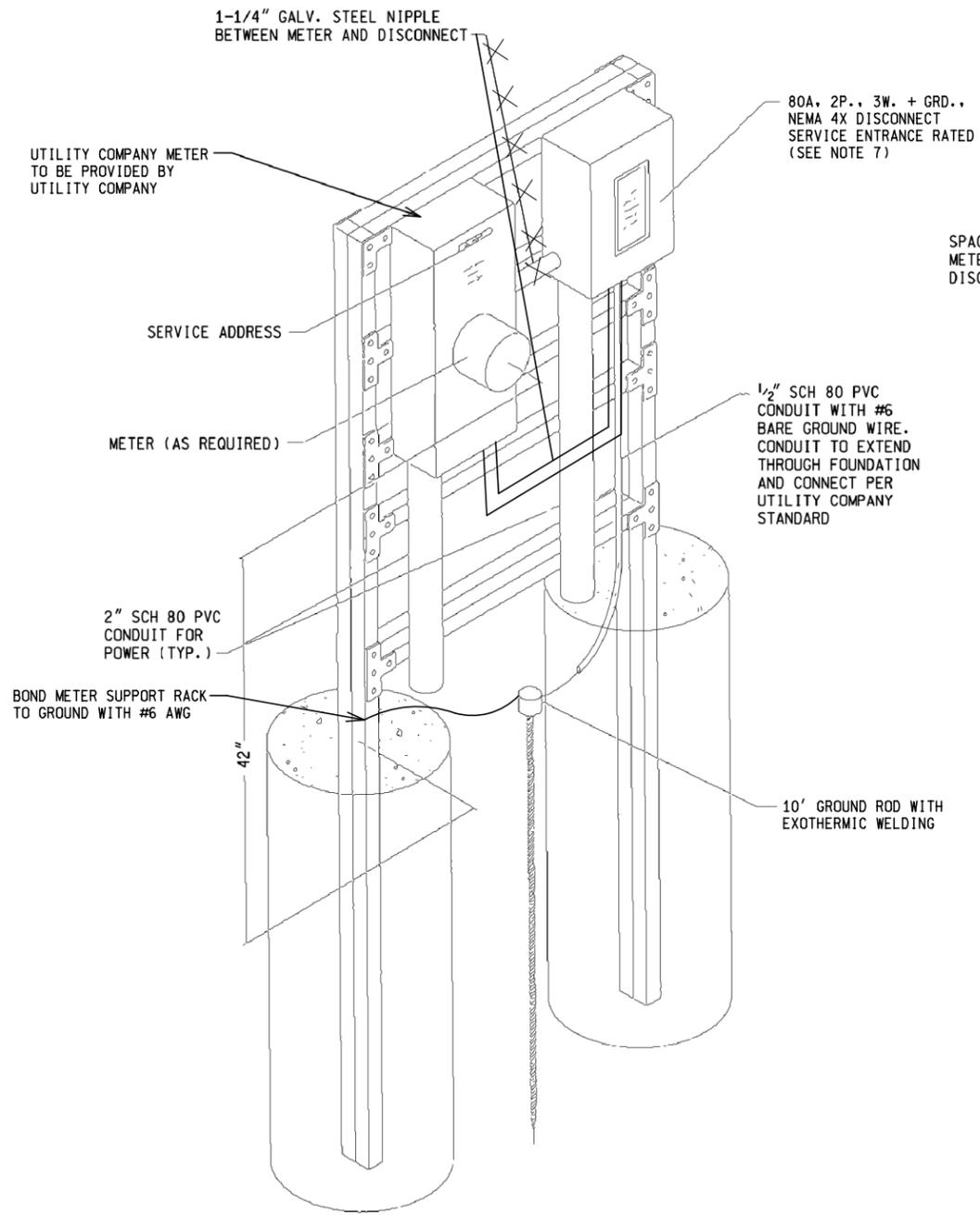
TYPICAL ESS 120/240 V. ONE-LINE DIAGRAM

SCALE: NTS

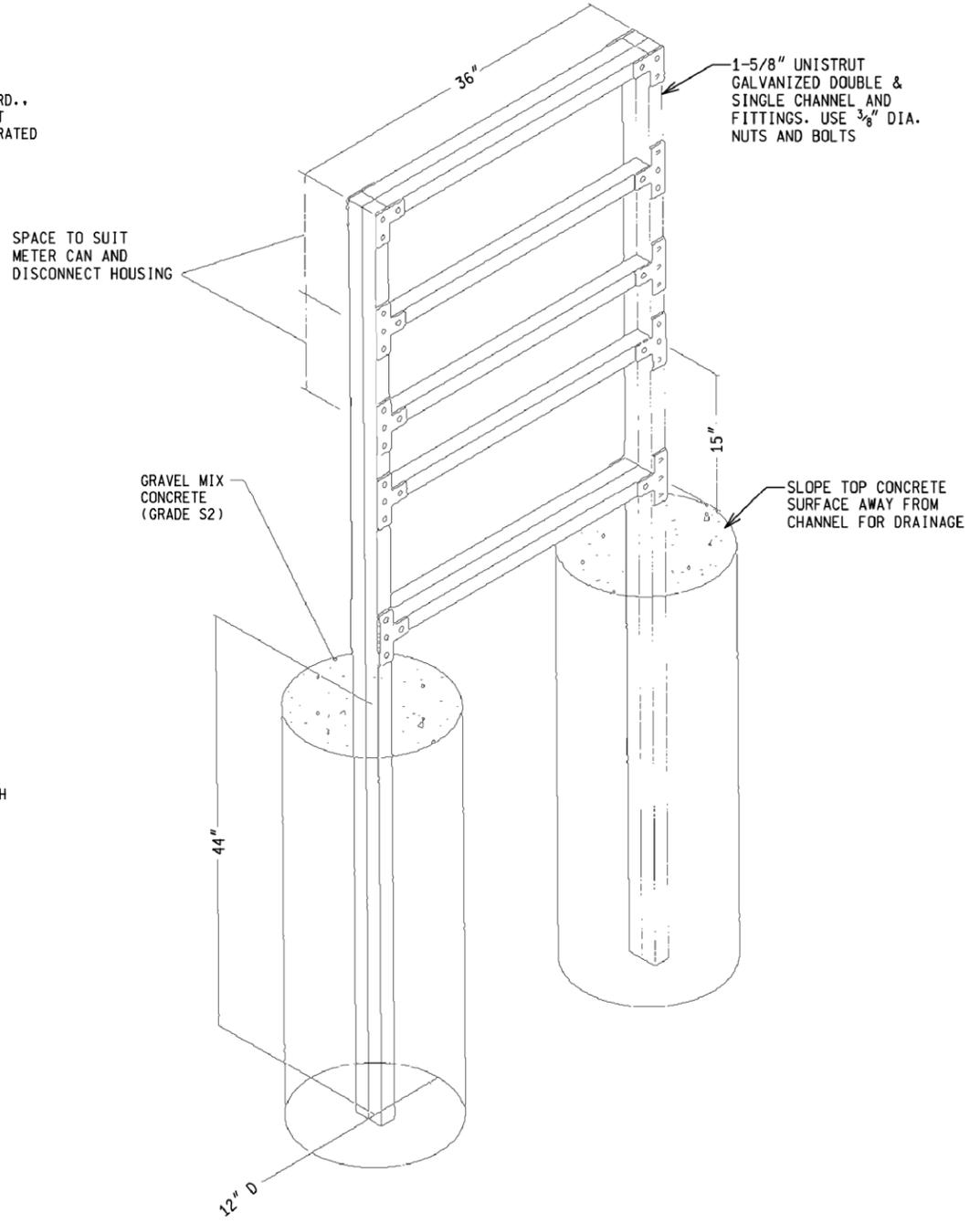
NOTES:

1. POSITION OF THE METER AND DISCONNECT SHALL BE INTERCHANGED WHERE REQUIRED AS APPROVED BY THE ENGINEER.
2. METER TO FACE AS SPECIFIED BY THE UTILITY COMPANY.
3. UTILITY COMPANY TO INSTALL CABLE FROM EXISTING UTILITY POLE TO METER RACK. ALL WORK SHALL BE PAID FOR UNDER THE POWER CO. (EST. COST TO CONTRACTOR) PAY ITEM.
4. ALL SERVICE DISCONNECTS SHALL BE LABELED IN ACCORDANCE WITH NEC 702.8 TO PROVIDE PROPER NOTIFICATION TO MAINTENANCE PERSONNEL THAT A STANDBY POWER SYSTEM (UPS) IS BEING USED.

AS-LET PLAN REVISIONS								 <small>PARSONS BRINCKERHOFF, INC. 500 GRISWOLD ST. SUITE 2900 DETROIT, MI 48226 313-963-5760</small>	 <small>Michigan Department of Transportation</small>	NO SCALE	DATE: 4/4/12	CS: 84911	TYPICAL ESS POWER DETAIL SHEET 1	
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				FILE: \$FILESS	DESIGN UNIT: GUSTAFSON	JN: 107425A	DRAWING
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											MISCELLANEOUS DETAILS			



GENERAL ARRANGEMENT



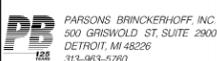
GENERAL PLAN

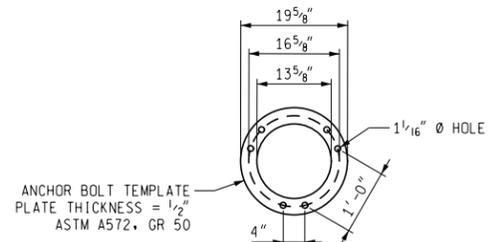
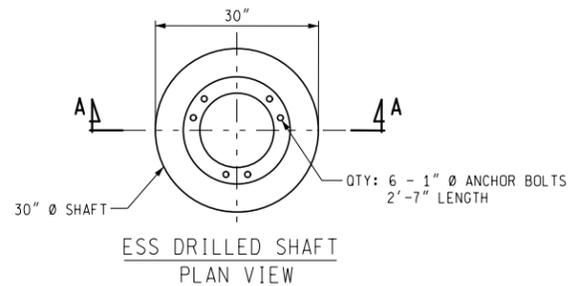
TYPICAL METER & SERVICE DISCONNECT RACK

SCALE: NTS

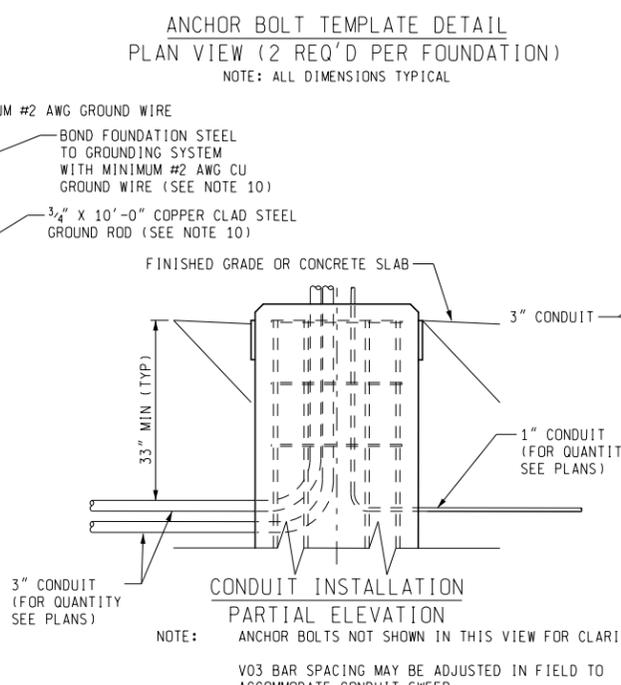
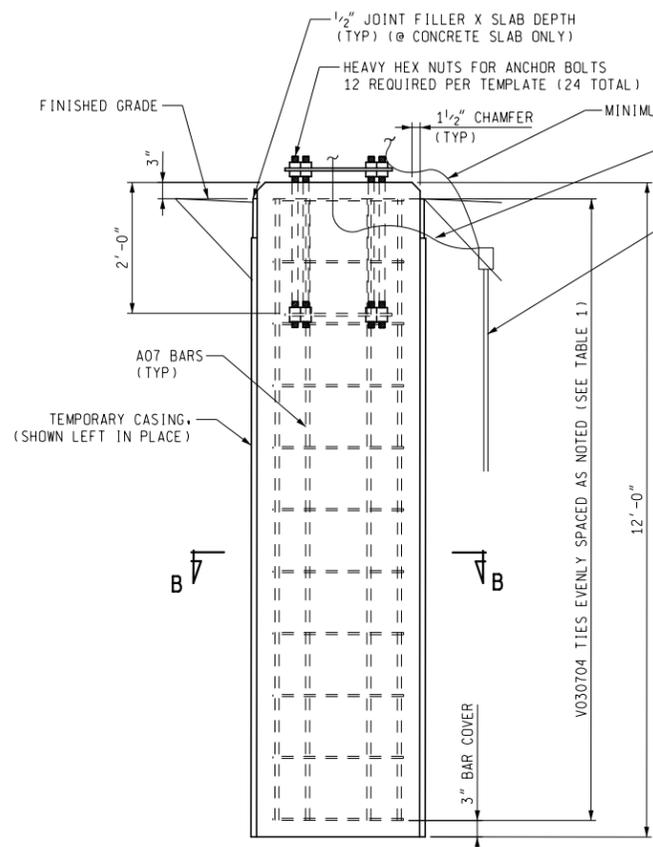
NOTES:

1. ALL LOCATIONS SHALL CONFORM TO NEC AND UTILITY COMPANY REQUIREMENTS.
2. POSITION OF THE METER AND DISCONNECT SHALL BE INTERCHANGED WHERE REQUIRED AS APPROVED BY THE MDT ENGINEER.
3. METER TO FACE AS SPECIFIED BY THE UTILITY COMPANY.
4. ALL SERVICE DISCONNECTS SHALL BE LABELED IN ACCORDANCE WITH NEC 702.8 TO PROVIDE PROPER NOTIFICATION TO MAINTENANCE PERSONNEL THAT A STANDBY POWER SYSTEM (UPS) IS BEING USED.
5. SITE #26-DISCONNECT IS TO BE INSTALLED ON THE BACK SIDE OF EXISTING SERVICE WITH METER AND DISCONNECT. NEW DISCONNECT PANEL IS TO BE CONNECTED TO EXISTING METER AS NOTED ABOVE. WORK WILL BE PAID FOR AS: METERED SERV

AS-LET PLAN REVISIONS								 <small>PARSONS BRINCKERHOFF, INC. 500 GRISWOLD ST. SUITE 2900 DETROIT, MI 48226 313-963-5760</small>	 <small>MDOT Michigan Department of Transportation</small>	NO SCALE	DATE: 4/4/12	CS: 84911	TYPICAL ESS POWER DETAIL SHEET 2	DRAWING	SHEET
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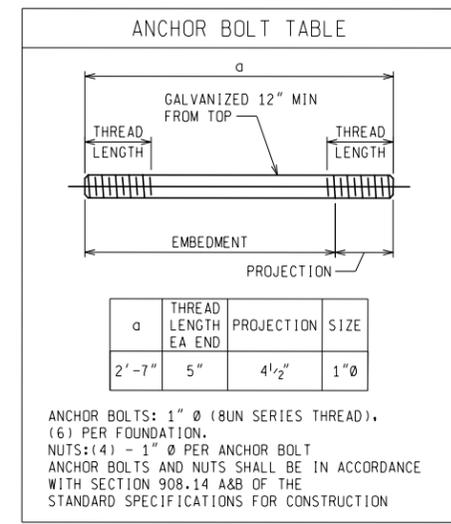


ANCHOR BOLT TEMPLATE DETAIL  
PLAN VIEW (2 REQ'D PER FOUNDATION)  
NOTE: ALL DIMENSIONS TYPICAL



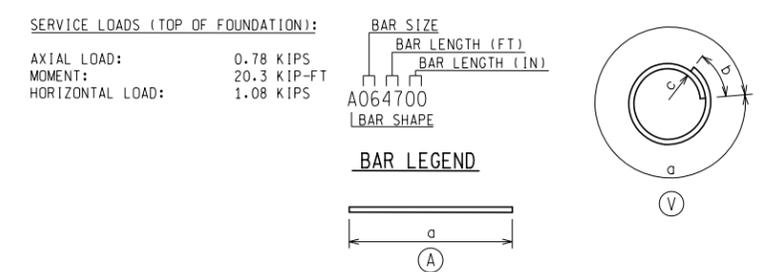
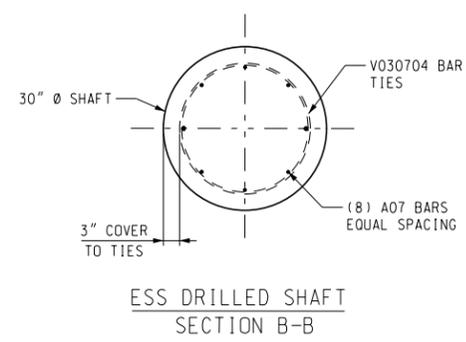
NOTE: REINFORCEMENT STEEL NOT SHOWN FOR CLARITY  
CONDUIT INSTALLATION PLAN

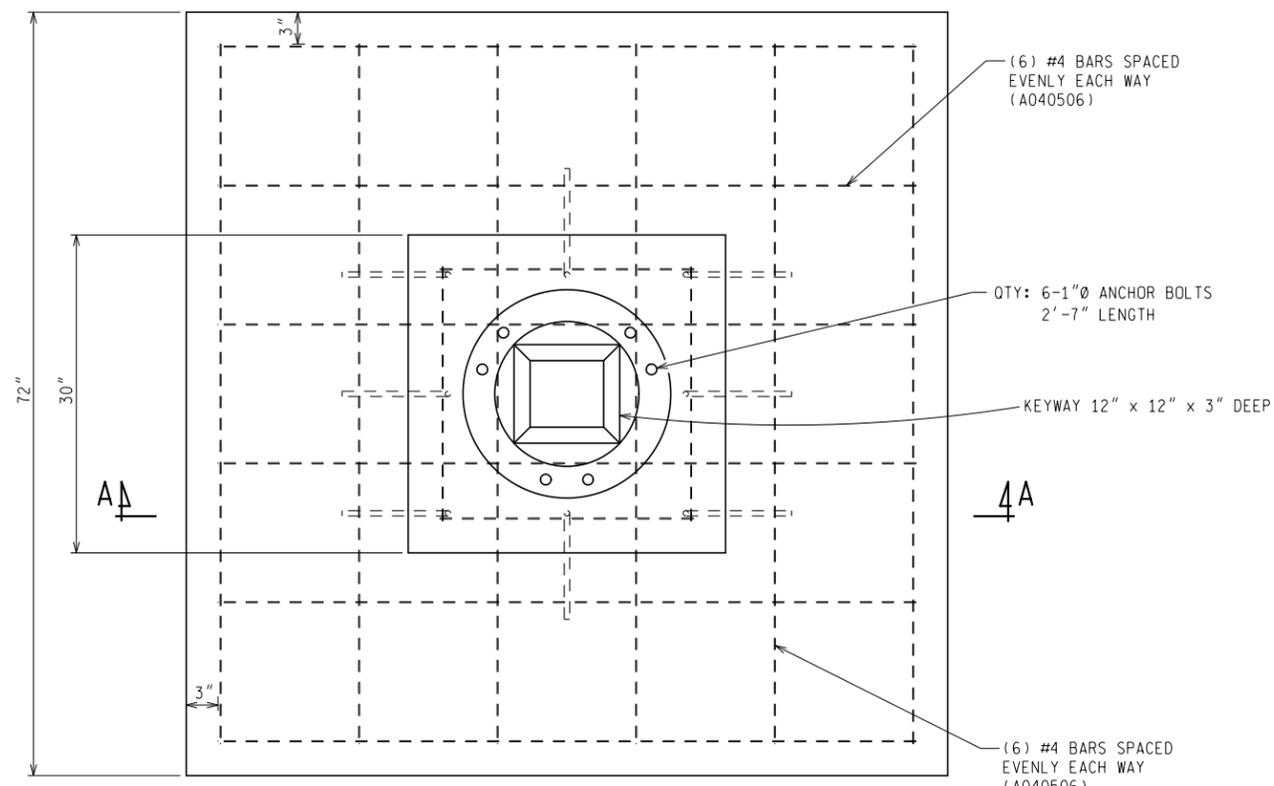
STEEL REINFORCEMENT BAR SCHEDULE							
BAR	a	b	c	SIZE	LENGTH	NO.	TOTAL WT.
A071106	11'-6"			7	11'-6"	8	188
V030704	6'-3 1/2"	1'-0 1/2"	11 5/8"	3	7'-4"	13	36
REINFORCEMENT WEIGHT PER FOUNDATION [Lb]							224
TOTAL WT. [Lb]							



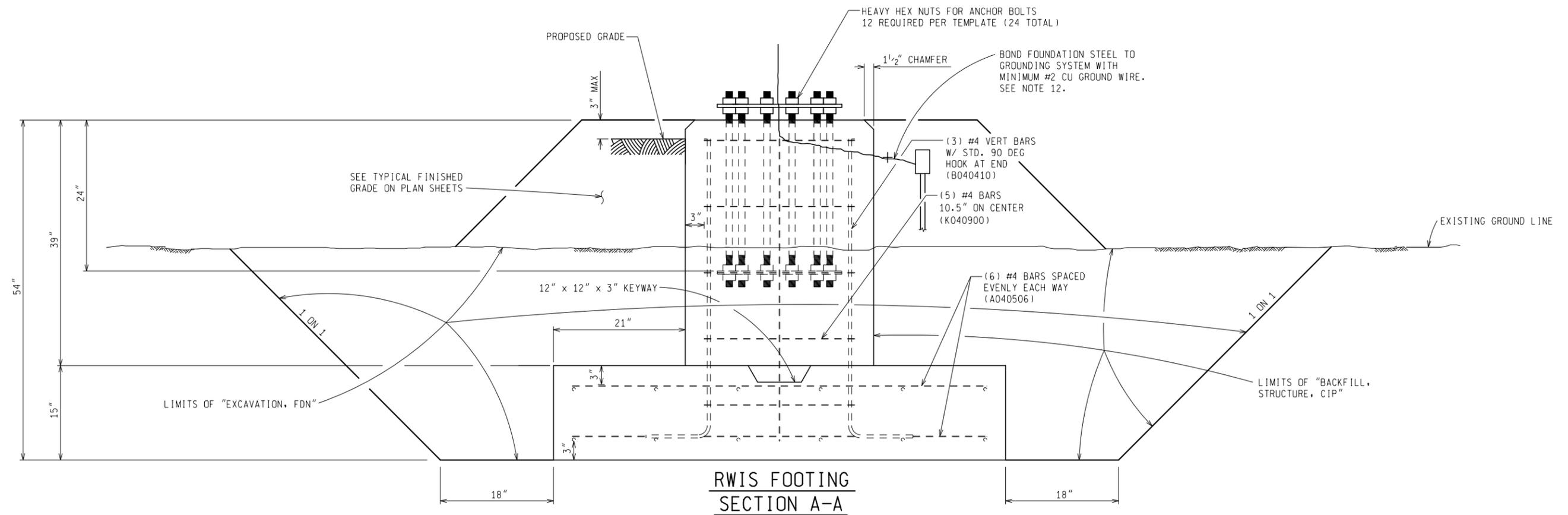
- REINFORCEMENT BAR & ANCHOR BOLT NOTES:
- REINFORCEMENT BARS FOR FOUNDATION SHALL BE GRADE 60 DEFORMED BARS AS SPECIFIED IN SECTION 905.03 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - CONTRACTOR SHALL VERIFY ANCHOR BOLT PATTERN PRIOR TO FABRICATION OF ANCHOR BOLTS AND TEMPLATES.
  - ANCHOR BOLTS ARE TO BE VERTICAL & POSITIONED AS SHOWN IN PLAN.
  - TEMPLATE PLATES & ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED, ASSEMBLED, AND APPROVED BY MDOT PRIOR TO SHIPPING.
  - DIAMETER OF BOLT HOLES IN TEMPLATES SHALL BE 1/16" LARGER THAN ANCHOR BOLT DIAMETER.
  - INSTALLATION SHALL BE ACCORDING TO SUBSECTION 810.03N OF THE STANDARD SPECIFICATIONS.
  - THE TEMPLATES SHALL BE WELL SUPPORTED, HORIZONTALLY LEVEL & FIRMLY ANCHORED IN PLACE FOR A MINIMUM OF 24 HOURS AFTER THE CONCRETE PLACEMENT IS COMPLETED.
  - DUE CARE SHALL BE TAKEN DURING THE CONCRETE PLACEMENT TO AVOID DISPLACING THE ANCHOR BOLTS.
  - NO HAMMERING ON OR CUTTING OF THE ANCHOR BOLTS OR TEMPLATES WILL BE ALLOWED. NO CHISELING OR DAMAGING OF GALVANIZED FINISH WILL BE PERMITTED.
  - AFTER TOP TEMPLATE IS REMOVED, THREAD NUTS ON TO THE BOLT FLUSH WITH THE BOLT END TO PROTECT THREADS UNTIL FRAME IS ERECTED.

- NOTES:
- ALL MATERIALS & CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - CONTRACTOR MUST TAKE APPROPRIATE PRECAUTIONS TO PREVENT DAMAGING EXISTING STRUCTURES AND UTILITIES. ANY DAMAGE TO EXISTING STRUCTURES OR UTILITIES MUST BE REPAIRED AT THE CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE ENGINEER, INCLUDING ENGINEERING ANALYSIS AND REDESIGN, AND WITHOUT ANY EXTENSION OF THE COMPLETION DATES FOR THE PROJECT.
  - ALL DISTURBED AREAS SHALL BE RESTORED IN ACCORDANCE WITH THE SPECIAL PROVISION FOR, "Slope Restoration, Non-Freeway". CONTRACTOR IS TO MINIMIZE THE AREAS OF DISTURBANCE AS MUCH AS IT IS PRACTICAL.
  - CONCRETE MUST BE PROTECTED FROM FLOWING WATER AND DAMAGE FROM MECHANICAL EQUIPMENT AND NEARBY CONSTRUCTION VIBRATIONS. VIBRATIONS FROM CONSTRUCTION OPERATIONS (VIBRATORY CASING INSTALLATIONS, CONCRETE DEMOLITION, ETC.) WILL NOT BE PERMITTED WITHIN A RADIUS OF 25 FEET UNTIL THE CONCRETE HAS ATTAINED 75 PERCENT OF ITS SPECIFIED MINIMUM STRENGTH.
  - CONCRETE MUST BE PROTECTED FROM STRENGTH REDUCTION CAUSED BY HEAT, FROST OR FREEZING ACTIONS PER SECTION 706.03 OF THE STANDARD SPECIFICATIONS.
  - FINAL CONDUIT LOCATIONS AND HARDWARE INSTALLATION CONFIGURATION PLANS, INCLUDING WIRING CIRCUIT SCHEMATICS, TO BE SUBMITTED IN CONTRACTOR'S DRILLED SHAFT INSTALLATION PLANS FOR APPROVAL BY THE ENGINEER.
  - CONDUIT MUST BE AS SPECIFIED IN SECTION 819 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - SEE PLANS FOR TOP OF SHAFT ELEVATION. IN ORDER FOR CONDUIT TO ENTER FOUNDATION, CONTRACTOR MAY CUT HOLES IN THE STEEL CASING OR STEEL CASING MAY STOP AT THE CONDUIT ENTRANCE TO FOUNDATION. CUT HOLES MUST BE LOCATED, CUT AND FINISHED SO AS NOT TO DAMAGE CONDUIT. TOP OF FOUNDATION MUST BE FORMED SEPARATELY IF THE STEEL CASING STOPS AT THE CONDUIT ENTRANCE TO THE FOUNDATION. THE COST OF ALL LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO CUT HOLES IN THE STEEL CASING OR FORM, POUR, FINISH AND CURE THE PORTION OF THE FOUNDATION ABOVE THE CASING SHALL BE INCLUDED IN THE BID ITEM "Drilled Shaft, 30 inch". AT CONTRACTOR'S OPTION, THE CASING MAY STOP 1'-0" BELOW FINISHED GRADE ELEVATIONS.
  - COBBLES, BOULDERS OR RIPRAP MUST NOT BE CLASSIFIED AS OBSTRUCTIONS.
  - ALL GROUNDING WORK INCLUDING MATERIALS AND LABOR SHALL BE PAID FOR IN ACCORDANCE WITH THE SPECIAL PROVISION FOR "Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment".





**RWIS FOOTING  
PLAN VIEW**



**RWIS FOOTING  
SECTION A-A**

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

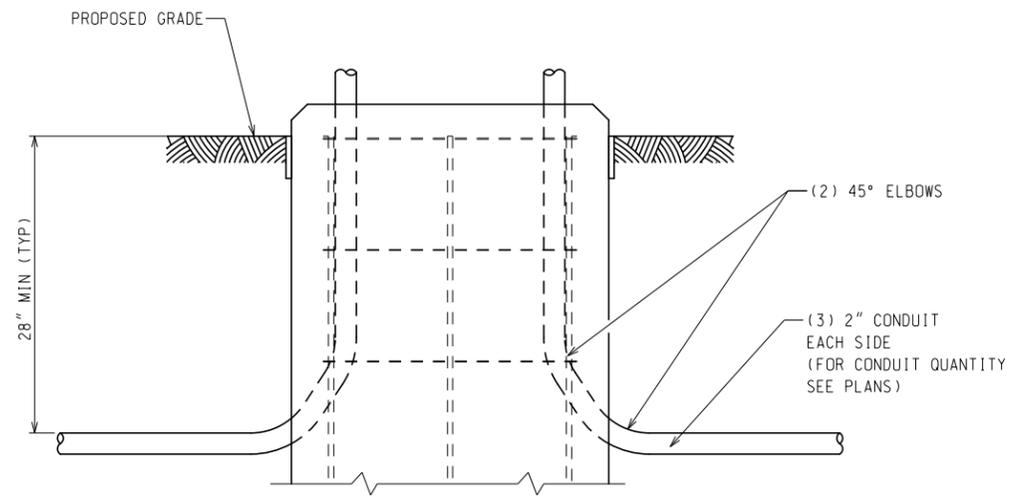
DRAWN BY: BEKMANIS  
CHK'D BY: GROTENHUIS CORR BY: AMB  
FILE: 849111 spreadftg 001.dgn

DATE: 04-02-12  
DESIGN UNIT: GARCIA  
TSC: ISHPERING

CS: 84911  
JN: 107425A

SPREAD FOOTING DETAILS

DRAWING SHEET  
SPREAD FTG 001  
12



**CONDUIT INSTALLATION  
PARTIAL ELEVATION**

\* NOTE: ANCHOR BOLTS NOT SHOWN FOR CLARITY

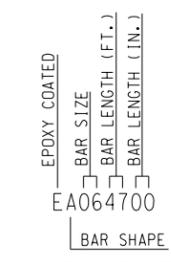
**ANCHOR BOLT TABLE**

a	THREAD LENGTH EA END	PROJECTION	SIZE
27"	5"	4 1/2"	1"Ø

ANCHOR BOLTS: 1"Ø (8UN SERIES THREAD), (6) PER FOUNDATION.  
 NUTS: (4) - 1"Ø PER ANCHOR BOLT  
 ANCHOR BOLTS AND NUTS SHALL BE IN ACCORDANCE WITH SECTION 908.15 A&B OF THE MDOT "STANDARD SPECIFICATIONS FOR CONSTRUCTION"

- NOTES :**
- ALL MATERIALS & CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - FOUNDATION CONCRETE SHALL BE GRADE S2.
  - TOP OF FOUNDATION SHALL BE 3" ABOVE FINISHED GRADE.
  - FOUNDATION SHALL RECEIVE RUBBED SURFACE FINISH FROM TOP OF FOUNDATION TO 6" BELOW GRADE.
  - SUBSURFACE INFORMATION CAN BE OBTAINED FROM THE SOIL BORING DATA PLAN SHEET.
  - ALL DISTURBED AREAS SHALL BE RESTORED IN ACCORDANCE WITH THE PROJECTS SPECIAL PROVISION FOR SLOPE RESTORATION. CONTRACTOR IS TO MINIMIZE THE AREAS OF DISTURBANCE AS MUCH AS IT IS PRACTICAL.
  - PROVIDE ALL ACCESSORIES NECESSARY TO SUPPORT REINFORCEMENT AT THE POSITIONS SHOWN ON THE PLANS.
  - FOOTING DESIGN BASED ON 1000 PSF SOIL BEARING PRESSURE ON NATIVE OR STRUCTURALLY COMPACTED SOIL. GEOTECHNICAL ENGINEER SHALL OBSERVE AND APPROVE EXCAVATION BASE PRIOR TO CONCRETE PLACEMENT.
  - CONCRETE SHALL BE PLACED CONTINUOUSLY TO THE MAT OUTLINE INDICATED ON THE FOUNDATION DRAWING. DURING CONCRETE PLACEMENT, THE CONTRACTOR SHALL NOT ALLOW FOR A COLD JOINT IN THE FOUNDATION MAT. CONSTRUCTION JOINT BETWEEN PIER AND FOUNDATION MAT IS PERMITTED.
  - CONTRACTOR SHALL VERIFY ANCHOR BOLT PATTERN PRIOR TO FABRICATION OF ANCHOR BOLTS AND TEMPLATES.
  - FINAL CONDUIT LOCATIONS TO BE SUBMITTED IN CONTRACTOR'S INSTALLATION PLAN AND APPROVED BY ENGINEER.
  - ALL GROUNDING WORK INCLUDING MATERIALS AND LABOR SHALL BE PAID FOR IN ACCORDANCE WITH THE SPECIAL PROVISION FOR "GROUNDING, BONDING, LIGHTING PROTECTION AND SURGE PROTECTION FOR ITS EQUIPMENT"

- REINFORCEMENT BAR & ANCHOR BOLT NOTES :**
- REINFORCEMENT BARS FOR FOUNDATION SHALL BE GRADE 60 DEFORMED BARS AS SPECIFIED IN SECTION 905.03 OF THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - ANCHOR BOLTS ARE TO BE VERTICAL & POSITIONED AS SHOWN IN PLAN.
  - TEMPLATE PLATES & ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED, ASSEMBLED, AND APPROVED BY MDOT PRIOR TO SHIPPING.
  - DIAMETER OF BOLT HOLES IN TEMPLATES SHALL BE 1/16" LARGER THAN ANCHOR BOLT DIAMETER.
  - INSTALLATION SHALL BE ACCORDING TO SUBSECTION 810.03N OF THE STANDARD SPECIFICATIONS.
  - THE TEMPLATES SHALL BE WELL SUPPORTED, HORIZONTALLY LEVEL & FIRMLY ANCHORED IN PLACE FOR A MINIMUM OF 24 HOURS AFTER THE CONCRETE PLACEMENT IS COMPLETED.
  - DUE CARE SHALL BE TAKEN DURING THE CONCRETE PLACEMENT TO AVOID DISPLACING THE ANCHOR BOLTS.
  - NO HAMMERING ON THE ANCHOR BOLTS OR TEMPLATES WILL BE ALLOWED. NO CHISELING OR DAMAGING OF GALVANIZED FINISH WILL BE PERMITTED.
  - AFTER TOP TEMPLATE IS REMOVED, THREAD NUTS ON TO THE BOLT FLUSH WITH THE BOLT END TO PROTECT THREADS UNTIL FRAME IS ERECTED.



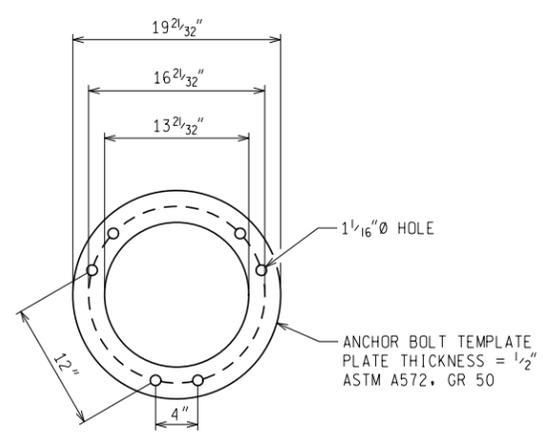
**REINFORCEMENT, STEEL, EPOXY COATED**

BAR	NO. REQ'D	TOTAL WT
A040506	48	177
B040410	16	52
K040900	10	61

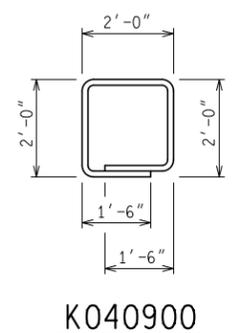
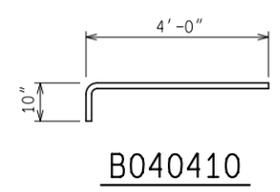
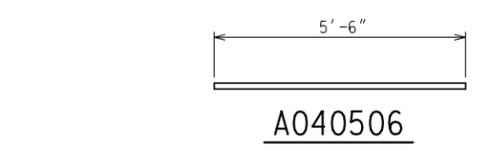
NOTE: TOTALS ARE FOR (2) FOUNDATIONS.

**SERVICE LOADS (TOP OF FOUNDATION):**

AXIAL LOAD: 0.78 KIPS  
 MOMENT: 20.3 KIP-FT  
 HORIZONTAL LOAD: 1.08 KIPS



**ANCHOR BOLT TEMPLATE DETAIL  
PLAN VIEW**



PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

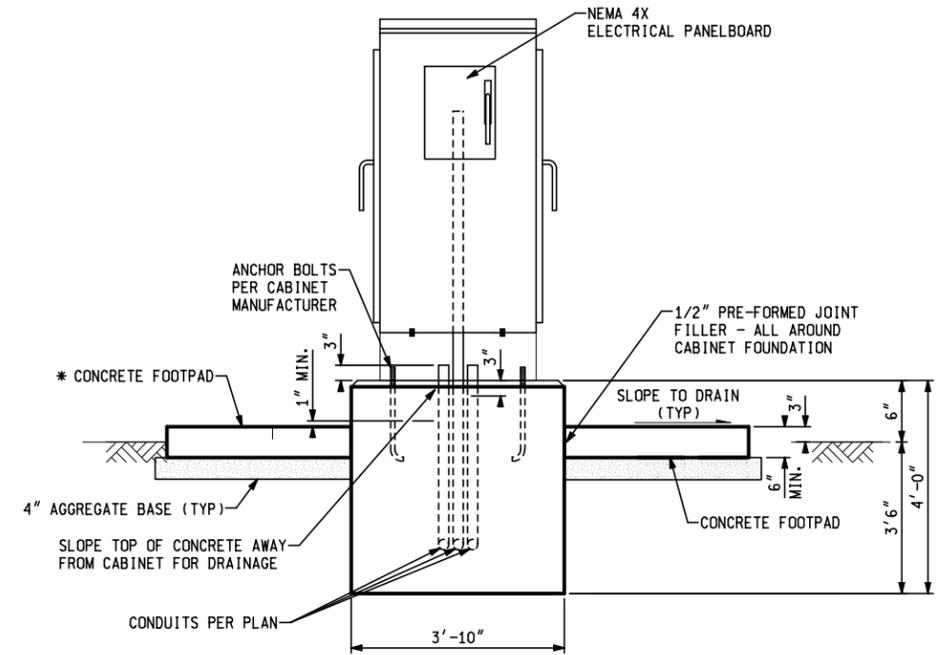
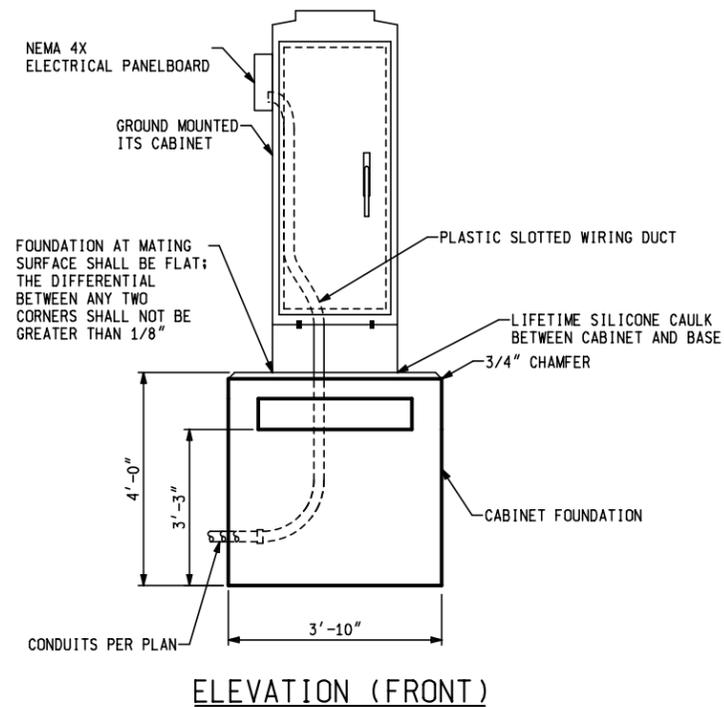
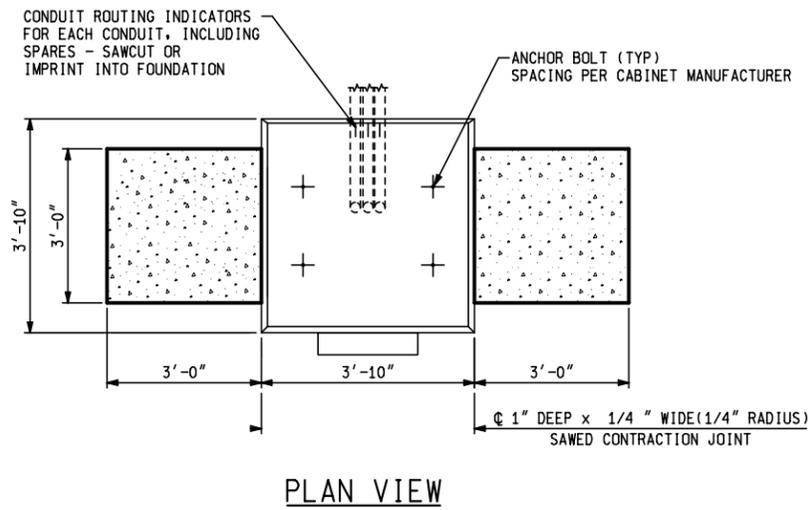
DRAWN BY: BEKMANIS  
 CHK'D BY: GROTENHUIS CORR BY: AMB  
 FILE: 849111 spreadftg 002.dgn

DATE: 04-02-12  
 DESIGN UNIT: GARCIA  
 TSC: ISHPERING

CS: 84911  
 JN: 107425A

SPREAD FOOTING DETAILS

DRAWING	SHEET
SPREAD FTG 002	13



\* THE ELEVATIONS OF THE CONCRETE FOOTPADS SHALL BE ADJUSTED TO MEET THE SITE CONDITIONS.

**TYPICAL GROUND MOUNTED CABINET DETAIL**

NOT TO SCALE

CABINET ID#	SITE #	ROUTE	SHORT NAME	LOCATION
E-US2_MM120_Wakefield	1	US-2	Wakefield ESS	US-2 West of M-28
E-US45_MM135_Rockland	2	US-45	Rockland ESS	US-45 South of US-45/M-26
E-M28_MM000_TroutCreek	3	M-28	Trout Creek ESS	M-28 Houghton/Ontonagon County Line
E-M38_MM053_Nisula	4	M-38	Nisula ESS	M-38 Houghton/Ontonagon County Line
E-US41_MM108_Calumet	5	US-41	Calumet ESS	US-41 near Store Street
E-US41_MM010_Arnheim	6	US-41	Arnheim ESS	US-41 1 mile north of Houghton/Baraga County Line
E-M95_MM001_Republic	9	M-95	Republic ESS	M-95 north of the Marquette/Dickinson County Line
E-US41_MM112_Negaunee	10	US-41	Negaunee ESS	US-41/M-28 East of Negaunee
E-M35_MM346_CedarRiver	12	M-35	Cedar River ESS	M-35 South of Delta/Menominee County Line
E-US2_MM058_RapidRiver	14	US-2	Rapid River ESS	US-2/US-41 West of Rapid River
E-US41_MM162_Trenary	15	US-41	Trenary ESS	US-41 South of Trenary
E-US41_MM001_Kiva	16	US-41	Kiva ESS	US-41 North of Marquette/Alger County Line
E-M94_MM001_Sundell	17	M-94	Sundell ESS	M-94 East of the Marquette/Alger County Line
E-US2_MM041_Manistique	21	US-2	Manistique ESS	US-2 West of Manistique near Tannery Road
E-US2_MM229_BlaneyPark	22	US-2	Blaney Park ESS	US-2 at M-77
E-M28_MM066_Dafer	26	M-28	Dafer ESS	M-28 west of I-75

**CABINET ID NAMES**

**NOTE:**

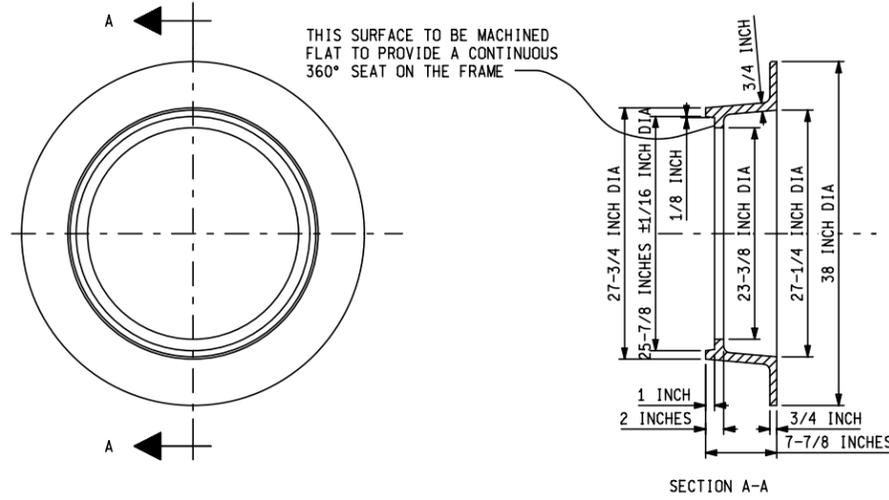
1. THE SOIL BENEATH THE CONCRETE FOOTPAD AND AGGREGATE SHALL BE COMPACTED IN PLACE WITH A PLATE COMPACTOR OR OTHER COMPACTION METHOD APPROVED BY THE ENGINEER, PRIOR TO PLACING THE AGGREGATE.

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DATE: 4/4/12	CS: 84911	TYPICAL GROUND MOUNTED ITS CABINET DETAIL	DRAWING	SHEET
									DESIGN UNIT: GUSTAFSON	JN: 107425A			
									TSC: ISHPERING				14



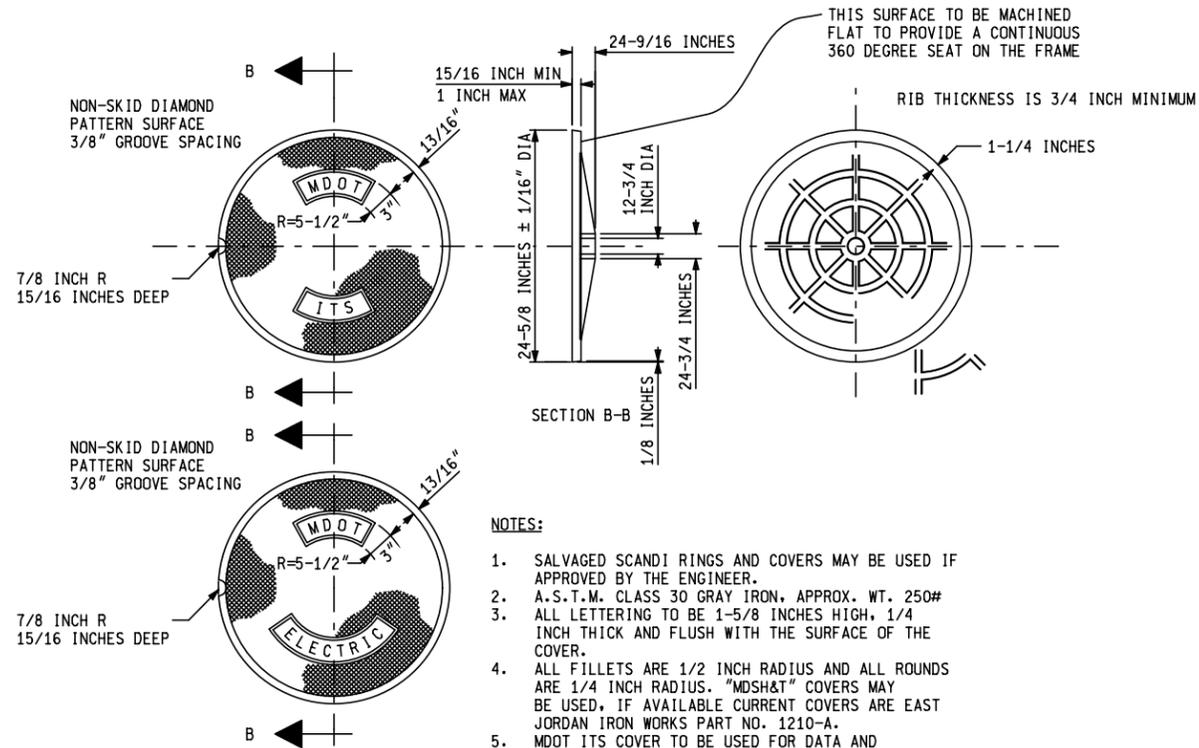
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FILE: 107425 MSCDET CAB 001.DGN



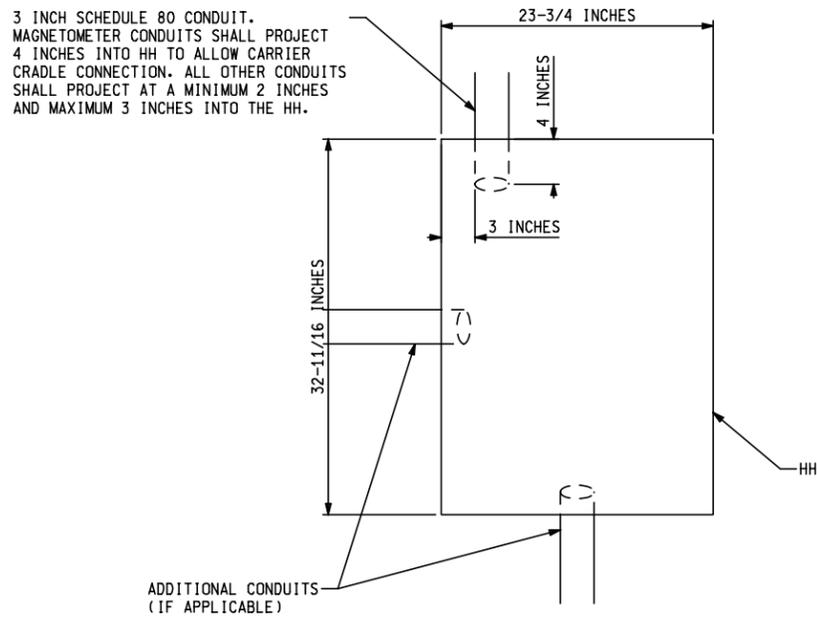
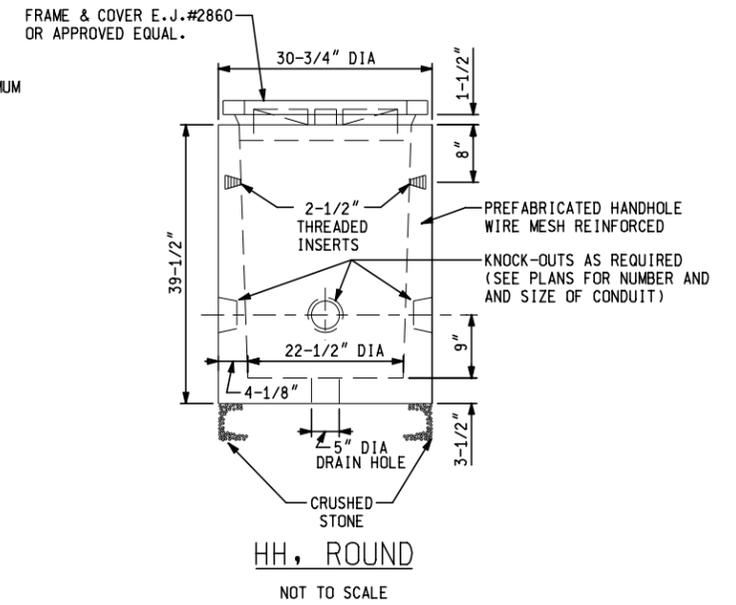
- NOTES:**
1. ALL FILLETS ARE 1/2 INCH RADIUS AND ALL ROUNDS ARE 1/4 INCH RADIUS.
  2. A.S.T.M. CLASS 30 GRAY IRON APPROX. WT. 250#

**HANDHOLE FRAME (TYP)**  
NOT TO SCALE



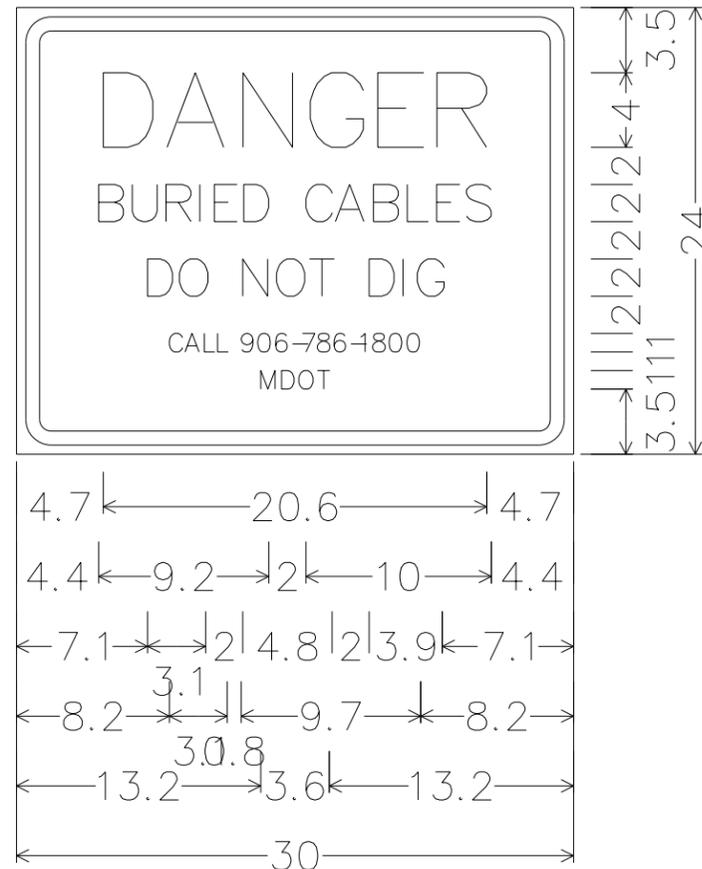
- NOTES:**
1. SALVAGED SCANDI RINGS AND COVERS MAY BE USED IF APPROVED BY THE ENGINEER.
  2. A.S.T.M. CLASS 30 GRAY IRON, APPROX. WT. 250#
  3. ALL LETTERING TO BE 1-5/8 INCHES HIGH, 1/4 INCH THICK AND FLUSH WITH THE SURFACE OF THE COVER.
  4. ALL FILLETS ARE 1/2 INCH RADIUS AND ALL ROUNDS ARE 1/4 INCH RADIUS. "MDSH&T" COVERS MAY BE USED, IF AVAILABLE CURRENT COVERS ARE EAST JORDAN IRON WORKS PART NO. 1210-A.
  5. MDOT ITS COVER TO BE USED FOR DATA AND COMMUNICATION CABLES FOR ITS DEVICES AND MDOT ELECTRIC COVER TO BE USED FOR POWER CABLES.
  6. TOP OF HANDHOLE SHALL BE SET AT 1" BELOW GRADE.

**HANDHOLE COVER (TYP)**  
NOT TO SCALE



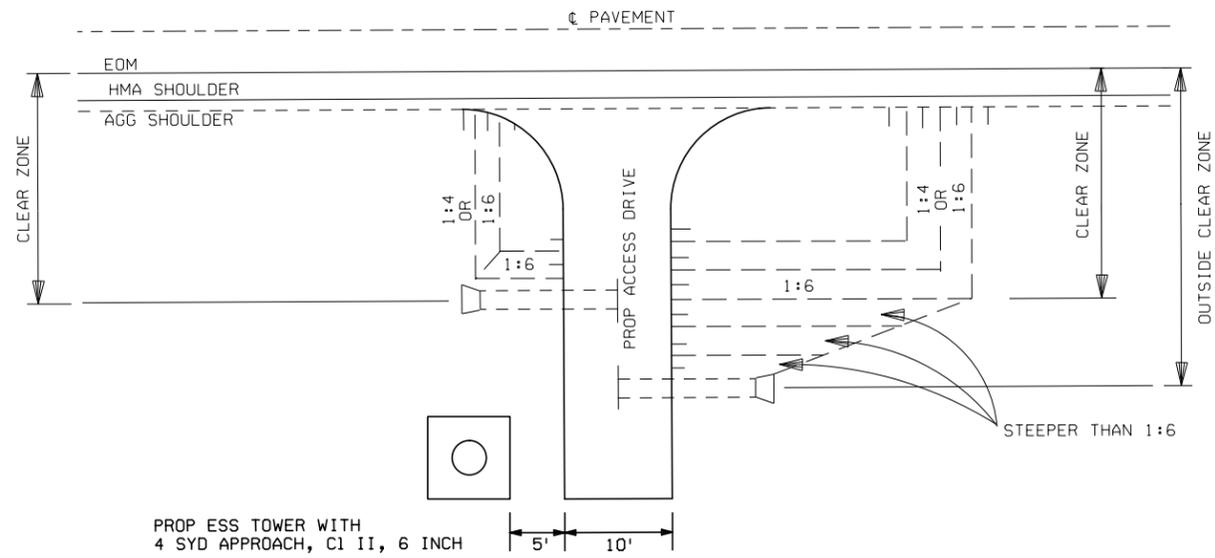
**CONDUIT ENTRIES INTO HANDHOLE (TYP)**  
NOT TO SCALE

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MDOT Michigan Department of Transportation		NO SCALE	DATE: 4/4/12	CS: 84911	HANDHOLE DETAILS		DRAWING	SHEET
											DESIGN UNIT:	JN: 107425A				15
											TSC:					

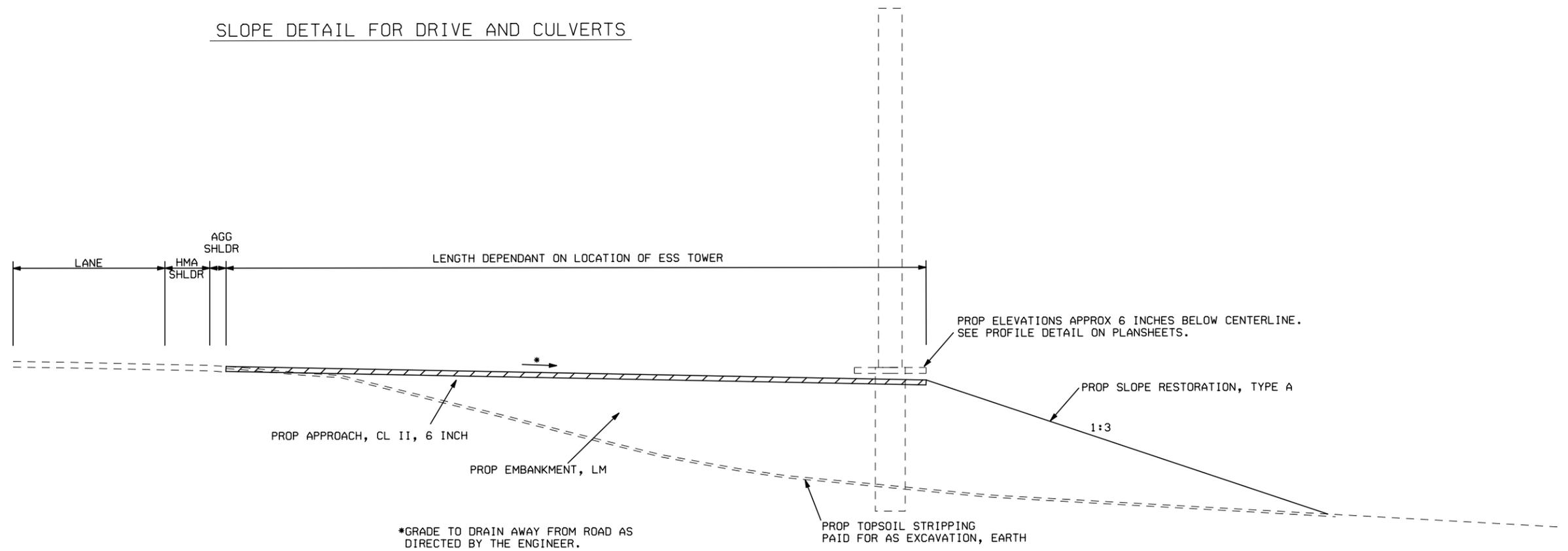


W-Var, Type IIIB, Danger Buried Cables;  
 0.8" Border, 0.5" Indent, Black on Yellow;  
 [DANGER] D;  
 [BURIED CABLES] D;  
 [DO NOT DIG] D;  
 [CALL 906-786-1800] D;  
 [MDOT] D;

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION			NO SCALE	DATE: 4/4/12	CS: 84911	BURIED CABLE SIGN DETAIL	DRAWING	SHEET
											DESIGN UNIT: GUSTAFSON	JN: 107425A			16
											TSC: ISHPERING				



SLOPE DETAIL FOR DRIVE AND CULVERTS



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



**NO SCALE**

FILE: 107425 MISC ROAD DETAIL

DATE: 4/4/12  
 DESIGN UNIT:  
 TSC: ISHPEMING

CS: 84911  
 JN: 107425A

ACCESS DRIVE AND CULVERT DETAIL

DRAWING SHEET

## GENERAL NOTES

### UTILITIES

#### **UNDERGROUND UTILITIES / MISS DIG**

For protection of underground utilities and in conformance with Public Act 53, 1974, the Contractor shall dial 1-800-482-7171 a minimum of three full working days, excluding Saturdays, Sundays, and holidays prior to beginning each excavation in areas where public utilities have not been previously located. Members will thus be routinely notified. This does not relieve the Contractor of the responsibility of notifying utility owners who may not be a part of the "Miss Dig" alert system.

#### **MDOT ELECTRICAL SYSTEMS**

Contractors shall contact the maintenance representative at the MDOT Region / TSC Office to have MDOT electrical systems staked.  
Superior Region 1-906-786-1800

If plan information indicates an existing underground utility is or will be out of service within the limits of this contract. The Contractor is cautioned to treat such a line as if it were still in service and notify "Miss Dig" when working in the area of the out of service facility.

### EARTHWORK

#### **EARTHWORK**

Earthwork quantities are computed based upon limited survey information. These quantities are for bidding purposes only and will be adjusted by the Engineer based upon actual field measurements.

#### **SOIL EROSION MEASURES**

Appropriate soil erosion and sedimentation control measures shall be in place prior to earth-disturbing activities. Place turf establishment items as soon as possible on potential erodable slopes as directed by the Engineer. Critical ditch grades shall be protected with either sod or seed/mulch or mulch blanket as directed by the Engineer.

### BASES

#### **AGGREGATE BASE**

Aggregate bases shall use aggregate 22A, unless otherwise specified.

### PAVEMENT

#### **SOIL BORINGS AND/OR PAVEMENT CORES**

The soil boring logs and/or pavement cores represent point information. No inference should be made that subsurface or pavement conditions are the same at other locations.

#### **SIGNS**

#### **PERMANENT SIGNS**

Any permanent signs requiring relocation due to Contractor operations shall be salvaged and reset by the Contractor at locations designated by the Engineer. Signs and posts damaged during the removal and storage operations shall be replaced with new signs and posts. The cost of this work shall be borne by the Contractor.

## ENVIRONMENTAL

#### **RECREATIONAL PROPERTIES**

The Contractor shall not park any vehicles or store any equipment on any public recreational property. Access to the recreational site must be maintained at all times.

## PROJECT SPECIFIC NOTES

#### **TOWERS**

Final tower locations to be verified by MDOT Engineer.

Tower folds away from ITS cabinet and parallel to the roadway as shown on the plans or as directed by the Engineer.

#### **CONDUIT**

Conduit runs shall be a minimum of 4' from road signs.

All conduit shall be Schedule 80 PVC.

#### **EMBANKMENT**

All material used for Embankment, LM shall be Class III or better.

#### **PERMITS**

All permits necessary for the construction of this project are the responsibility of the Contractor.

#### **DRIVE PERMITS**

Houghton County Road Commission will require drive permits for the field access drive on site #5 and 6.

#### **PEDESTAL FOUNDATION**

All pedestal foundations shall be a minimum 20 foot height on a square aluminum base. Contractor shall submit documentation stating compliance to NCHRP-350.

#### REVISIONS

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: 107425\_Note\_doc

DATE: 4/4/12

DESIGN UNIT: Gustafson

TSC: Ishpeming

CS: 84911

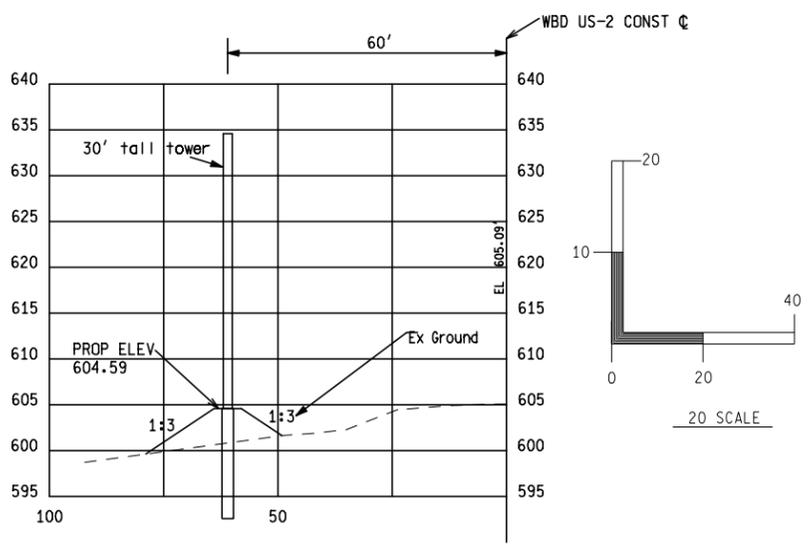
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NOTE SHEET

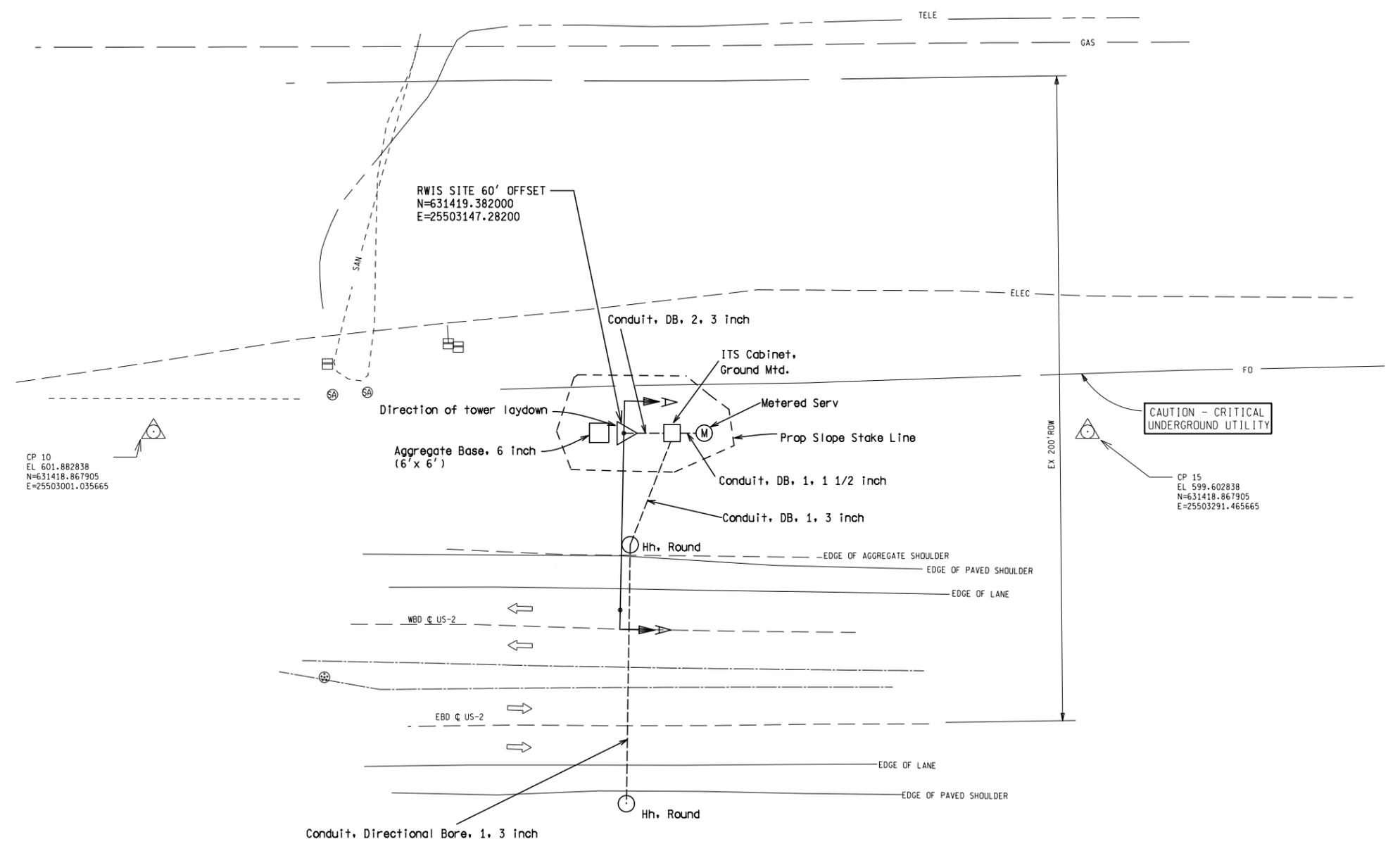
DRAWING SHEET

NOTE CONST

18



SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec. 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
40 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
80 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Syd	Aggregate Base, 6 inch
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
100 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Lightning Protection, Pole
4 Syd	Approach, CI II, 6 inch
46 Cyd	Embankment, LM
130 Syd	Slope Restoration, Type A
13 Cyd	Excavation, Earth
2.2 Cyd	Conc. Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.09 LS	Drilled Shaft Equipment, Furnished
1 Ea	Serv Disconnect

CP 10  
EL 601.882838  
N=631418.867905  
E=25503001.035665

CP 15  
EL 599.602838  
N=631418.867905  
E=25503291.465665

CAUTION - CRITICAL UNDERGROUND UTILITY

NO.	DATE	AUTH	DESCRIPTION

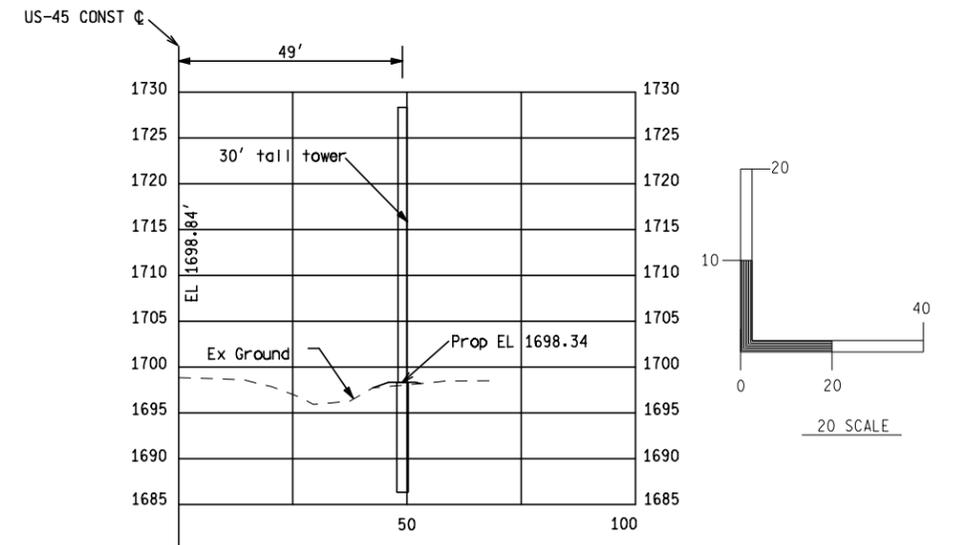
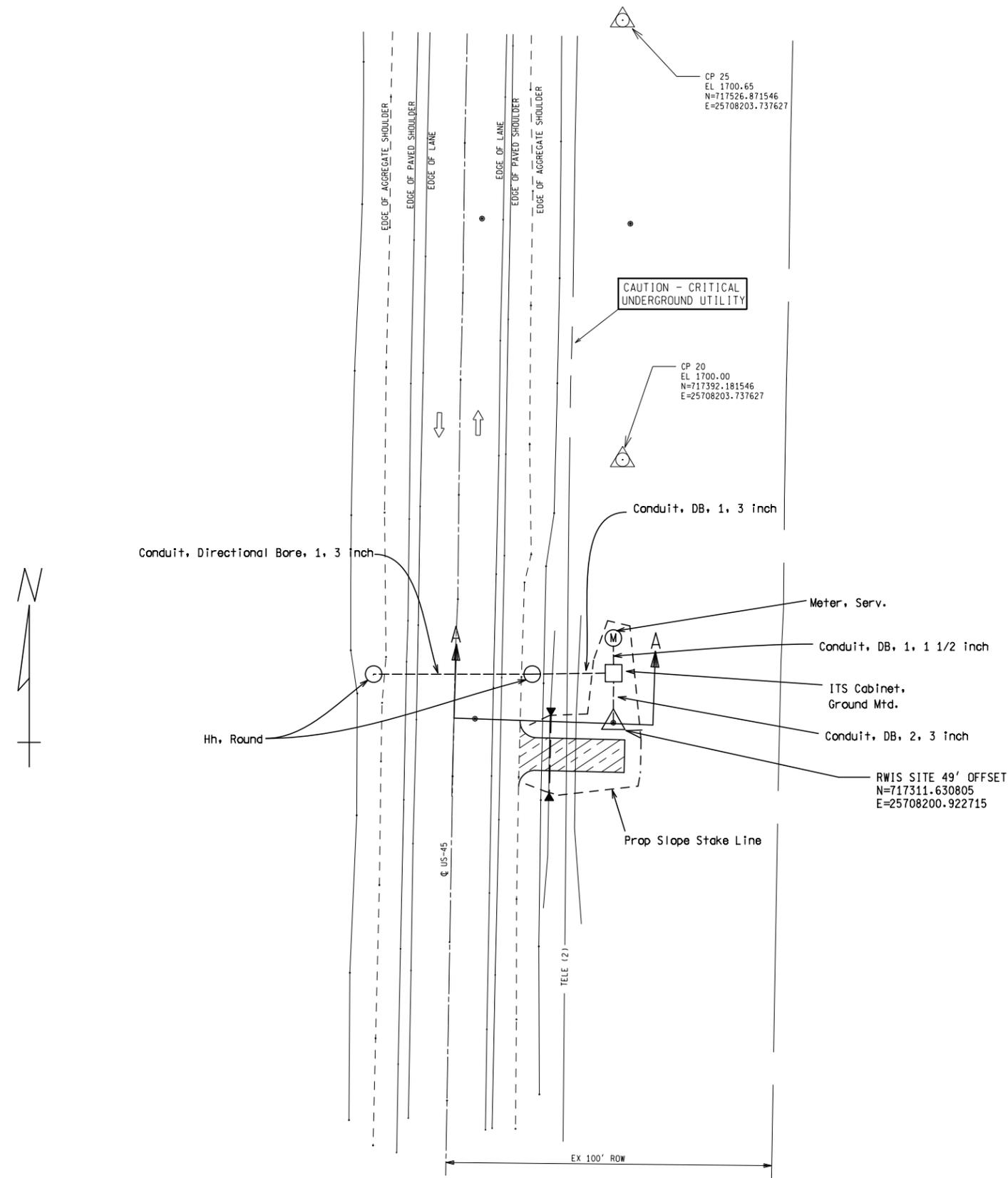


DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING  
FILE: 1 CF US2.dgn

CS: 84911  
JN: 107425A

ESS SITE #1 CONSTRUCTION SHEET  
US-2, GOGEBIC COUNTY

DRAWING SHEET  
CONST 19

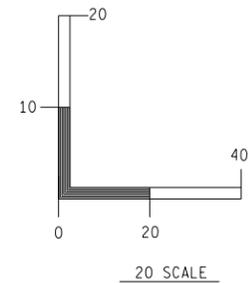
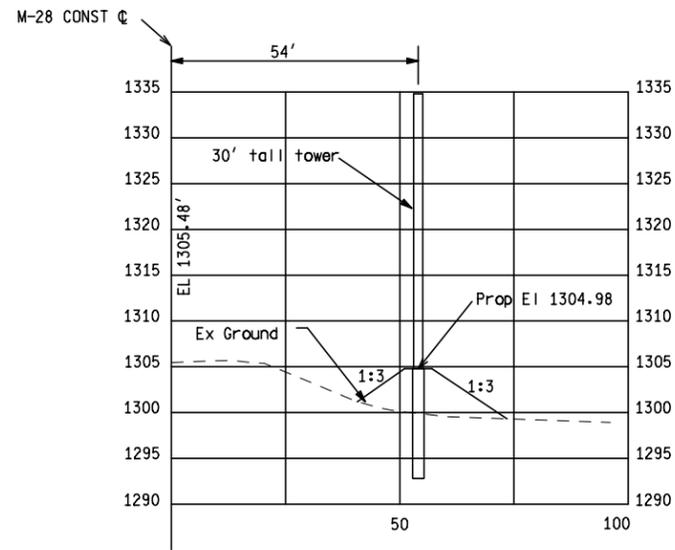


SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

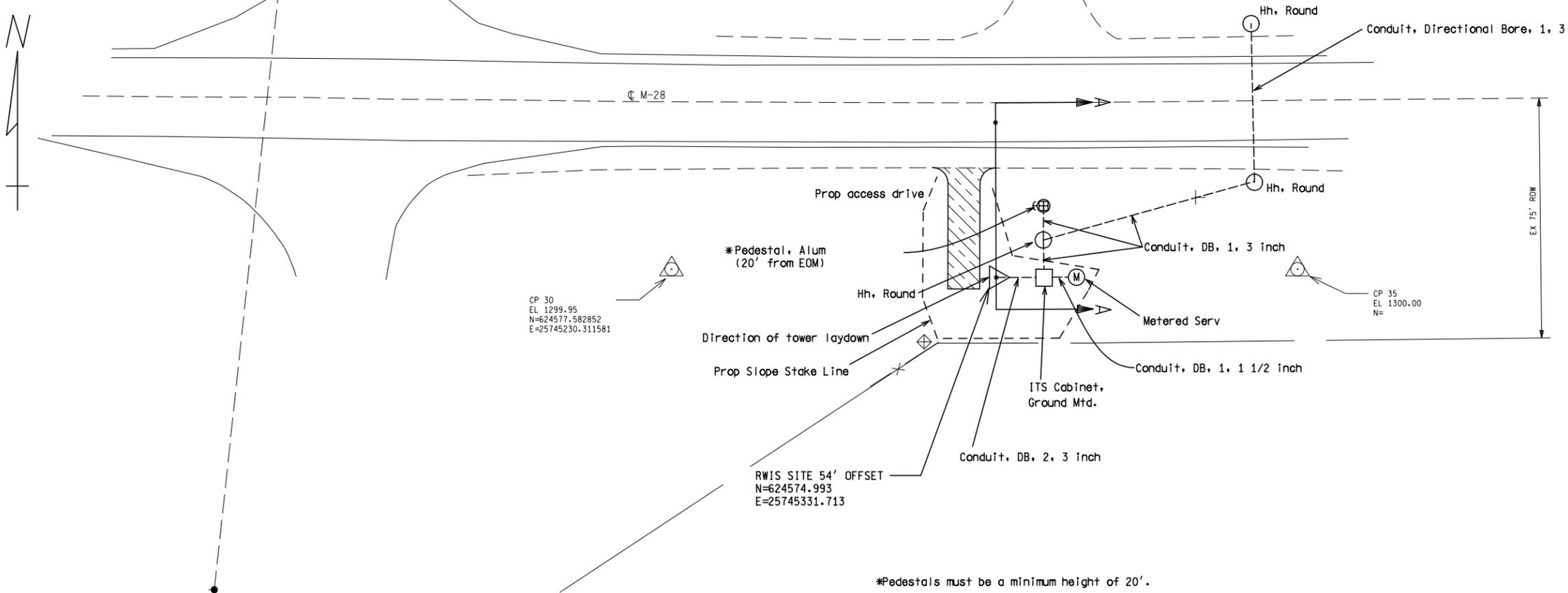
2 Ea	Hh, Round
10 Ft	Conduit, DB, 1. 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
25 Ft	Conduit, DB, 1. 3 inch
15 Ft	Conduit, DB, 2. 3 inch
50 Ft	Conduit, Directional Bore, 1. 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
133 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
41 Syd	Approach, Cl II, 6 inch
1 Ea	Lightning Protection, Pole
21 Cyd	Embankment, LM
75 Syd	Slope Restoration, Type A
24 Ft	Culv, Cl F, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
11 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
1 Ea	Serv Disconnect

SECTION 7  
T47N-R37W  
DUNCAN TOWNSHIP

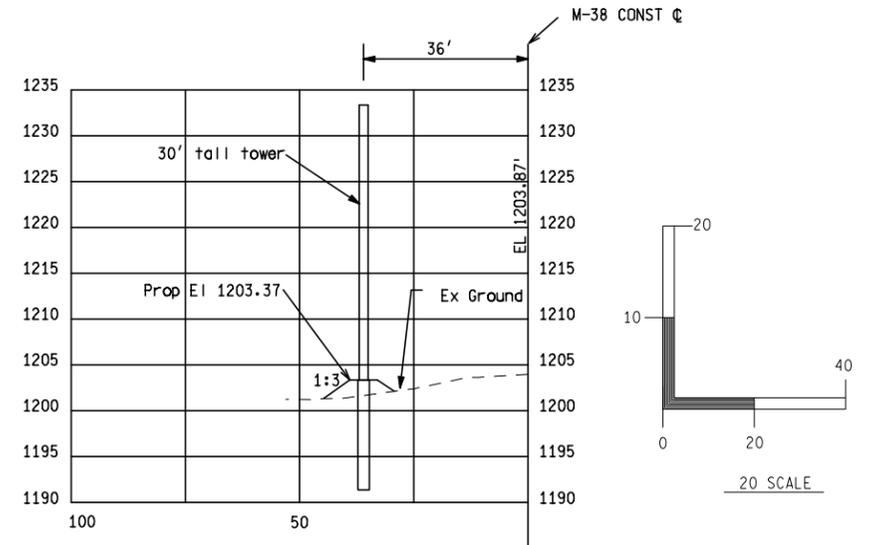


SECTION A-A

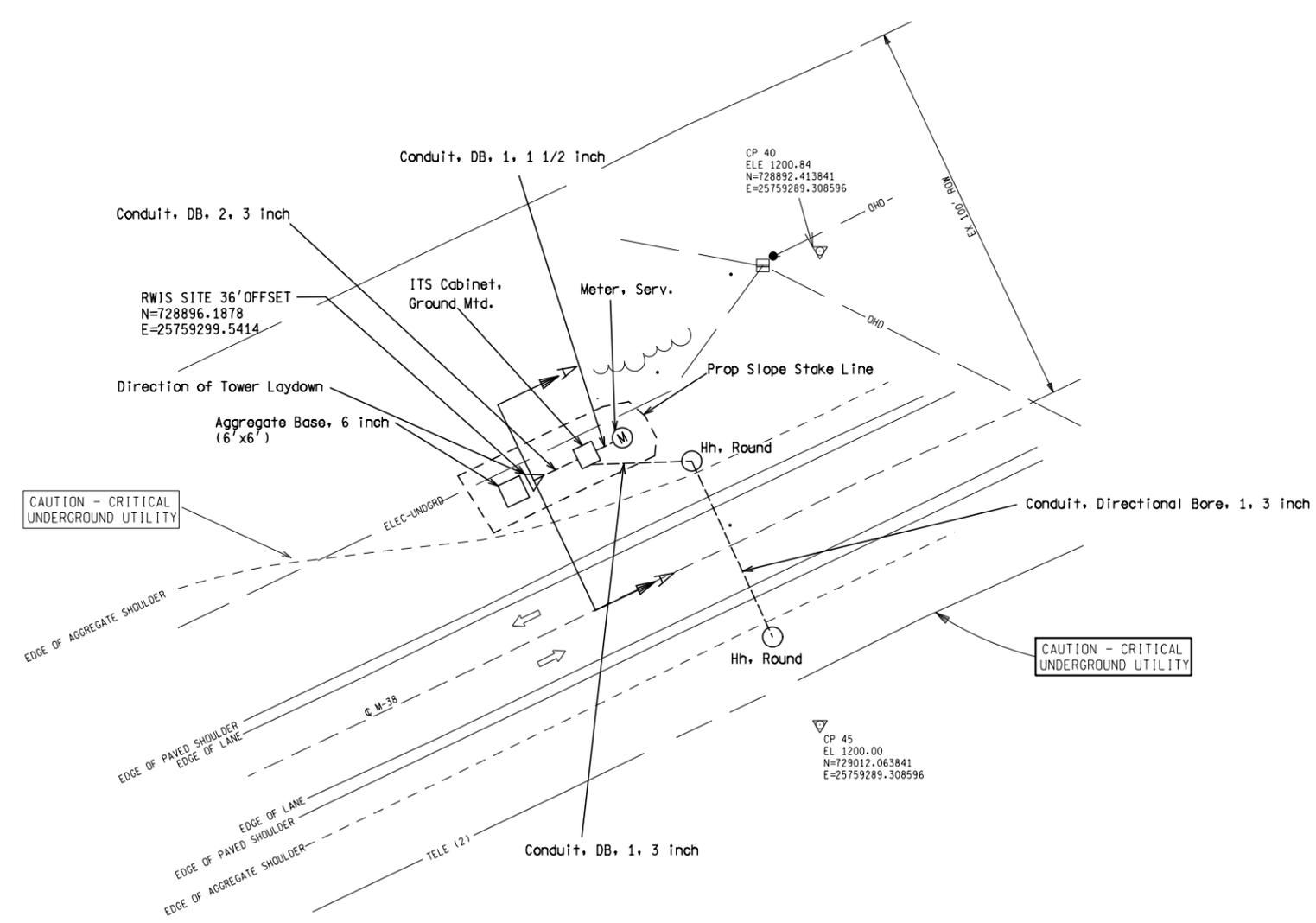
CONSTRUCTION QUANTITIES THIS SHEET	
3 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
95 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
50 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
2000 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Pedestal, Alum
1 Ea	Pedestal, Fdn
48 Syd	Approach, CI II, 6 inch
1 Ea	Lightning Protection, Pole
142 Cyd	Embankment, LM
175 Syd	Slope Restoration, Type A
17 Cyd	Excavation, Earth
2.2 Cyd	Conc. Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
1 Ea	Serv Disconnect



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 4/4/12	CS: 84911	ESS SITE #3 CONSTRUCTION SHEET	DRAWING	SHEET
								 		DESIGN UNIT: GUSTAFSON	JN: 107425A	M-28, HOUGHTON COUNTY		CONST
								FILE: 3 CF M28.dgn		TSC: ISHPEMING				21



SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET

- 2 Ea Hh. Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec. 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 30 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 50 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Syd Aggregate Base, 6 inch
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 600 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 7 Cyd Embankment, LM
- 70 Syd Slope Restoration, Type A
- 4 Syd Approach, CI II, 6 inch
- 8 Cyd Excavation, Earth
- 2.2 Cyd Conc. Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.08 LS Drilled Shaft Equipment, Furnished
- 1 Ea Serv Disconnect



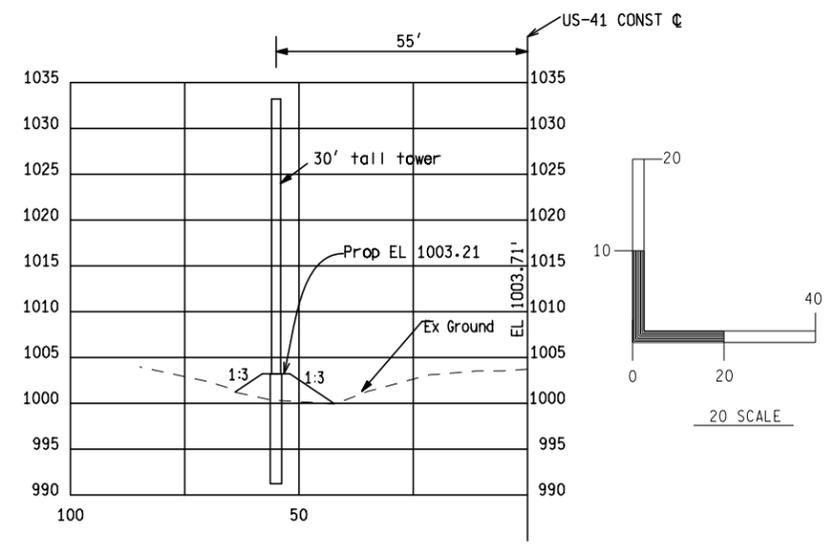
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 4/4/12	CS: 84911	ESS SITE #4 CONSTRUCTION SHEET		DRAWING	SHEET
										DESIGN UNIT: GUSTAFSON	JN: 107425A	M-38, ONTONAGON COUNTY			CONST
								FILE: 4 CF M38.dgn		TSC: ISHPEMING					22

SECTION 26  
T56N.R33W  
OSCEOLA TOWNSHIP

CP 55  
ELEV 1001.145995  
N=891728.976709  
E=25884405.552000

RWIS SITE, 55' OFFSET  
N=891636.7725  
E=25884409.7417

CP 50  
ELEV 1000.00  
N=891587.545000  
E=25884405.552000



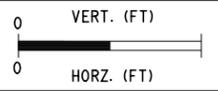
SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

- 2 Ea Hh, Round
- 10 Ft Conduit, DB, 1. 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 25 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 60 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 206 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 56 Syd Approach, CI II, 6 inch
- 1 Ea Lightning Protection, Pole
- 75 Cyd Embankment, LM
- 65 Syd Slope Restoration, Type A
- 16 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.09 LS Drilled Shaft Equipment, Furnished
- 24 Ft Culv, CI F, 18 inch
- 2 Ea Culv, Slip End Sect, 1 on 6, 18 inch, Longit
- 1 Ea Serv Disconnect



NO.	DATE	AUTH	DESCRIPTION



DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING  
FILE: 5 ISH US41.dgn

CS: 84911  
JN: 107425A

ESS SITE #5 CONSTRUCTION SHEET  
US-41, HOUGHTON COUNTY

DRAWING SHEET  
CONST 23

SECTION 26  
T53N,R33W  
CHASSELL TOWNSHIP

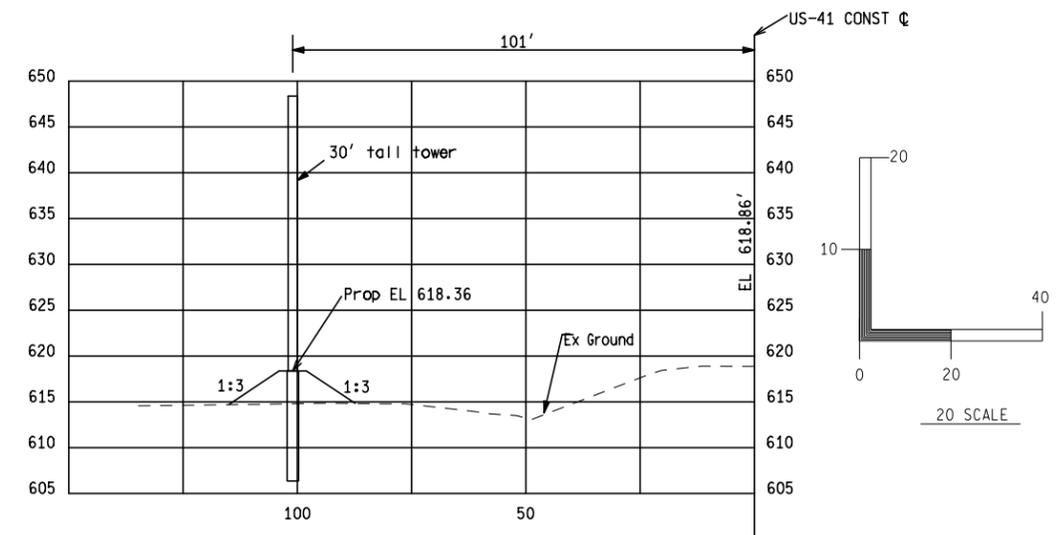
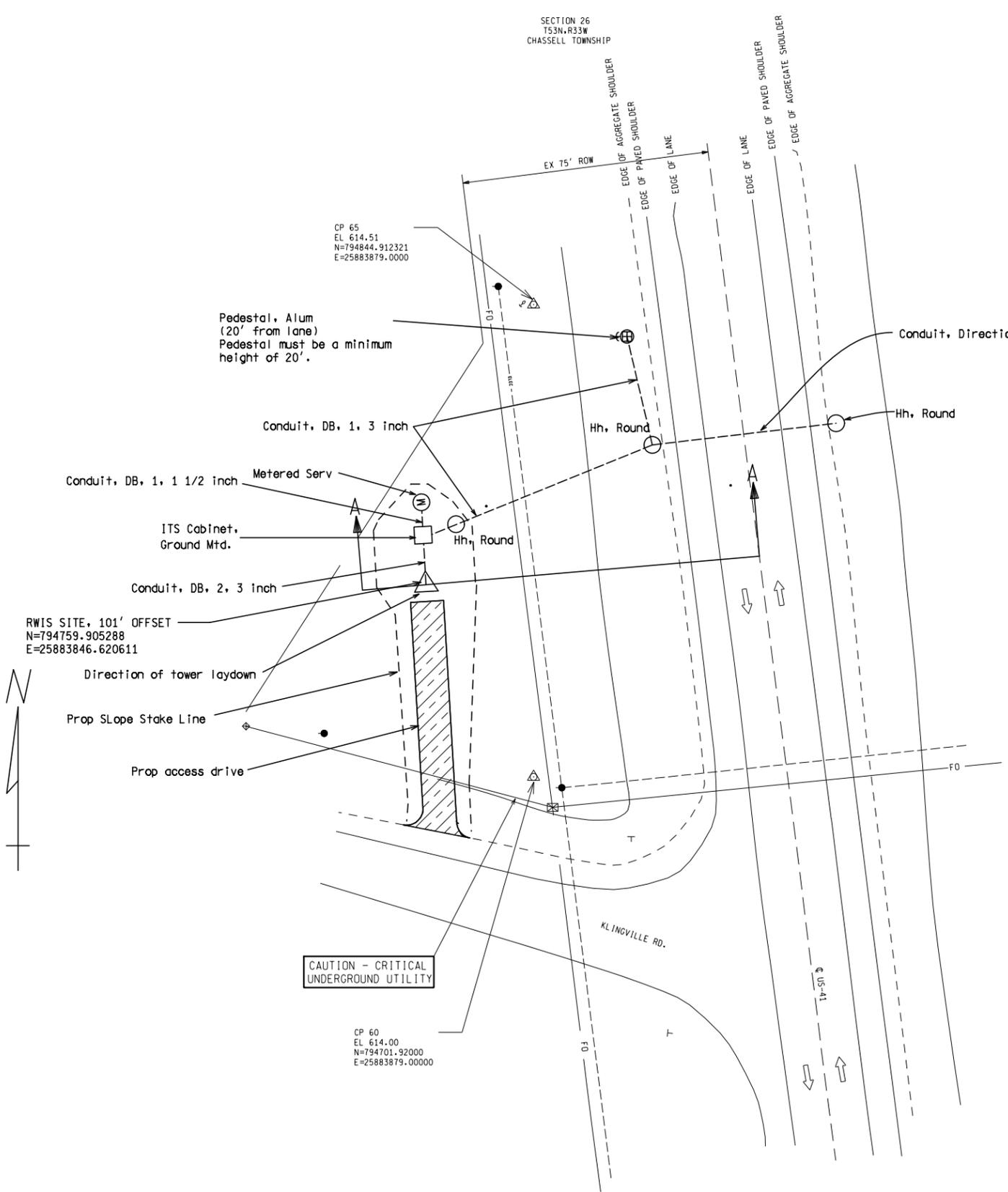
CP 65  
EL 614.51  
N=794844.912321  
E=25883879.0000

Pedestal, Alum  
(20' from lane)  
Pedestal must be a minimum  
height of 20'.

RWIS SITE, 101' OFFSET  
N=794759.905288  
E=25883846.620611

CAUTION - CRITICAL  
UNDERGROUND UTILITY

CP 60  
EL 614.00  
N=794701.92000  
E=25883879.00000



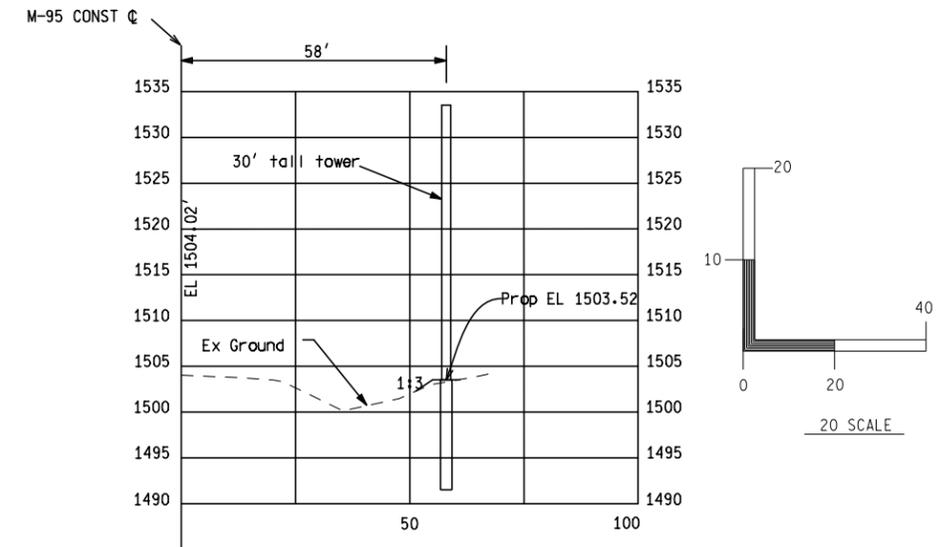
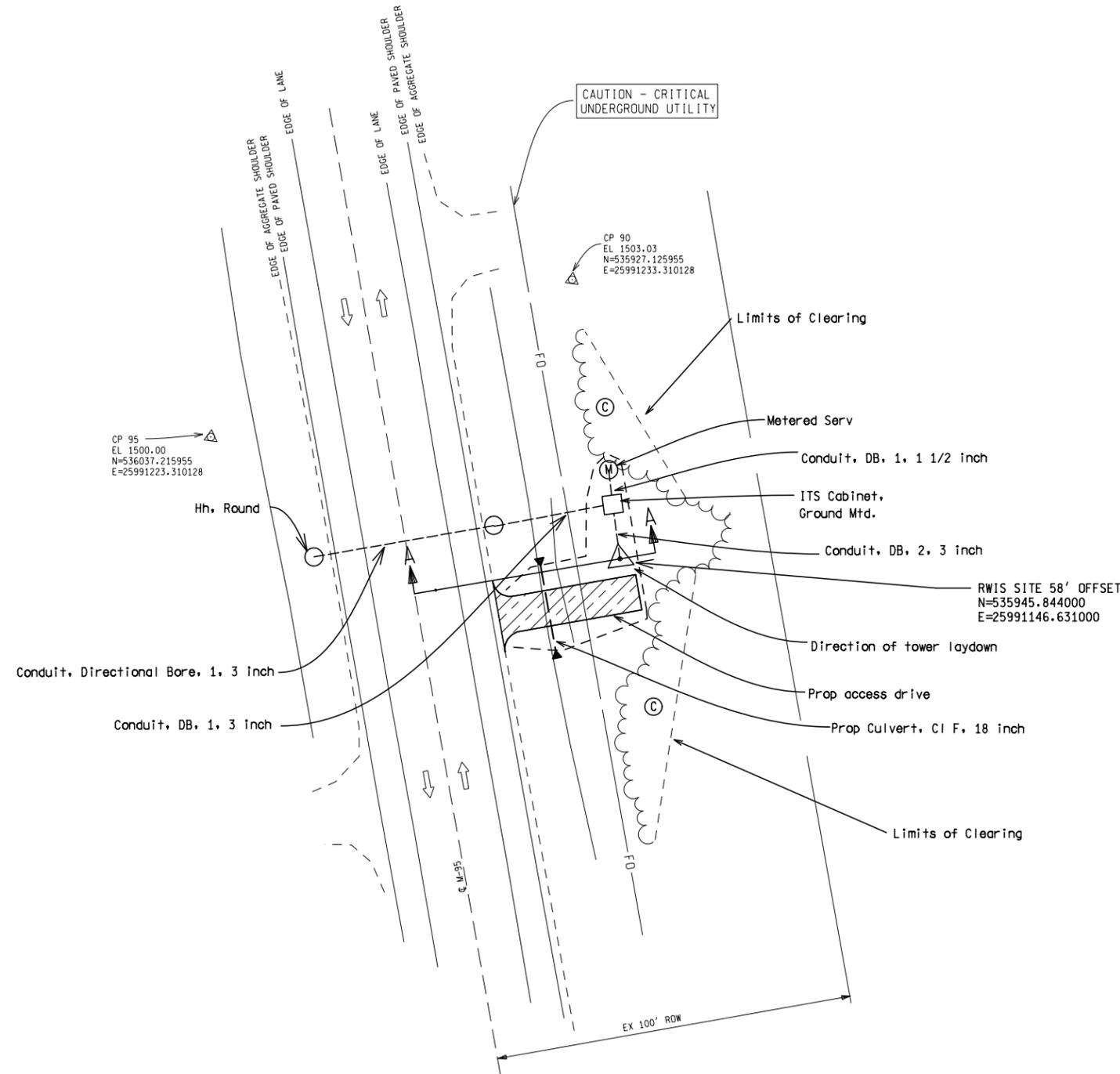
SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

- 3 Ea Hh. Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 105 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 60 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 100 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 1 Ea Lightning Protection, Pole
- 83 Syd Approach, CI II, 6 inch
- 186 Cyd Embankment, LM
- 175 Syd Slope Restoration, Type A
- 24 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.08 LS Drilled Shaft Equipment, Furnished
- 12 Ft Temp Casing-Left in Place
- 1 Ea Pedestal, Alum
- 1 Ea Pedestal, Fdn
- 1 Ea Serv Disconnect

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 4/4/12	CS: 84911	ESS SITE #6 CONSTRUCTION SHEET	DRAWING	SHEET
										DESIGN UNIT: GUSTAFSON	JN: 107425A	US-41, HOUGHTON COUNTY		CONST
								0 VERT. (FT) 0 HORZ. (FT)		TSC: ISHPEMING				24
										FILE: 6 ISH US41.dgn				

SECTION 36  
T45N,R30W  
REPUBLIC TOWNSHIP



SECTION A-A

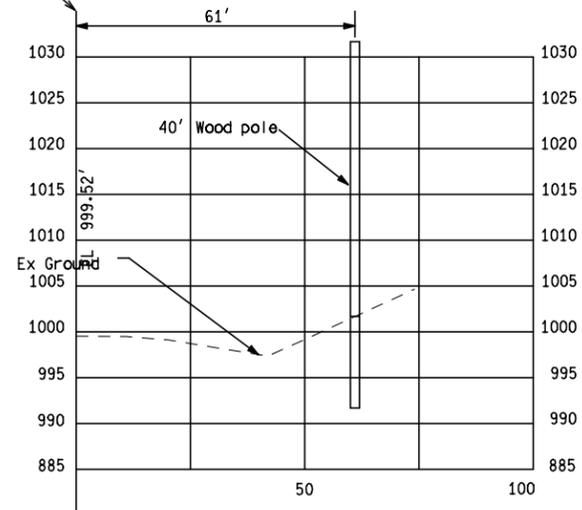
CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh, Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
35 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
55 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
2000 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
0.03 Acre	Clearing
1 Ea	Lightning Protection, Pole
50 Syd	Approach, CI II, 6 inch
42 Cyd	Embankment, LM
75 Syd	Slope Restoration, Type A
24 Ft	Culv, CI F, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
11 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
1 Ea	Serv Disconnect



EBD US-41 CONST C

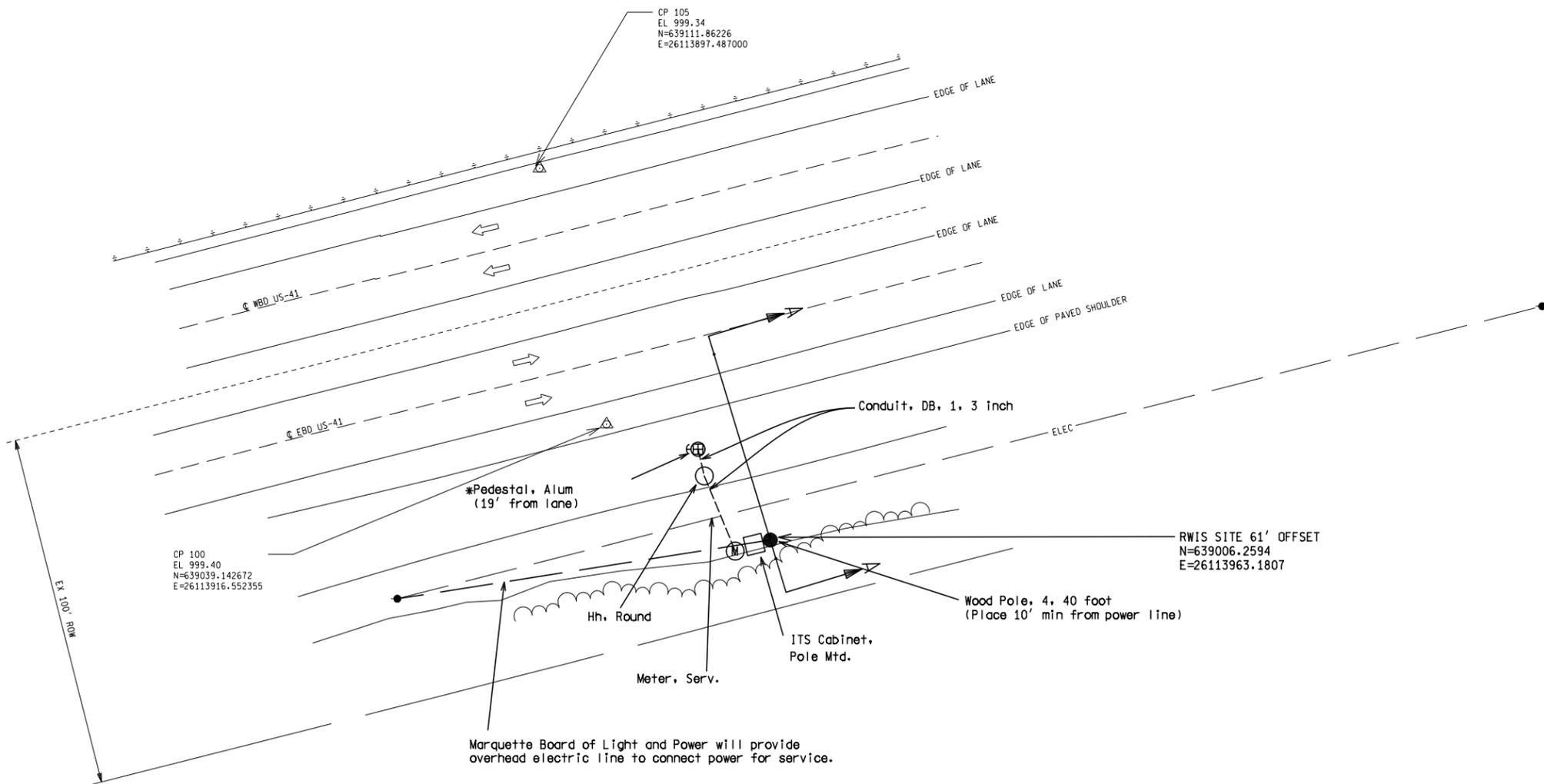
SECTION 26  
T48N,R26W  
NEGAUNEE TOWNSHIP



SECTION A-A

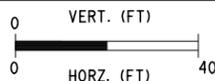
CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 30 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 300 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ITS Cabinet, Pole Mtd.
- 1 Ea Pedestal, Alum
- 1 Ea Pedestal, Fdn
- 1 Ea Lightning Protection, Pole
- 1 Ea Wood Pole, 4, 40 foot
- 10 Syd Slope Restoration, Type A
- 1 Ea Serv Disconnect



\*Pedestals must be a minimum height of 20'.

NO.	DATE	AUTH	DESCRIPTION



FILE: 10 ISH\US41.dgn

DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHP/EMING

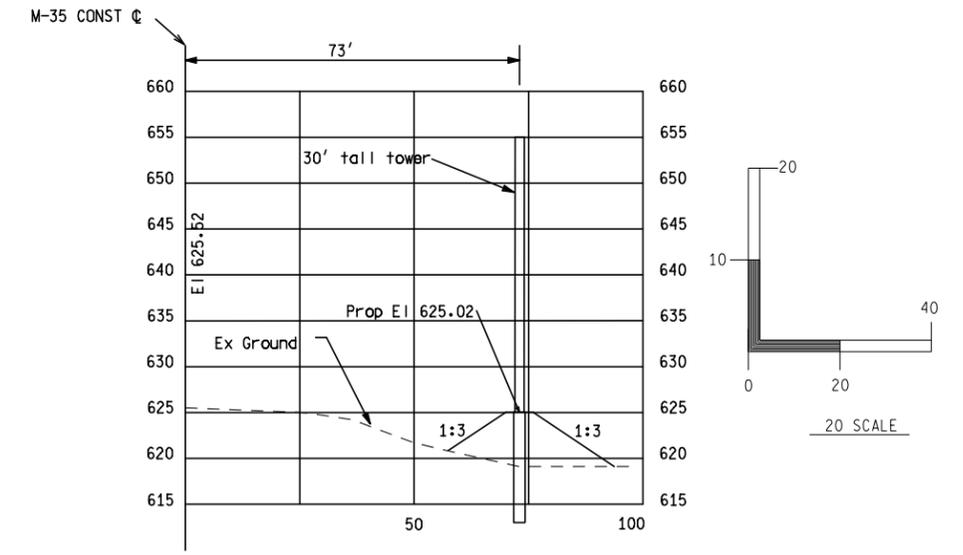
CS: 84911  
JN: 107425A

ESS SITE #10 CONSTRUCTION SHEET  
US-41, MARQUETTE COUNTY

DRAWING SHEET  
CONST 26

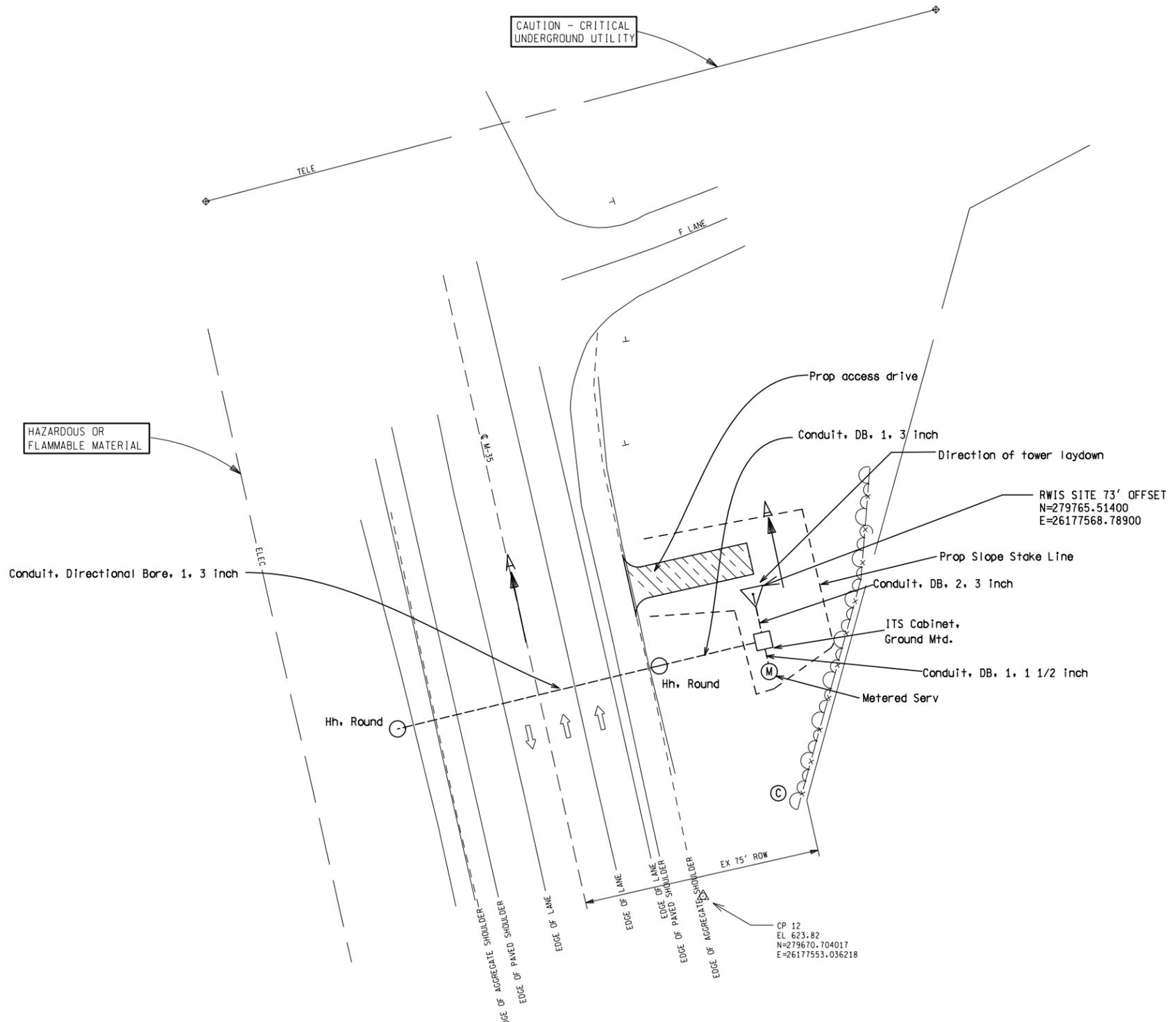
SECTION 4  
T36N.R24W  
CEDARVILLE TOWNSHIP

CAUTION - CRITICAL UNDERGROUND UTILITY



SECTION A-A

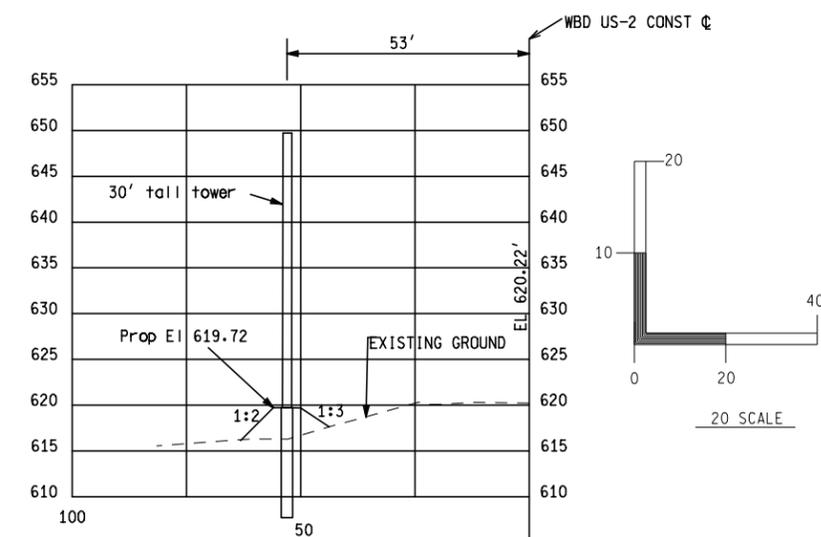
HAZARDOUS OR FLAMMABLE MATERIAL



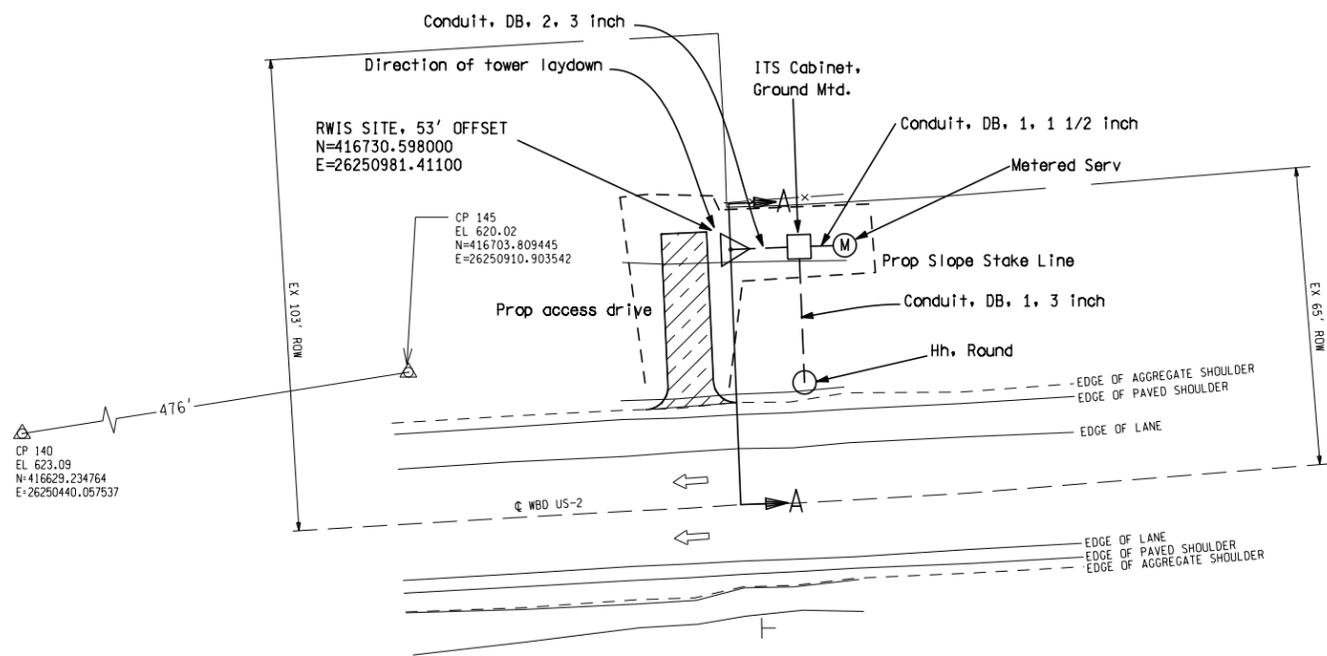
CONSTRUCTION QUANTITIES THIS SHEET	
2 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
35 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
85 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
3,800 Dir	Power Co. (Est. Cost to Contractor)
50 Syd	Approach, CI II, 6 inch
1 Ea	Lightning Protection, Pole
0.01 Acre	Clearing
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
190 Cyd	Embankment, LM
160 Syd	Slope Restoration, Type A
20 Cyd	Excavation, Earth
2.2 Cyd	Conc. Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.09 LS	Drilled Shaft Equipment, Furnished
1 Ea	Serv Disconnect

CP 12  
EL 623.82  
N=279670.704017  
E=26177553.036218

CP 12A (372' SOUTH)  
E1 622.30  
N=279309.241982  
E=26177636.486304



SECTION A-A



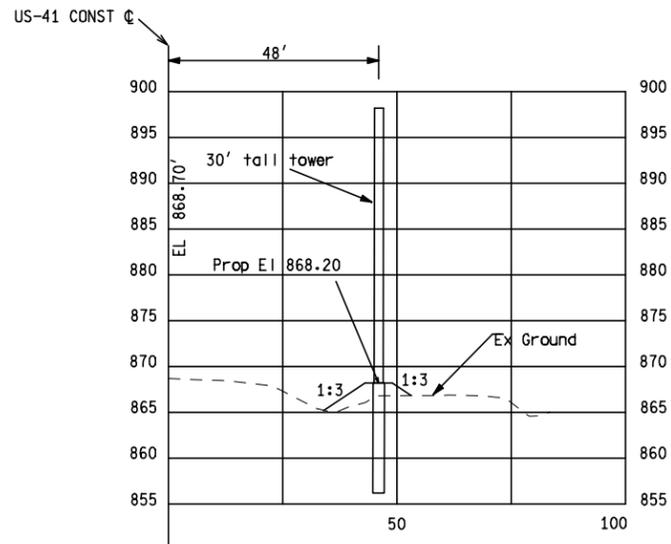
CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 15 Ft Conduit, DB, 2, 3 inch
- 30 Ft Conduit, DB, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 700 Dlr Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 1 Ea Lightning Protection, Pole
- 48 Syd Approach, CI II, 6 inch
- 66 Cyd Embankment, LM
- 100 Syd Slope Restoration, Type A
- 13 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.08 LS Drilled Shaft Equipment, Furnished
- 12 Ft Temp Casing-Left in Place
- 1 Ea Serv Disconnect

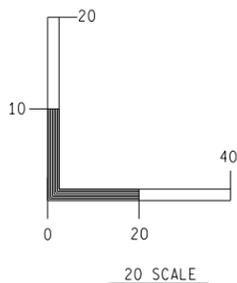
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	DATE: 4/4/12	CS: 84911	ESS SITE #14 CONSTRUCTION SHEET	DRAWING	SHEET
								DESIGN UNIT: GUSTAFSON	JN: 107425A	US-2, DELTA COUNTY		CONST
								TSC: ISHPEMING				28



FILE: 14 ESC US2.dgn



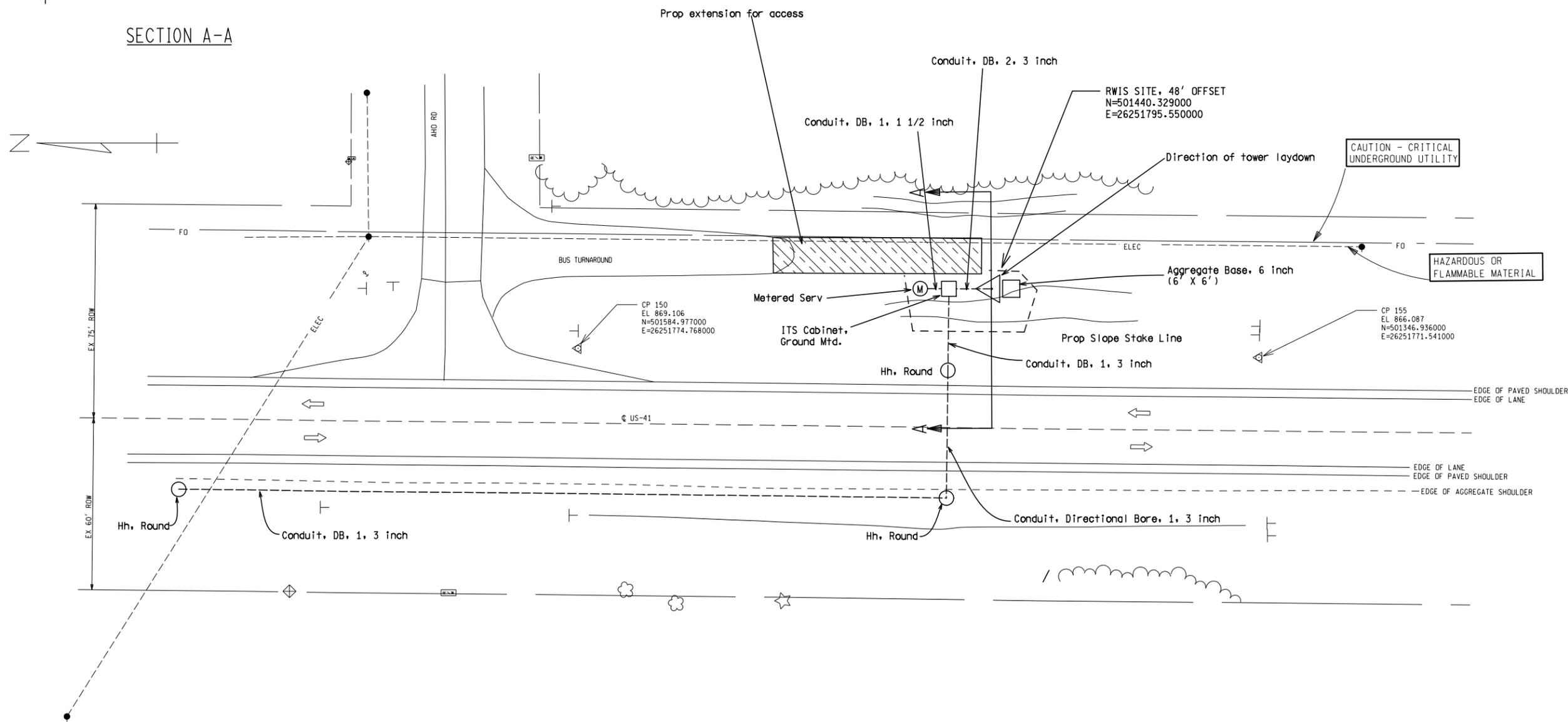
SECTION 6  
T43N,R21W  
MASONVILLE TOWNSHIP



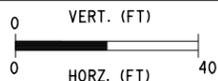
CONSTRUCTION QUANTITIES THIS SHEET

- 3 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 300 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 50 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 1700 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 15 Cyd Embankment, LM
- 104 Syd Approach, C I II, 6 inch
- 1 Ea Lightning Protection, Pole
- 80 Syd Slope Restoration, Type A
- 17 Cyd Excavation, Earth
- 1 Ea Serv Disconnect
- 10 Cyd Excavation, Fdn
- 8 Cyd Backfill, Structure, CIP
- 145 Lb Reinforcement, Steel, Epoxy Coated
- 2.5 Cyd Conc, Low Temperature Protection
- 2.5 Cyd Substructure Conc

SECTION A-A



NO.	DATE	AUTH	DESCRIPTION



FILE: 15 ESC US41.dgn

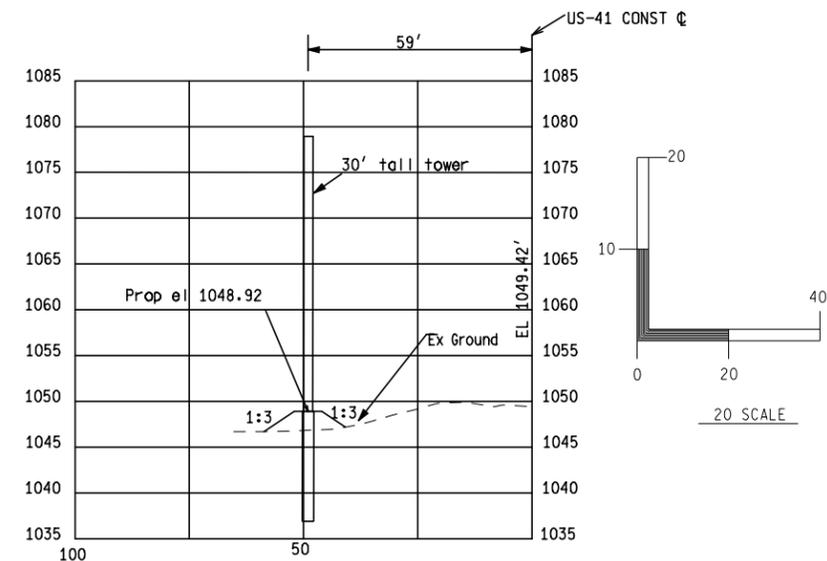
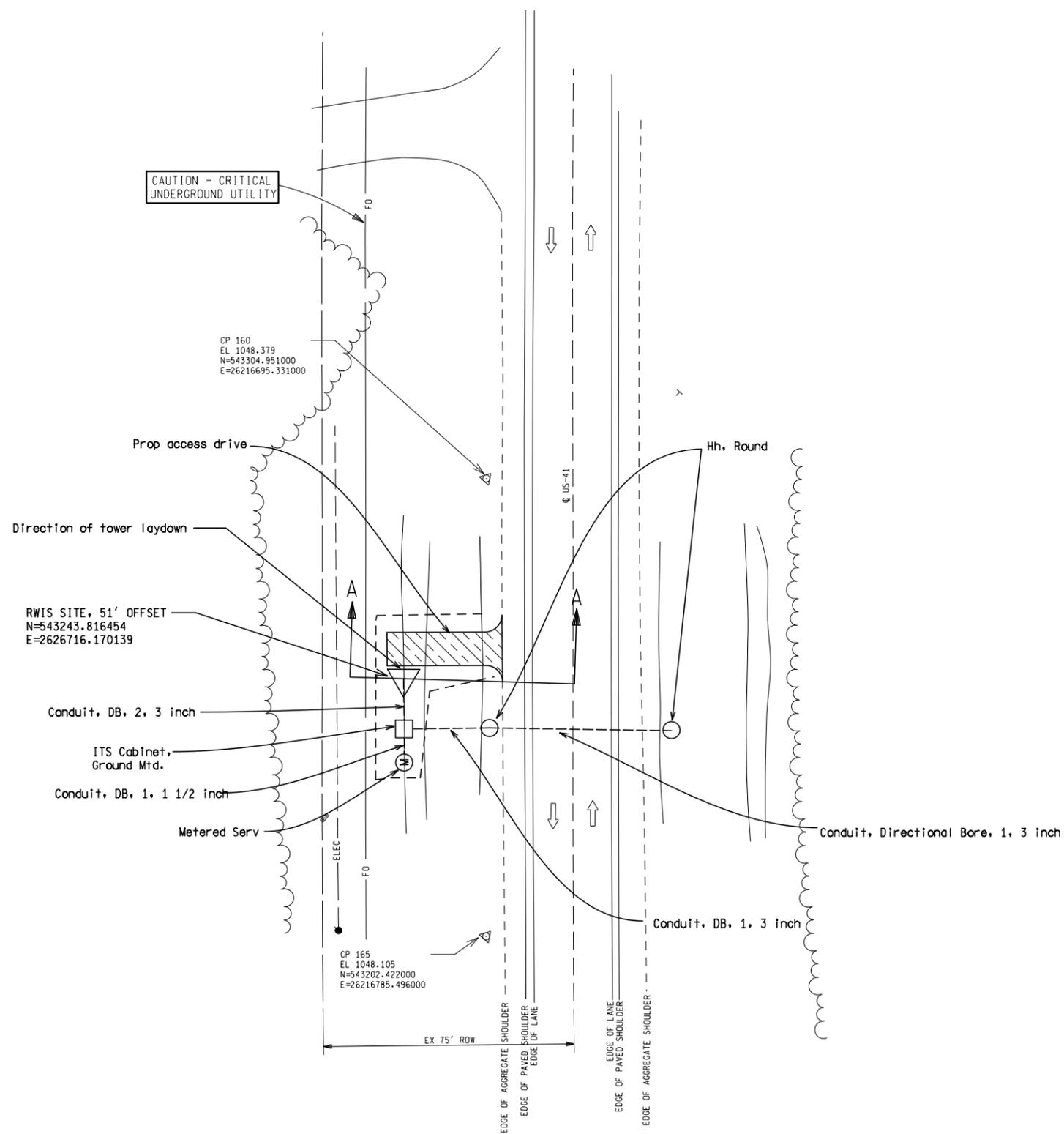
DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

CS: 84911  
JN: 107425A

ESS SITE #15 CONSTRUCTION SHEET  
US-41, DELTA COUNTY

DRAWING SHEET  
CONST 29

SECTION 25  
T45N.R23W  
SKANDIA TOWNSHIP



SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
25 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
55 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
1350 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
38 Cyd	Embankment, LM
45 Syd	Approach, CI 11, 6 inch
1 Ea	Lightning Protection, Pole
70 Syd	Slope Restoration, Type A
11 Cyd	Excavation, Earth
2.3 Cyd	Conc, Grade S2
8 Lb	Reinforcement, Steel
1 Ea	Serv Disconnect
10 Cyd	Excavation, Fdn
8 Cyd	Backfill, Structure, CIP
145 Lb	Reinforcement, Steel, Epoxy Coated
2.5 Cyd	Conc, Low Temperature Protection
2.5 Cyd	Substructure Conc

NO.	DATE	AUTH	DESCRIPTION



FILE: 16 ESC US41.dgn

DATE: 4/4/12

DESIGN UNIT: GUSTAFSON

TSC: ISHPEMING

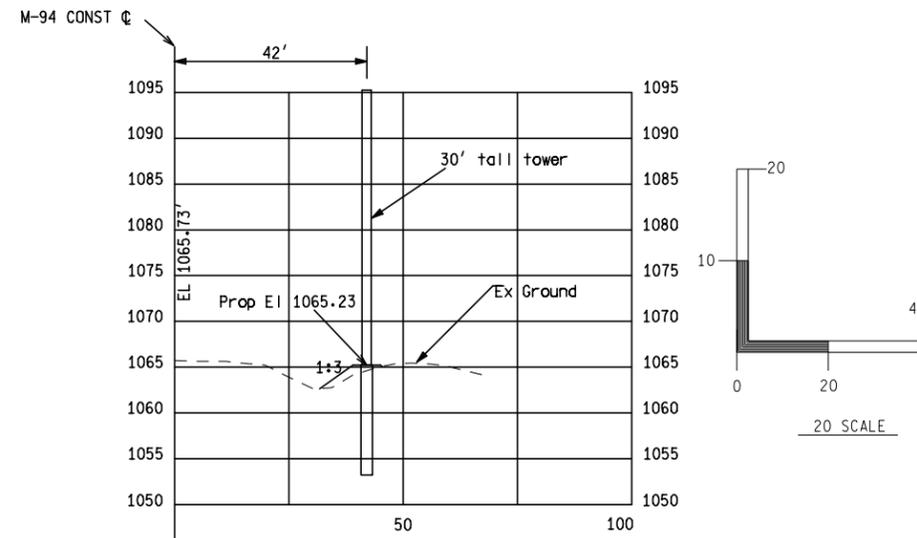
CS: 84911

JN: 107425A

ESS SITE #16 CONSTRUCTION SHEET  
US-41, MARQUETTE COUNTY

DRAWING	SHEET
	CONST
	30

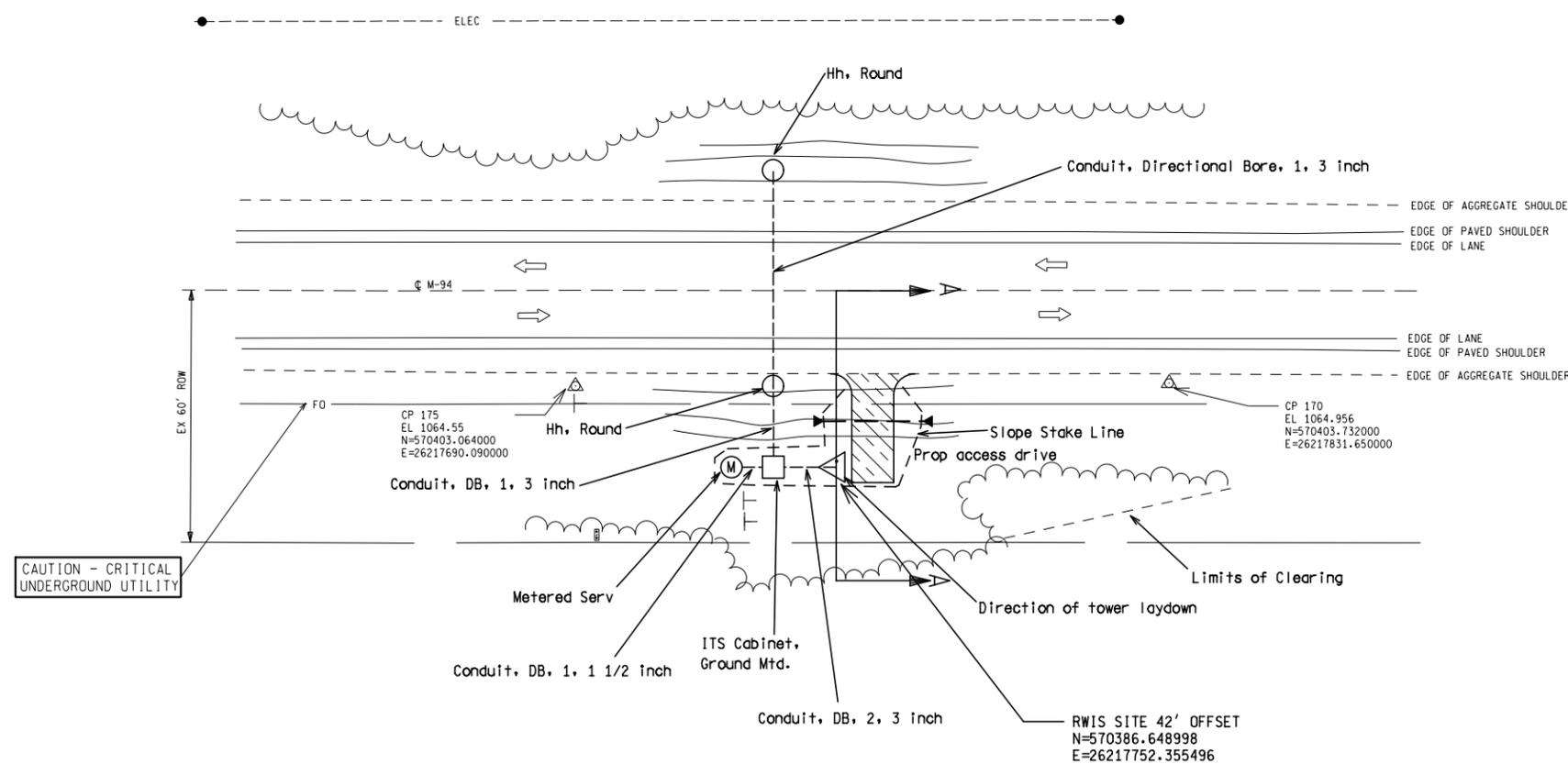
SECTION 31  
T46N.R22W  
ROCK RIVER TOWNSHIP



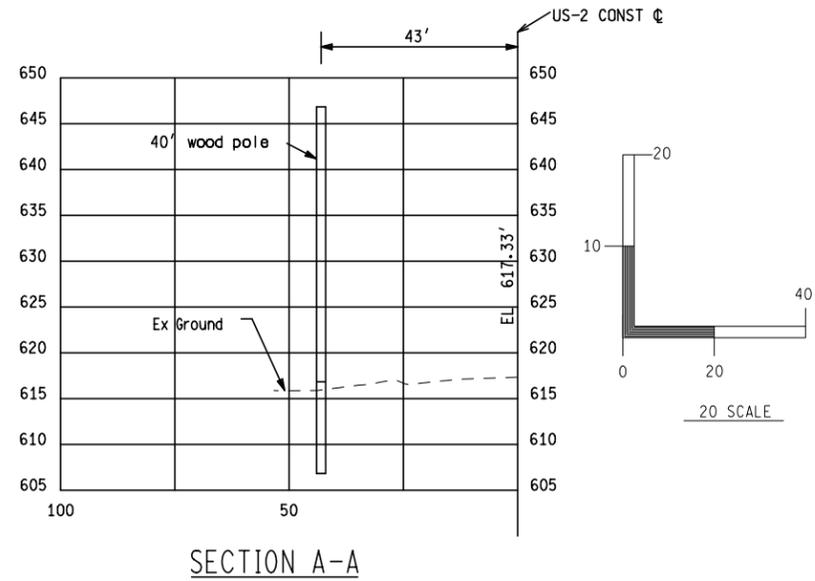
SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

- 2 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 25 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 50 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 700 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 1 Ea Lightning Protection, Pole
- 24 Ft Culv, CI A, 18 inch
- 2 Ea Culv, Slip End Sect, 1 on 6, 18 inch, Longit
- 30 Syd Approach, CI II, 6 inch
- 24 Cyd Embankment, LM
- 0.02 Acre Clearing
- 50 Syd Slope Restoration, Type A
- 7 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.08 LS Drilled Shaft Equipment, Furnished
- 1 Ea Serv Disconnect



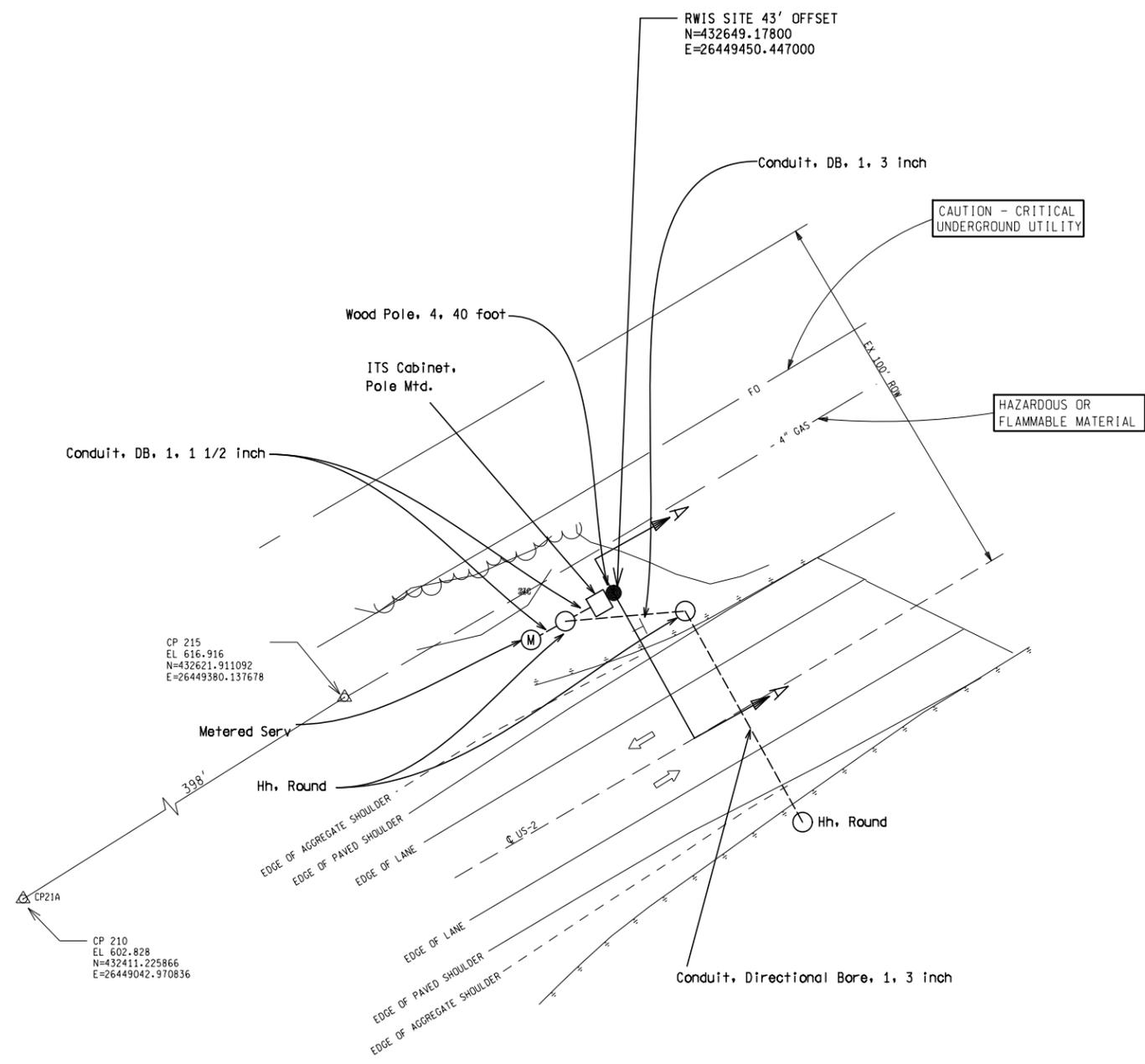
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 4/4/12	CS: 84911	ESS SITE #17 CONSTRUCTION SHEET	DRAWING	SHEET
								0 VERT. (FT)	FILE: 17 ESC M94.dgn	DESIGN UNIT: GUSTAFSON	JN: 107425A	M-94, ALGER COUNTY		CONST
								0 HORZ. (FT)		TSC: ISHPEMING				31



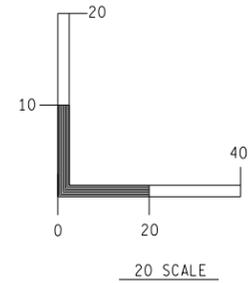
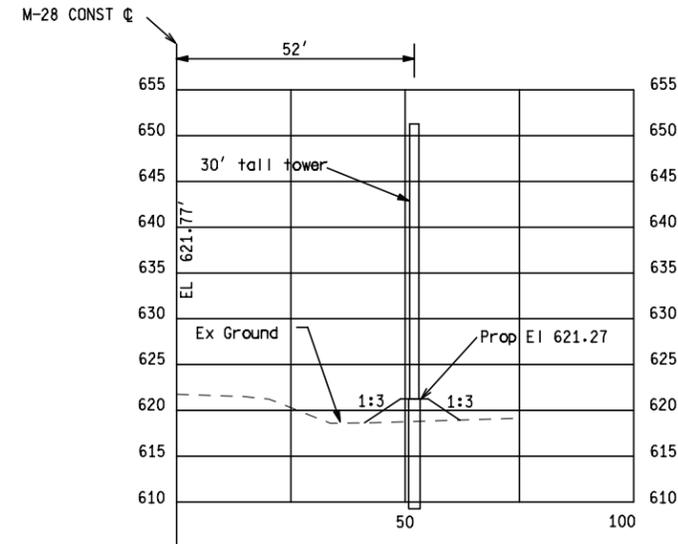
SECTION A-A

**CONSTRUCTION QUANTITIES THIS SHEET**

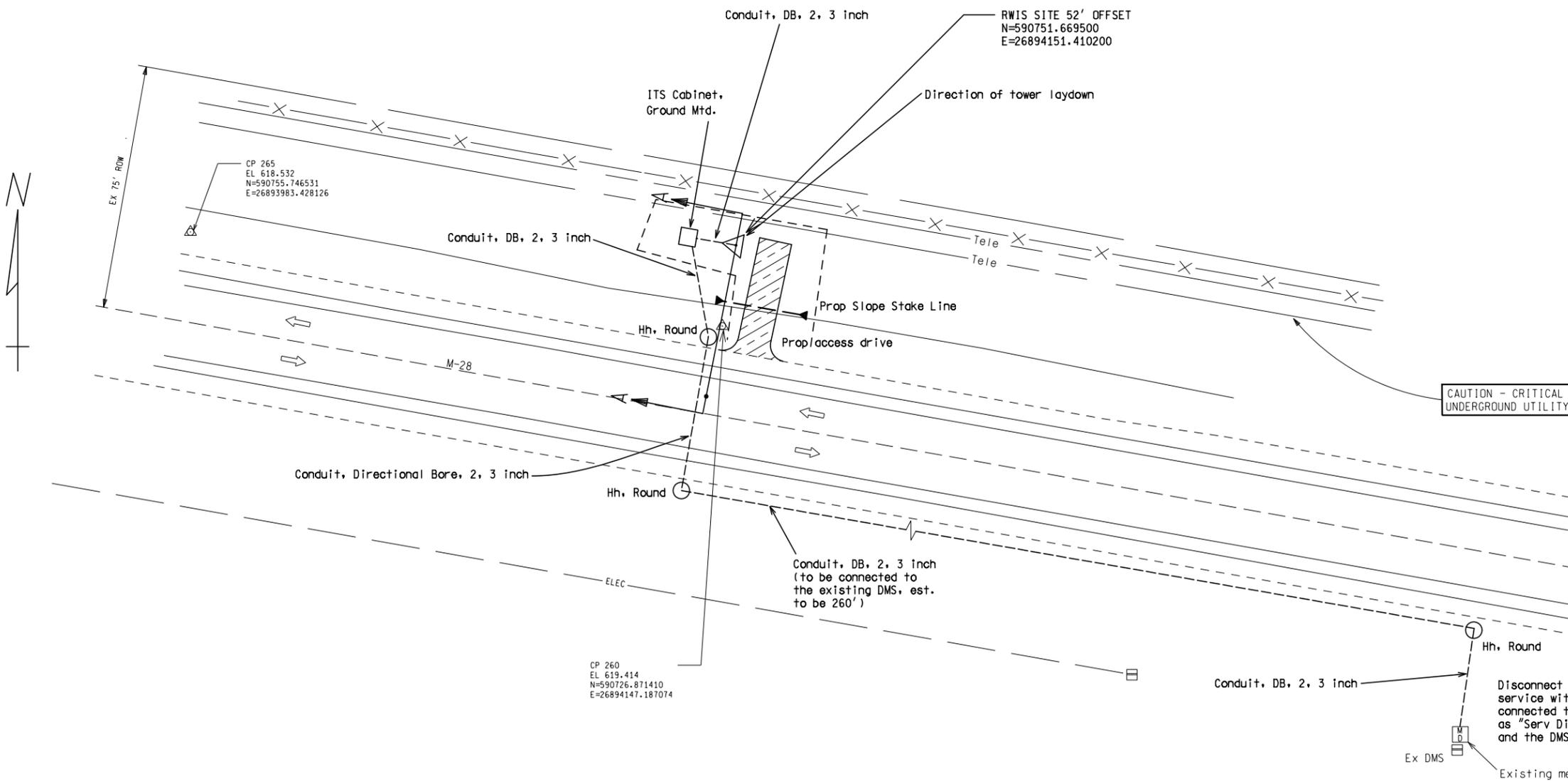
2 Ea	Hh, Round
30 Ft	Conduit, DB, 1, 1 1/2 inch
30 Ft	Cable, Sec, 600V, 3, 1/C#4
30 Ft	Cable, Equipment Grounding Wire, 1/C#4
35 Ft	Conduit, DB, 1, 3 inch
65 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
1 Ea	Wood Pole, 4, 40 foot
1 Ea	ITS Cabinet, Pole Mtd.
8500 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	Lightning Protection, Pole
5 Syd	Slope Restoration, Type A
1 Ea	Serv Disconnect







SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET	
3 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
350 Ft	Conduit, DB, 2, 3 inch
50 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Serv Disconnect
4 Sft	Sign, Type III B
1 Ea	ESS Tower
12 Ft	Post, Steel, 3 lb
1440 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Lightning Protection, Pole
115 Cyd	Embankment, LM
50 Syd	Approach, CI II, 6 inch
150 Syd	Slope Restoration, Type A
17 Cyd	Excavation, Earth
2.2 Cyd	Conc. Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.09 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
24 Ft	Culv, CI F, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
1 Ea	Serv Disconnect

THE IMPROVEMENTS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE MICHIGAN DEPARTMENT OF TRANSPORTATION 2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION. PHYSICAL ROAD NUMBER (PR#) & MILEPOST (MP) DATA ARE FROM MICHIGAN GEOGRAPHIC FRAMEWORK VERSION #11.

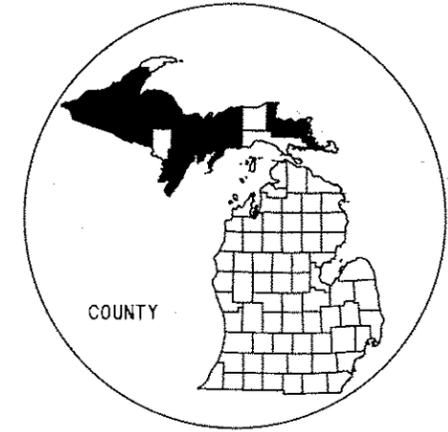
# MICHIGAN DEPARTMENT OF TRANSPORTATION

US-2, US-41, US-45, M-28,  
M-35, M-38, M-94, M-95

CITY OF WAKEFIELD

BOHEMIA, CHASSELL, DAFTER, DUNCAN, MANISTIQUE,  
MASONVILLE, MUELLER, NEGAUNEE, OSCEOLA,  
REPUBLIC, ROCKLAND, ROCK RIVER AND SKANDIA TOWNSHIPS

ALGER, CHIPPEWA, DELTA, GOGEBIC, HOUGHTON,  
MARQUETTE, MENOMINEE ONTONAGON AND SCHOOLCRAFT COUNTIES



COUNTY

COUNTY KEY

### 2010 TRAFFIC DATA

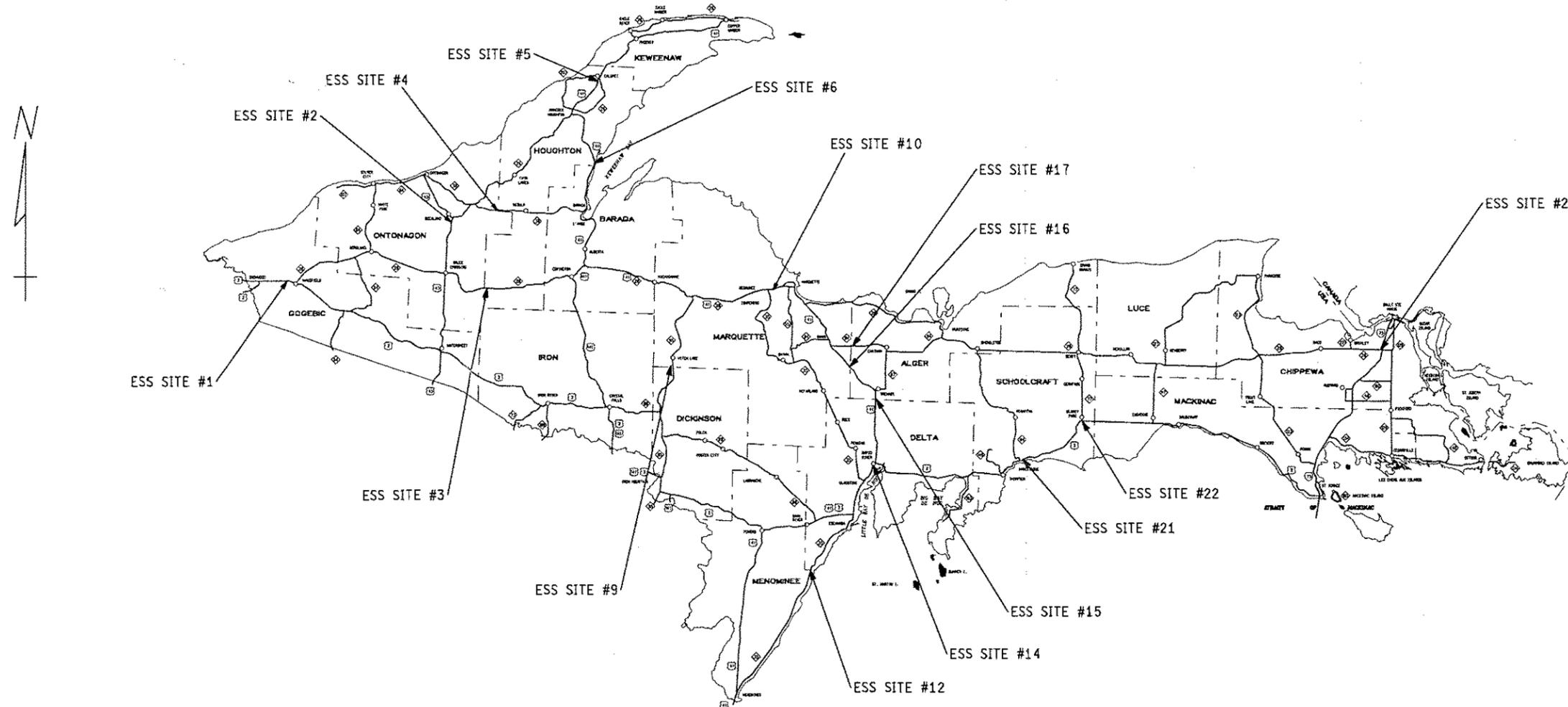
### SPEED DATA

ROAD (SITE #)	A.D.T.	D.H.V.	COMM.	DESIGN	POSTED
US-2 (1)	5800	564	7%	40	40
US-45 (2)	1300	206	10%	55	55
M-28 (3)	1400	165	9%	55	55
M-38 (4)	600	117	8%	55	55
US-41 (5)	6600	612	2%	45	45
US-41 (6)	4100	500	7%	55	55
M-95 (9)	1700	179	15%	55	55
US-41 (10)	8300	926	3%	55	55
M-35 (12)	2800	340	19%	55	55
US-2 (14)	4300	516	10%	55	55
US-41 (15)	2200	254	11%	55	55
US-41 (16)	1900	201	8%	55	55
M-94 (17)	1400	180	7%	55	55
US-2 (21)	7100	742	9%	55	55
US-2 (22)	3800	602	14%	55	55
M-28 (26)	3500	456	5%	55	55

SECTION	CONTROL SEC	JOB NO.	FEDERAL PROJECT	ITEM
1	84911	107425A		

CS:84911

JN:107425A



### APPROVALS

RECOMMENDED FOR APPROVAL BY: *Al Anderson* 4/11/12  
AL ANDERSON, P.E. - DELIVERY ENGINEER DATE

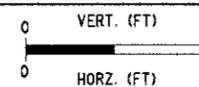
RECOMMENDED FOR APPROVAL BY: *Dawn Gustafson* 4-3-12  
DAWN GUSTAFSON, P.E. - TRAFFIC AND SAFETY ENGINEER DATE

MICHIGAN DEPARTMENT OF TRANSPORTATION  
KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: *Mark A. Van Port Fleet*  
MARK A. VAN PORT FLEET, P.E. - ENGINEER OF DEVELOPMENT DATE

MILES:  
CONTRACT FOR:  
CONSTRUCTION OF 16 ENVIRONMENTAL SENSOR STATIONS

NO.	DATE	AUTH.	DESCRIPTION	NO.	DATE	AUTH.	DESCRIPTION



FILE:107425 Title.dgn

DATE:  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEWING

CS: 84911  
JN: 107425A

DRAWING SHEET  
CONST



**PUBLIC UTILITIES**

The existing utilities listed below and shown on these plans represent the best information available as obtained on our surveys. This information does not relieve the contractor of the responsibility to be satisfied as to it's accuracy and the location of existing utilities.

<u>Name Of Owner</u>	<u>Type Of Utility</u>
<b>ESS SITE #1, CS 27021</b>	
City of Wakefield Attention: John Granato 311 Sunday Lake Street Wakefield, MI 49968 Phone: (906) 299-5132	Sewer, Electric
ATT Attention: Marsha Bertoldi 211 East B Street Iron Mountain, MI 49801 Phone: (906) 779-2744 Email: <a href="mailto:mb8983@att.com">mb8983@att.com</a>	Telephone
Xcel Energy Attention: Stacey Westeen 101 Alfred Wright Blvd. Ironwood, MI 49938 Phone: (906) 932-2848	Gas, Electric
<b>ESS SITE #2, CS 66032</b>	
Ontonagon County Telephone Company Attention: Fred Lundberg 618 River Street Ontonagon, MI 49953 Phone: (906) 884-9911	Telephone
Upper Peninsula Power Co. Attention: Mike Mickus 18494 E. Canal Road P.O. Box 130 Houghton, MI 49931 Phone: (906) 483-4543	Electric
<b>ESS SITE #3, CS 31021</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Midway Telephone Attention: Steve Rajala 11697 HWY M-28 Watton, Michigan 49970 Phone: (906) 355-2300	Telephone
Ontonagon County Rural Electrification Association Attention: Debbie Miles P. O. Box 97 Ontonagon, Michigan 49953 Phone: (906) 884-4151	Electric
<b>ESS SITE #4, CS 66041</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone

Ontonagon County Rural Electrification Association Attention: Debbie Miles P. O. Box 97 Ontonagon, Michigan 49953 Phone: (906) 884-4151	Electric
Ontonagon County Telephone Company Attention: Fred Lundberg 618 River Road Ontonagon, MI 49953 Phone: (906) 884-9911	Telephone
<b>ESS SITE #5, CS 31052</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
<b>ESS SITE #6, CS 31051</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a> Phone: (906) 475-0107 x1039	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
Baraga Telephone Company Attention: Paul Stark 204 State Street Baraga, Michigan 49908 Phone: (906) 353-6644	Telephone
<b>ESS SITE #9, CS 52011</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone

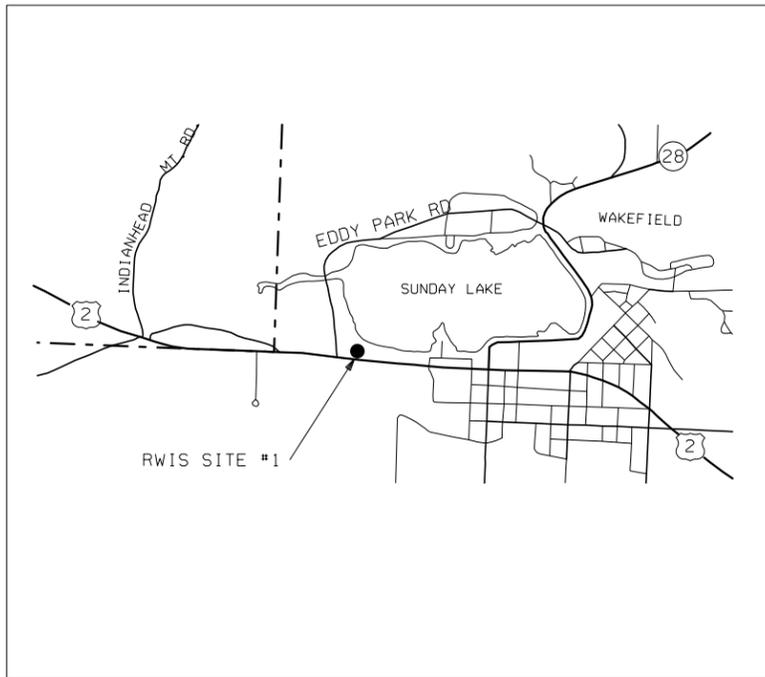
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Upper Peninsula Power Co. Attention: Michael Jurmu 18494 Canal Road Houghton, Michigan 49931 Phone: (906) 483-4572	Electric
<b>ESS SITE #10, CS 52042</b>	
AT&T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168	Telephone
Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a>	CATV
Marquette Board of Light and Power Attention: Karl Benstrom 2200 Wright Street. Marquette, Michigan 49855 Phone: (906) 228-0320	Electric
Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a>	Gas
Negaunee Township Attention: Mike Adams 42 M-35 Negaunee, MI 49866 Phone: (906) 475-7869	Water
<b>ESS SITE #12, CS 55031</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric
ATT Attention: Marsha Bertoldi 211 East B Street Iron Mountain, MI 49801 Phone: (906) 779-2744 Email: <a href="mailto:mb8983@att.com">mb8983@att.com</a>	Telephone
<b>ESS SITE #14, CS 21025</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric

AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone
Charter Communications Attention: Scott Beaster 385 Woodward Avenue Kingsford ,MI 49802 Phone: (906) 630-7795 Email: <a href="mailto:scott.beaster@chartercom.com">scott.beaster@chartercom.com</a>	CATV
DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas
Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjousineau@upppo.com">mjousineau@upppo.com</a>	Electric
WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergies.com">bruce.clark@weenergies.com</a>	Electric
<b>ESS SITE #15, CS 21051</b>	
Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a>	Electric
American Transmission Company Attention: Matt Ernst 801 O'Keefe Road, P.O. Box 6113 DePere, WI 54115-4928 Phone: (920) 338-6573 Email: <a href="mailto:mernst@atcllc.com">mernst@atcllc.com</a>	Electric
AT&T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a>	Telephone
Charter Communications Attention: Scott Beaster 385 Woodward Avenue Kingsford ,MI 49802 Phone: (906) 630-7795 Email: <a href="mailto:scott.beaster@chartercom.com">scott.beaster@chartercom.com</a>	CATV
DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a>	Gas

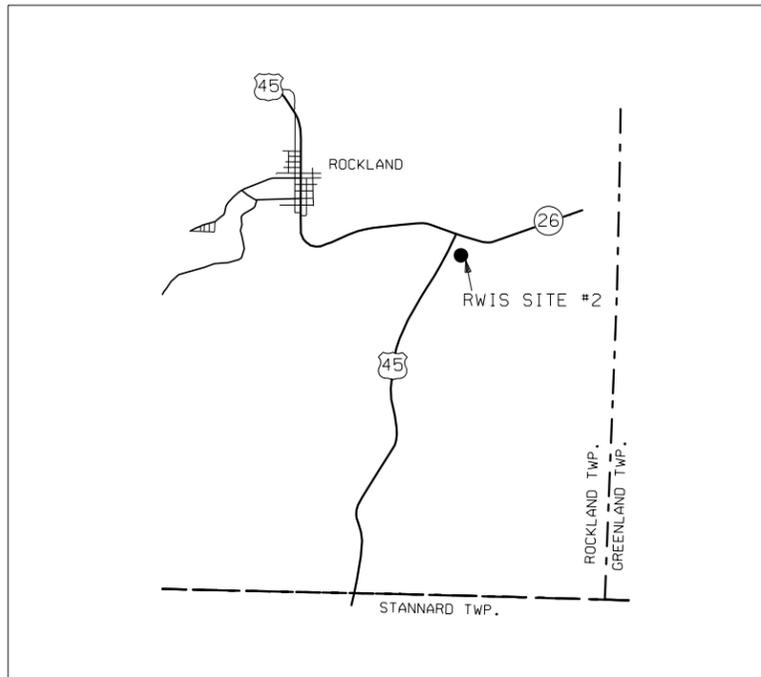
<p>Great Lakes Gas Transmission Attention: Kitty Martin 5250 Corporate Drive Troy, MI 48098 Phone: (248) 205-7596 Email: <a href="mailto:kitty_martin@transcanada.com">kitty_martin@transcanada.com</a></p> <p>TDS Telecom (Chatham Telephone) Attention: Bruce Kallio E3708 Marquette Street Chatham, MI 49816 Phone: (906) 439-5008 Email: <a href="mailto:bruce.kallio@tdstelecom.com">bruce.kallio@tdstelecom.com</a></p> <p>Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a></p> <p>WE Energies Attention: Bruce Clark 800 Industrial Park Drive Iron Mountain ,MI 49801 Phone: (906) 779-2486 Email: <a href="mailto:bruce.clark@weenergys.com">bruce.clark@weenergys.com</a></p> <p><b>ESS SITE #16, CS 52043</b></p> <p>Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a></p> <p>AT&amp;T Attention: Kurt Lahtinen 3255 US-41 West Marquette, Michigan 49855 Phone: (906) 225-6168</p> <p>Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a></p> <p>Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a></p> <p>Upper Peninsula Power Co. Attention: William Hereford P.O. Box 357 500 N. Washington Street Ishpeming, MI 49949-0357 Phone: (906) 485-2434</p> <p>TDS Telecom (Chatham Telephone) Attention: Dave Moore P.O. Box 197 Chatham, MI 49816 Phone: (906) 439-5008</p>	<p>Gas</p> <p>Telephone</p> <p>Electric</p> <p>Electric</p> <p>Electric</p> <p>Electric</p> <p>Telephone</p> <p>CATV</p> <p>Gas</p> <p>Electric</p> <p>Telephone</p>	<p><b>ESS SITE #17, CS 02021</b></p> <p>Alger-Delta Electric Coop. Attention: Steve Pyke 426 North 9th Street Gladstone, MI 49837 Phone: (906) 428-4141 Email: <a href="mailto:spykeadcea@chartermi.net">spykeadcea@chartermi.net</a></p> <p>Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a></p> <p>DTE Energy / MichCon Gas Attention: Ken Lake 1250 Mich Con Lane, S.W.,P.O. Box 279 Kalkaska ,MI 49646 Phone: (231) 258-3785 Email: <a href="mailto:lakekm@dteenergy.com">lakekm@dteenergy.com</a></p> <p>Hiawatha Telephone Co. Attention: Richard Kirmo 108 W. Superior Street Munising, MI 49862 Phone: (906) 387-9911</p> <p>TDS Telecom (Chatham Telephone) Attention: Bruce Kallio E3708 Marquette Street Chatham, MI 49816 Phone: (906) 439-5008 Email: <a href="mailto:bruce.kallio@tdstelecom.com">bruce.kallio@tdstelecom.com</a></p> <p>Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a></p> <p><b>ESS SITE #21 and #22, CS 75022</b></p> <p>AT&amp;T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a></p> <p>CenturyLink Attention: Mike Bergeron 100 Second Street, P.O.Box 389 Pinconning ,MI 48650-0389 Phone: (989) 879-8798 Email: <a href="mailto:michael.bergeron@centurytel.com">michael.bergeron@centurytel.com</a></p> <p>Charter Communications Attention: Brian Koski 359 US-41 East Negaunee, MI 49866 Phone: (906) 475-0107 x1039 Email: <a href="mailto:bkoski@chartercom.com">bkoski@chartercom.com</a></p>	<p>Electric</p> <p>CATV</p> <p>Gas</p> <p>Telephone</p> <p>Telephone</p> <p>CATV</p>	<p>City of Manistique Attention: Nick Bosanic P.O. Box 515 Manistique, MI 49854 Phone: (906) 341-5346 Email: <a href="mailto:saldrich@chartermi.net">saldrich@chartermi.net</a> Cloverland Electric Cooperative</p> <p>Attention: James Tennyson 335 Chippewa Ave, P.O. Box 338 Manistique ,MI 49854 Phone: (906) 341-5426 Email: <a href="mailto:jtennyson@edisonsault.com">jtennyson@edisonsault.com</a></p> <p>Great Lakes Gas Transmission Attention: Kitty Martin 5250 Corporate Drive Troy, MI 48098 Phone: (248) 205-7596 Email: <a href="mailto:kitty_martin@transcanada.com">kitty_martin@transcanada.com</a></p> <p>Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a></p> <p>Upper Peninsula Power Co. Attention: Mike Cousineau 2800 29th Ave North Escanaba ,MI 49829 Phone: (906) 786-1739 Email: <a href="mailto:mjcousineau@upppo.com">mjcousineau@upppo.com</a></p> <p>Pentland Township Attention: Gary Fahler 13105 CR 400 Newberry, MI 49868 Ph. (906) 293-8755 Cell (906) 440-2581 Fax (906) 293-8894 Email: <a href="mailto:pentwp@up.net">pentwp@up.net</a></p> <p>Semco Energy Attention: Mr. Val Lindsay 34 US-41 East Negaunee, MI 49866 Phone: (906) 475 -9901 Email: <a href="mailto:Val.Lindsay@semcoenergy.com">Val.Lindsay@semcoenergy.com</a></p> <p><b>ESS SITE #26, CS 17063</b></p> <p>AT&amp;T Attention: Mike Anderson 310 West 7th Street Sault Sainte Marie, MI 49783 Phone: (906) 632-9901 Email: <a href="mailto:Ma1421@att.com">Ma1421@att.com</a></p> <p>Charter Communications Attention: John Randazzo 2682 Ashmun Street Sault Ste. Marie, MI 49783 Ph. (906) 635-3102 Fax (906) 635-1520 Email: <a href="mailto:jrandazzo@chartercom.com">jrandazzo@chartercom.com</a></p>	<p>Water</p> <p>Electric</p> <p>Gas</p> <p>Gas</p> <p>Electric</p> <p>Water &amp; Sewer</p> <p>Gas</p> <p>Telephone</p> <p>Cable</p>	<p>Cloverland Electric Cooperative Attention: Johanna Wiltfong 2916 West M-28 Dafer, MI 49724 Ph. (906) 632-5191 Fax (906) 635-6815 Email: <a href="mailto:jwiltfong@cloverland.com">jwiltfong@cloverland.com</a></p> <p>Chippewa County Telephone Co. Attention: Ron Deneve, Jr P.O. Box 155 Brimley, MI 49715 Ph. (906) 248-3211 Fax (906) 248-6815 Email: <a href="mailto:rdeneve@iamadots.net">rdeneve@iamadots.net</a></p>	<p>Electric</p> <p>Telephone</p>
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<p>REVISIONS</p> <table border="1"> <thead> <tr> <th>NO.</th> <th>DATE</th> <th>AUTH</th> <th>DESCRIPTION</th> <th>NO.</th> <th>DATE</th> <th>AUTH</th> <th>DESCRIPTION</th> </tr> </thead> <tbody> <tr> <td> </td> </tr> </tbody> </table>								NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION									<p>Insert Logo</p> 	<p>NO SCALE</p>	<p>DATE 4/4/12</p> <p>DESIGN UNIT: Gustafson</p> <p>TSC: ISHPEMING</p>	<p>CS: 84911</p> <p>JN: 107425A</p>	<p>PROJECT INFORMATION SHEET</p>	<p>DRAWING</p> <p>PROJ</p>	<p>SHEET</p> <p>CONST</p>
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION																							

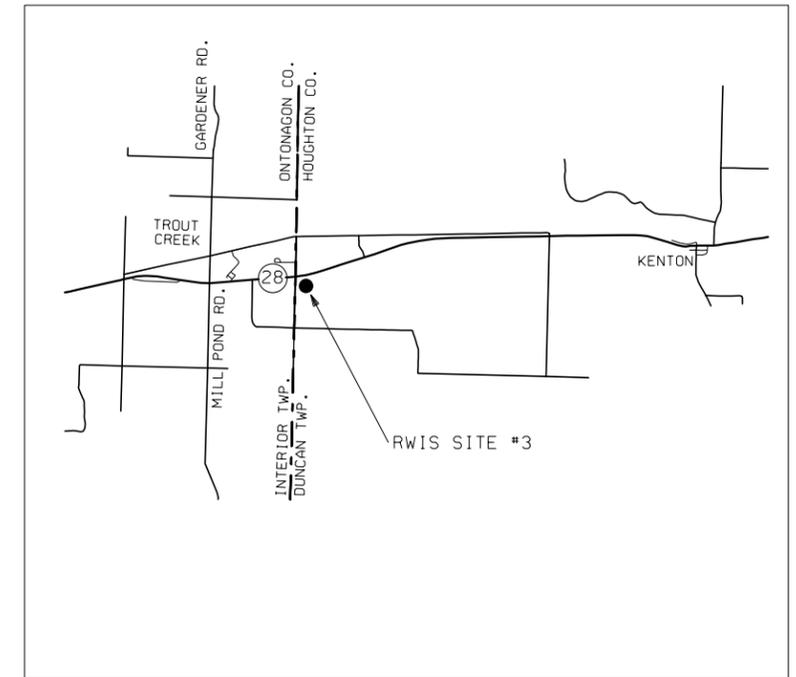
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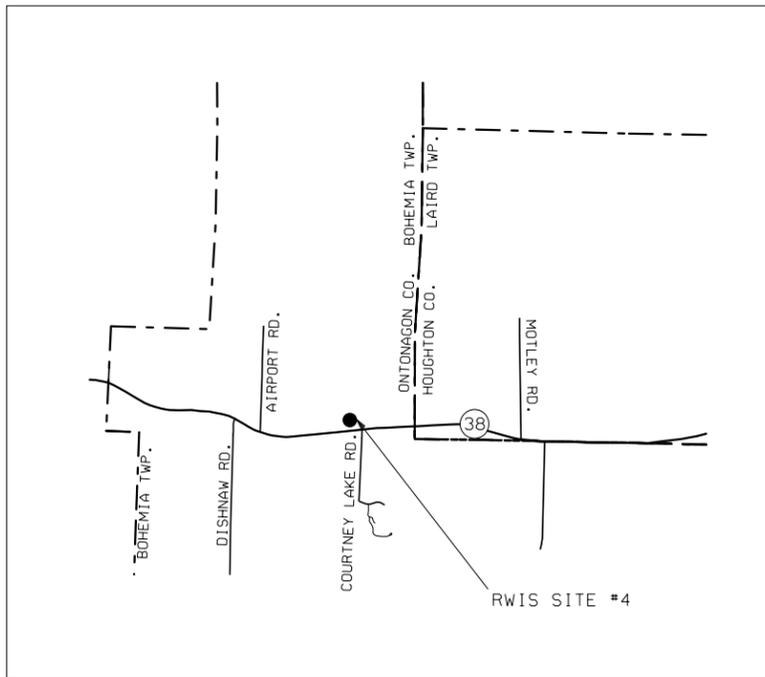
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GOGEBIC COUNTY  
CS 27021, CS MP 12.030



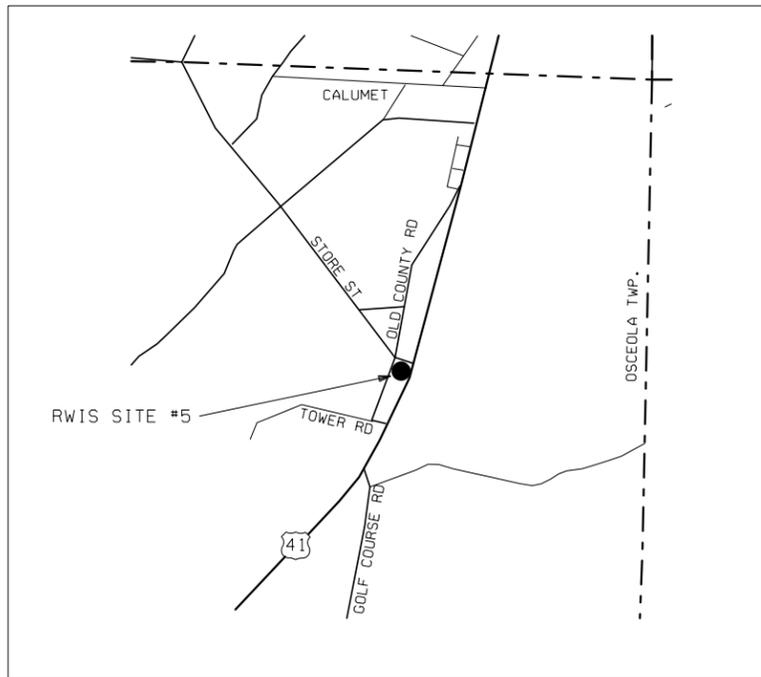
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ONTONAGON COUNTY  
CS 66032, CS MP 13.427



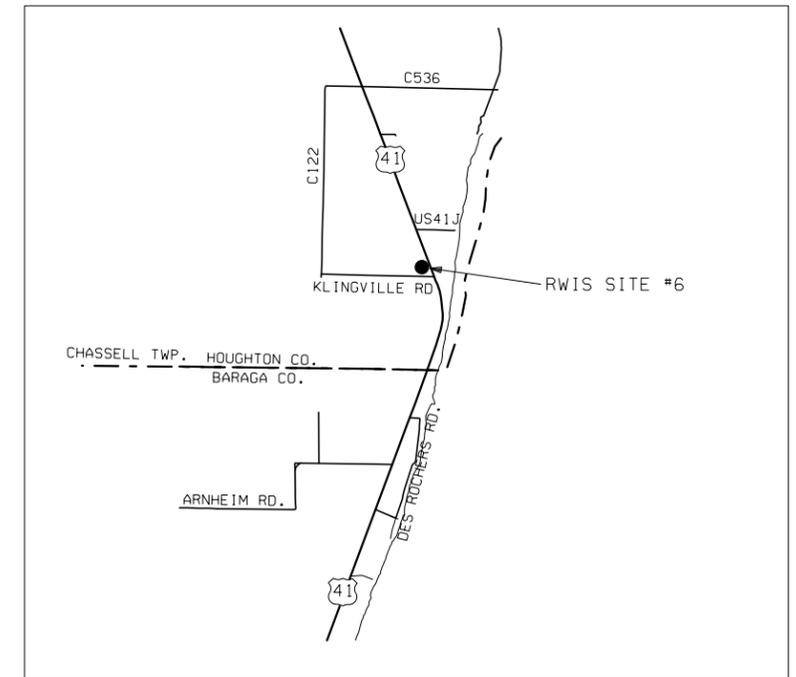
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HOUGHTON COUNTY  
CS 31021, CS MP 0.042



RWIS SITE #4: M-38 AT THE HOUGHTON/ONTONAGON CO. LINE  
ONTONAGON COUNTY  
CS 66041, CS MP 5.306



RWIS SITE #5: US-41 AT STORE ST.  
HOUGHTON COUNTY  
CS 31052, CS MP 10.795



RWIS SITE #6: US-41 AT KLINGVILLE RD.  
HOUGHTON COUNTY  
CS 31051, CS MP 1.022

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



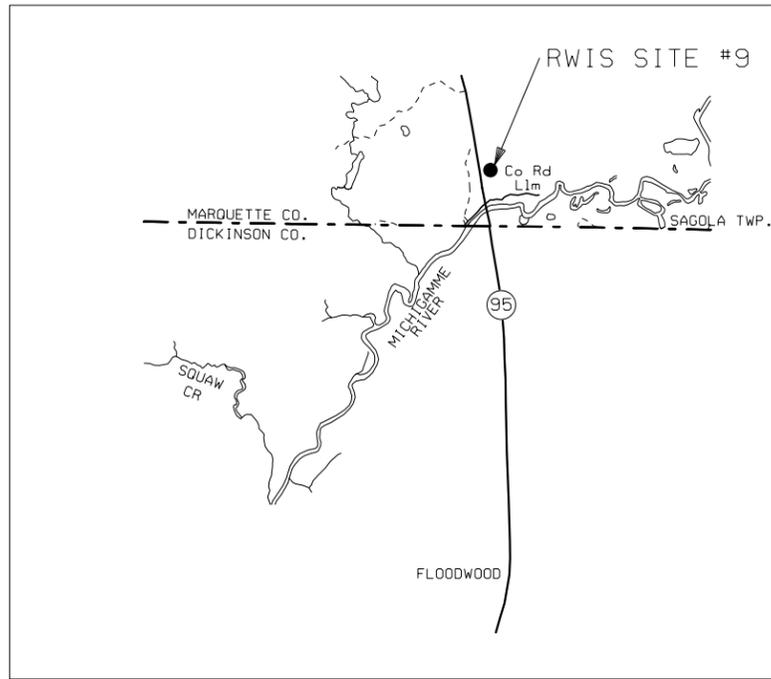
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DATE:4/4/12  
DESIGN UNIT:GUSTAFSON  
TSC:ISHPEMING

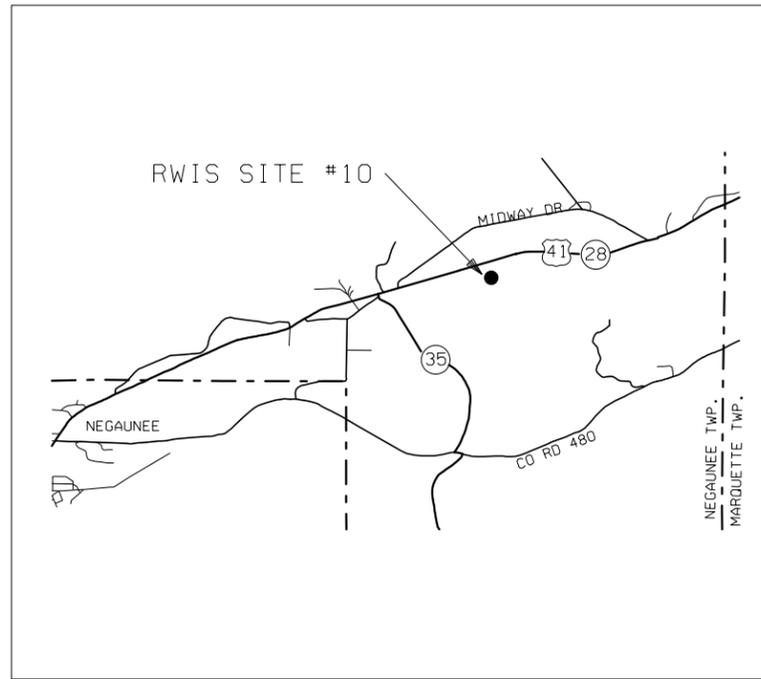
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JN:107425A

VICINITY MAP

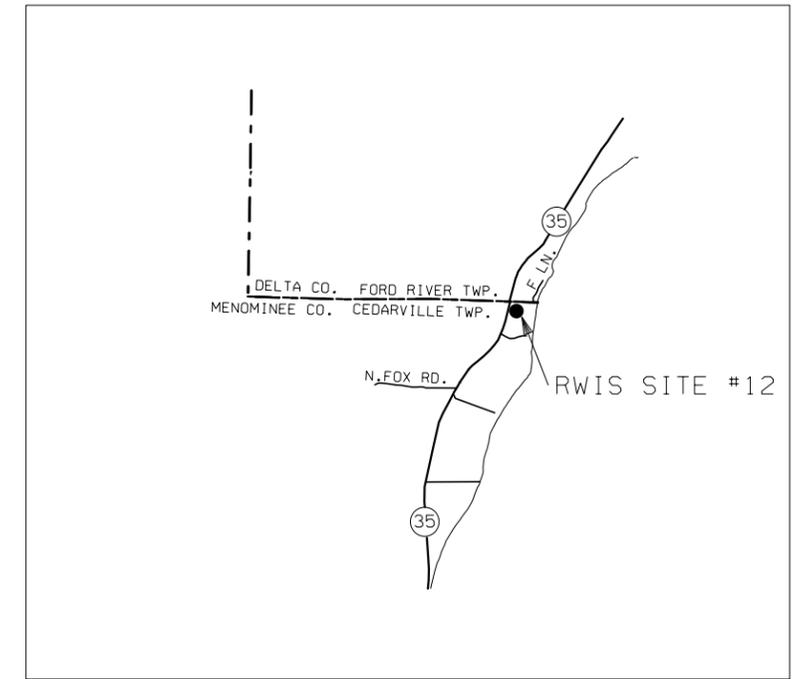
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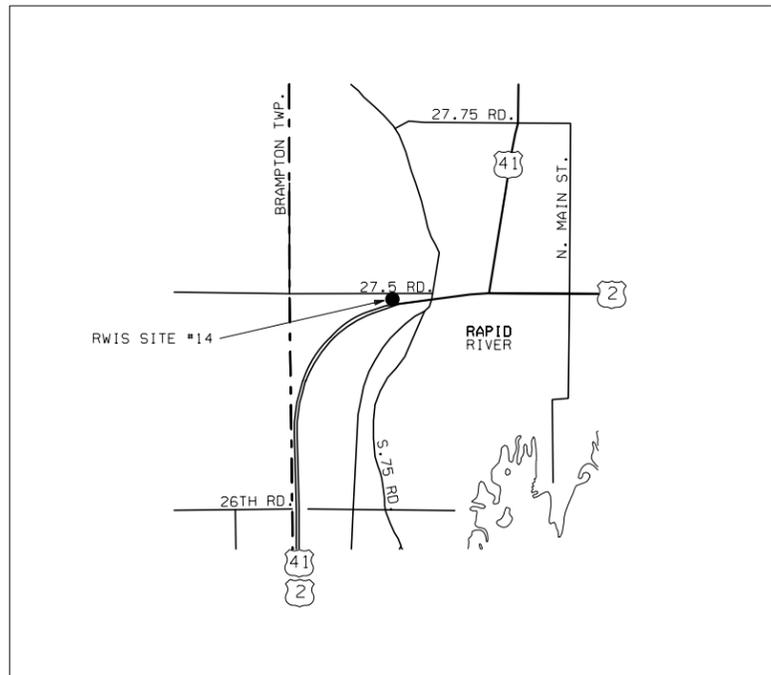
RWIS SITE #9: M-95 AT MARQUETTE/DICKINSON CO. LINE  
MARQUETTE COUNTY  
CS 52011, CS MP 0.221



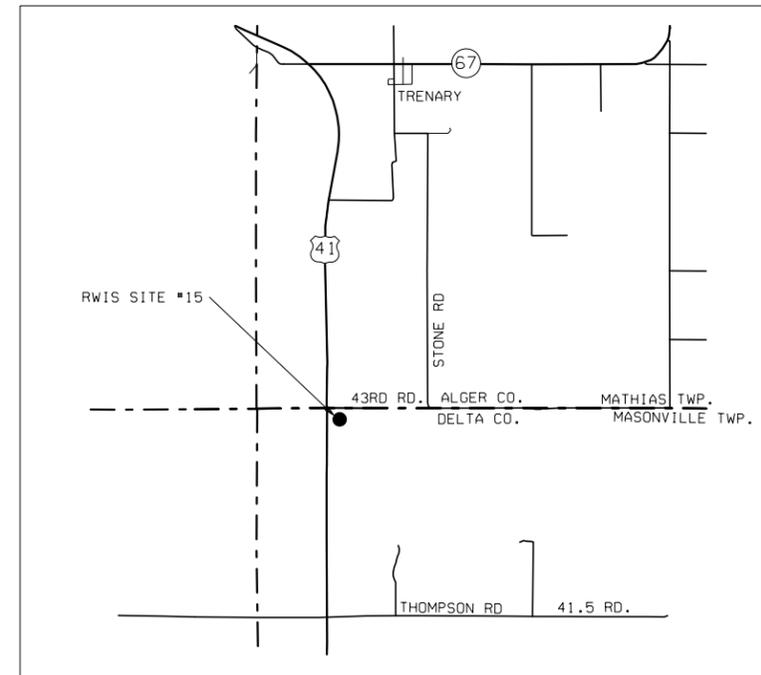
RWIS SITE #10: US-41 NEAR M-35  
MARQUETTE COUNTY  
CS 52042, CS MP 11.184



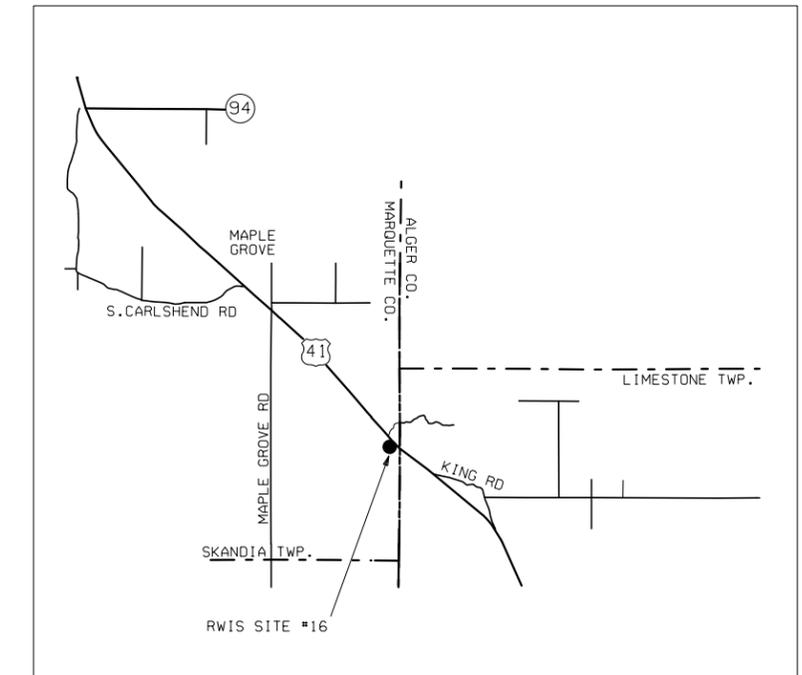
RWIS SITE #12: M-35 AT MENOMINEE/DELTA CO. LINE  
MENOMINEE COUNTY  
CS 55031, CS MP 34.575



RWIS SITE #14: US-2 IN RAPID RIVER  
DELTA COUNTY  
CS 21025, CS MP 5.80

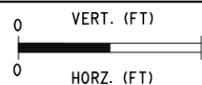


RWIS SITE #15: US-41 AT DELTA/ALGER CO LINE  
DELTA COUNTY  
CS 21051, CS MP 16.170



RWIS SITE #16: US-41 AT MARQUETTE/ALGER CO LINE  
MARQUETTE COUNTY  
CS 52043, CS MP 0.100

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



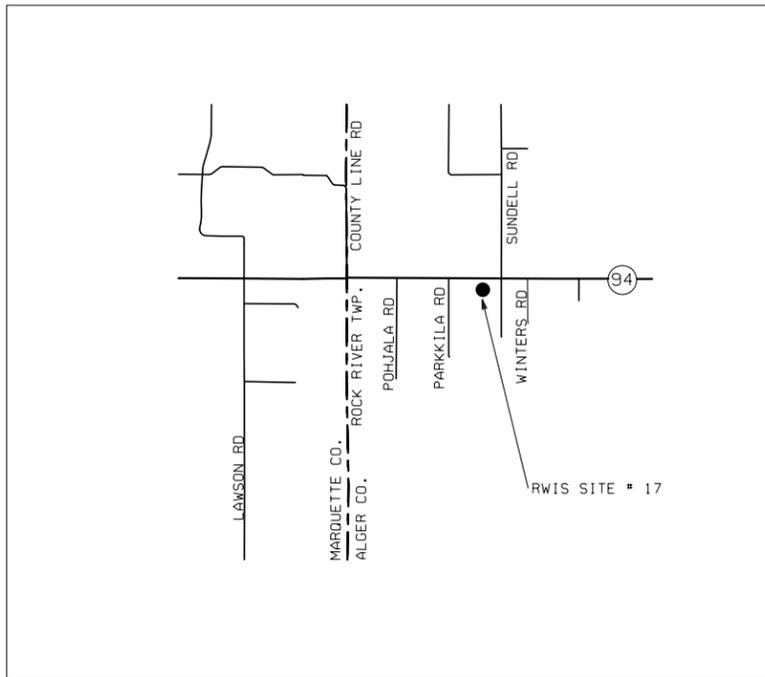
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DATE:4/4/12  
DESIGN UNIT:GUSTAFSON  
TSC:ISHPEMING

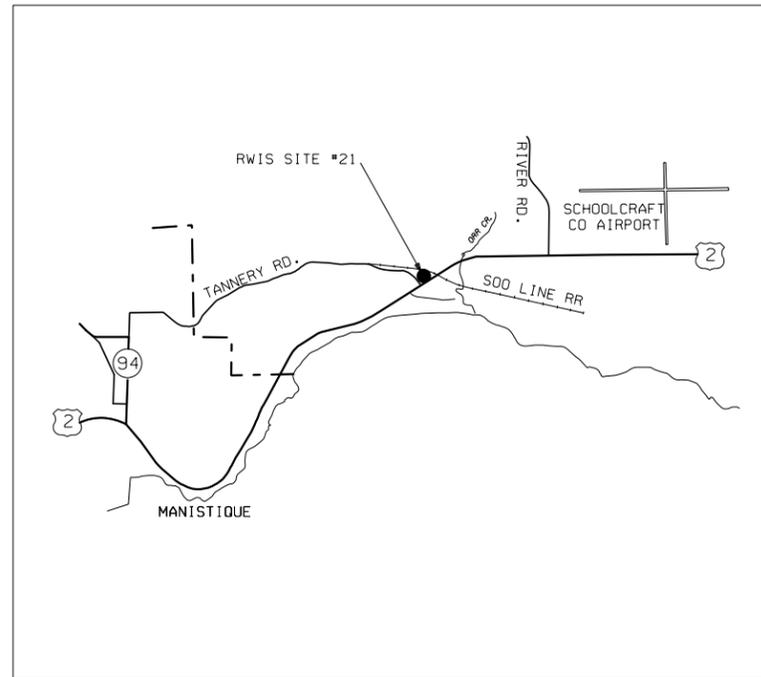
CS:84911  
JN:107425A

VICINITY MAP

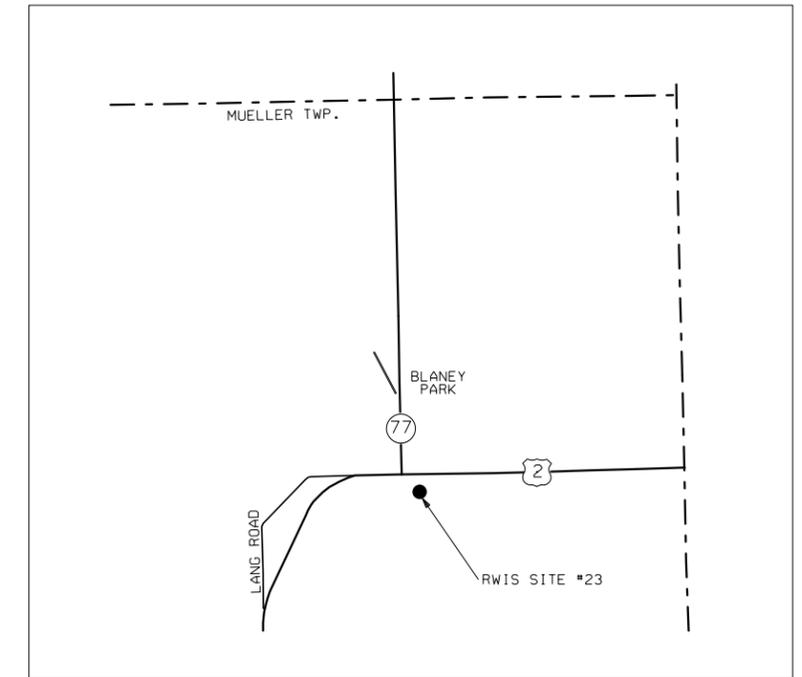
DRAWING SHEET  
2 CONST  
6



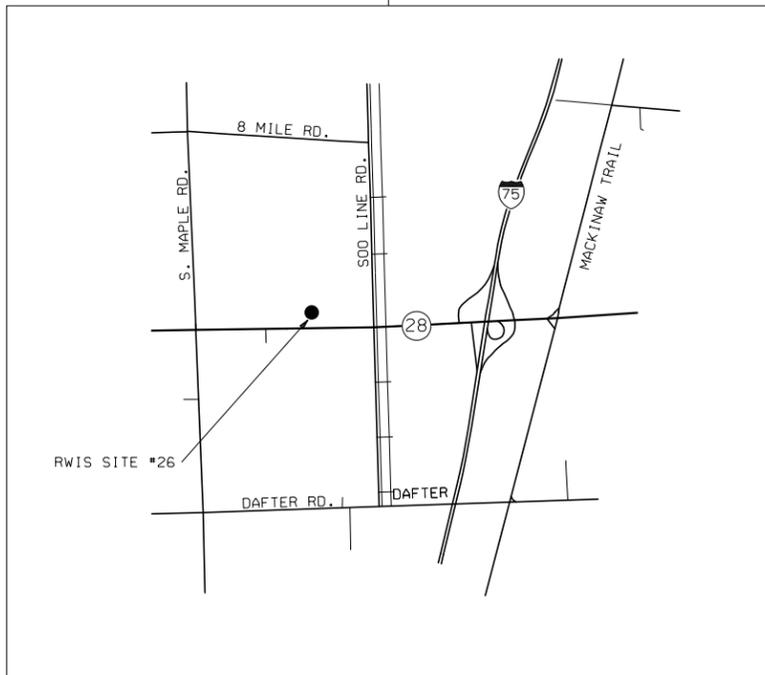
RWIS SITE #17: M-94 IN RUMLEY/SUNDELL  
ALGER COUNTY  
CS 02021, CS MP 0.100



RWIS SITE #21: US-2 EAST OF MANISTIQUE  
SCHOOLCRAFT COUNTY  
CS 75022, CS MP 4.095

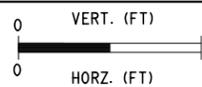


RWIS SITE #22: US-2 AT M-77  
SCHOOLCRAFT COUNTY  
CS 75022, CS MP 22.920



RWIS SITE #26: M-28 WEST OF SOO LINE RD.  
CHIPPEWA COUNTY  
CS 17063, CS MP 6.581

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

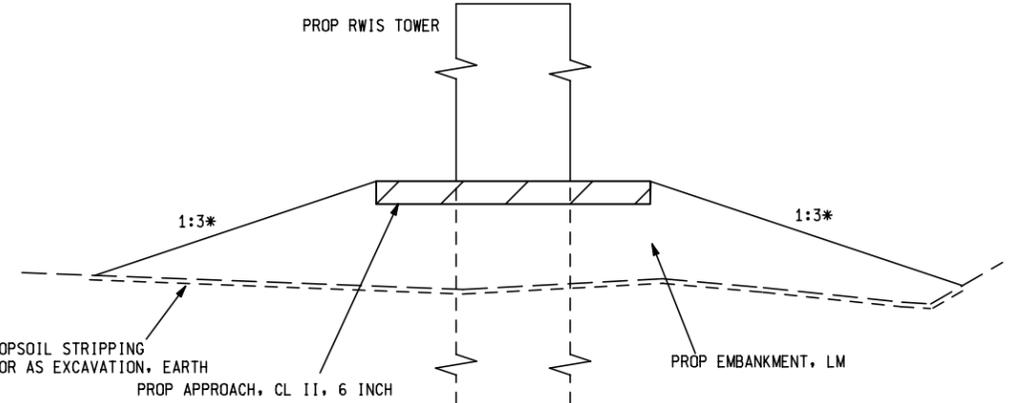
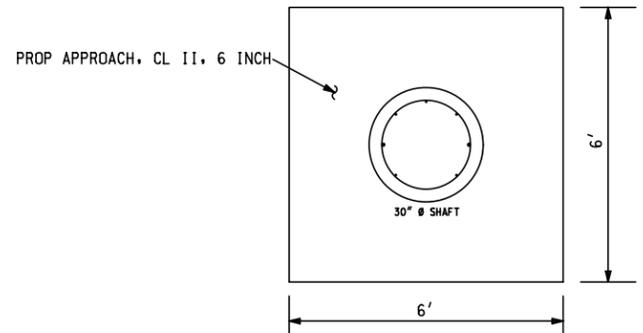
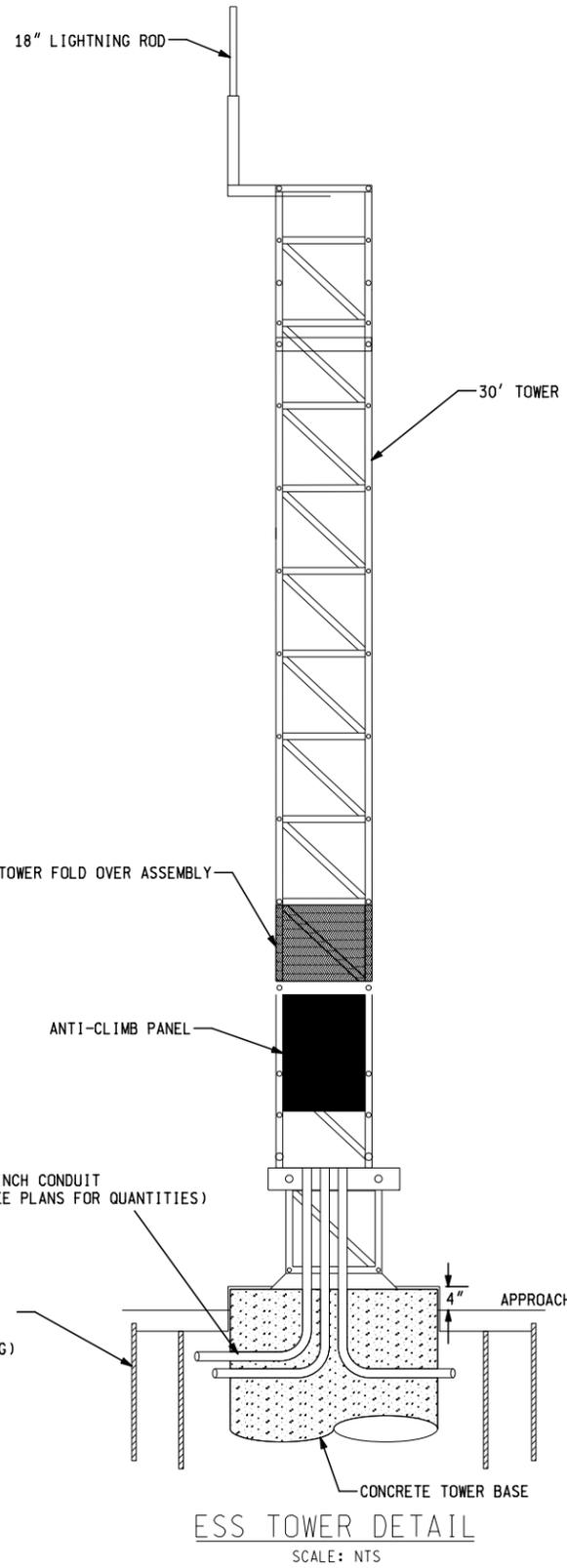


DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPERING  
FILE: 107425 Vicinity Map.dgn

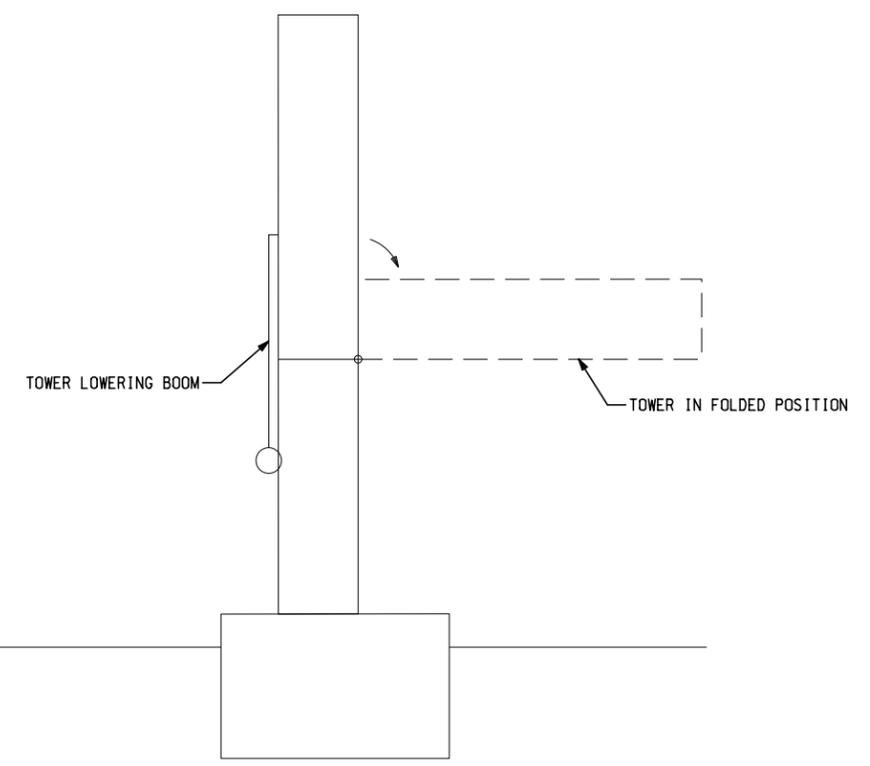
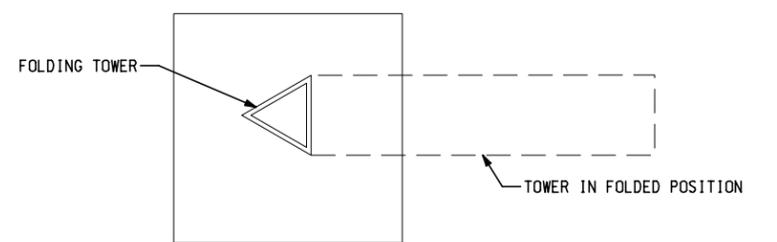
CS: 84911  
JN: 107425A

VICINITY MAP

DRAWING	SHEET
3	CONST
	7



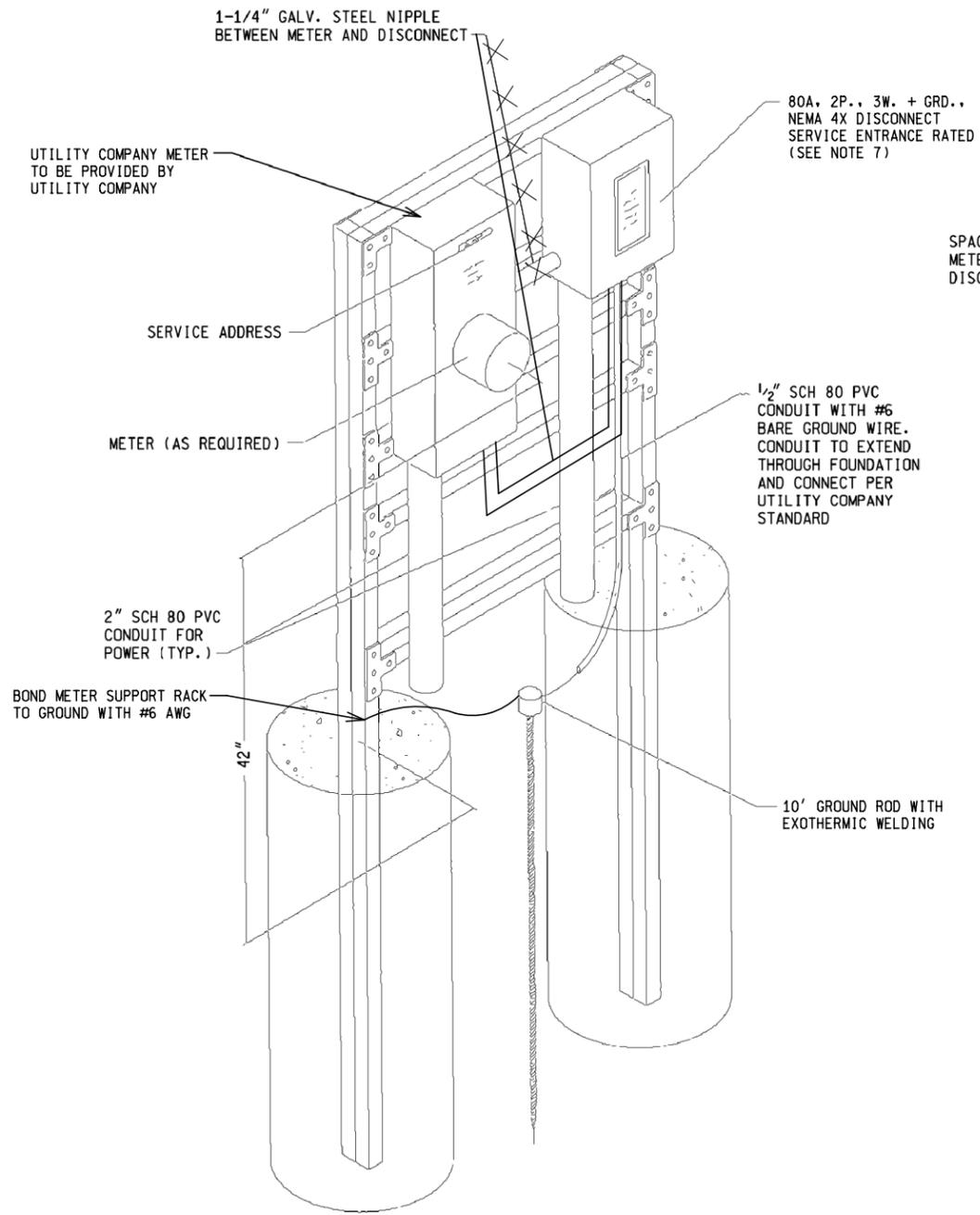
\*1:3 OUTSIDE THE CLEAR ZONE OR AS SHOWN ON THE PLANSHEET.



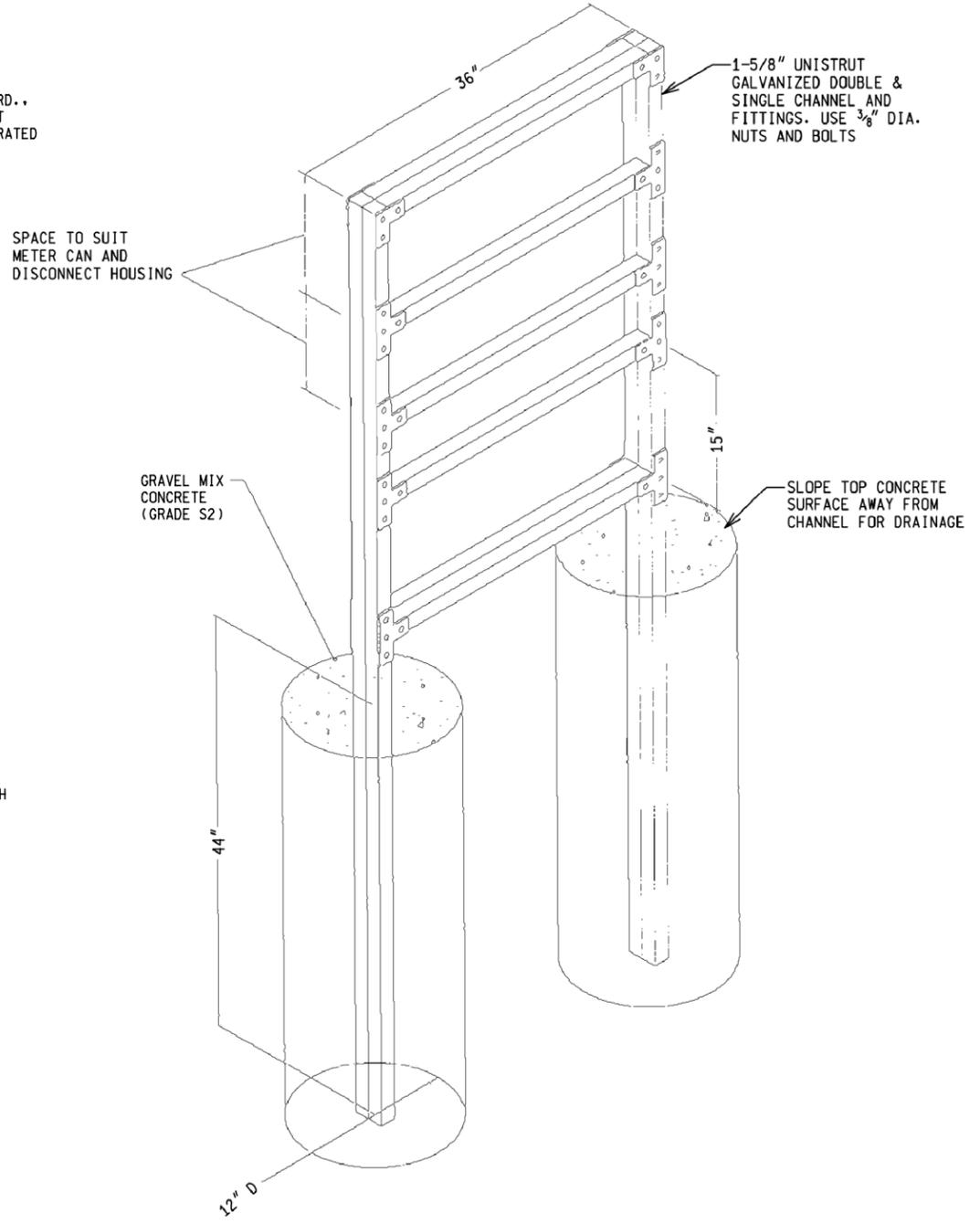
- NOTES:
1. LIGHTNING ROD MUST BE MOUNTED TO PROTECT ESS EQUIPMENT AS DETAILED IN THE SPECIAL PROVISION FOR GROUNDING AND BONDING ITS.
  2. ATTACHMENTS OF ALL DEVICES TO TOWER SHALL BE PER MANUFACTURER SPECIFICATIONS.
  3. ALL HARDWARE SHALL BE STAINLESS STEEL.
  4. ALL EQUIPMENT SHALL BE MOUNTED TO THE STRUCTURE WITH THE USE OF PRE-DRILLED HOLES ON THE TOWER. IT IS THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT SIZE AND PLACEMENT OF THE HOLES ON THE TOWER. UNUSED HOLES SHALL BE FILLED USING APPROPRIATELY SIZED NUTS AND BOLTS.

AS-LET PLAN REVISIONS									NO SCALE	DATE: 4/4/12	CS: 84911	TYPICAL ESS TOWER DETAIL SHEET		DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION			DESIGN UNIT:	JN: 107425A	MISCELLANEOUS DETAILS			
										FILE: MISC TOWER DETAIL	TSC: ISHPERING				





GENERAL ARRANGEMENT



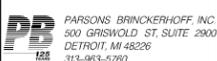
GENERAL PLAN

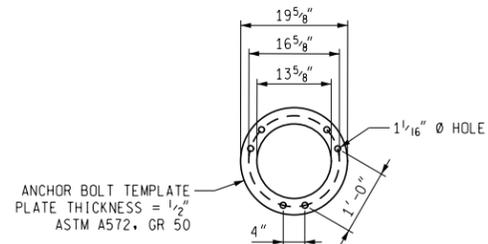
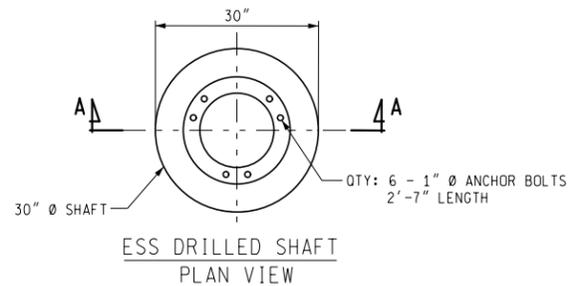
TYPICAL METER & SERVICE DISCONNECT RACK

SCALE: NTS

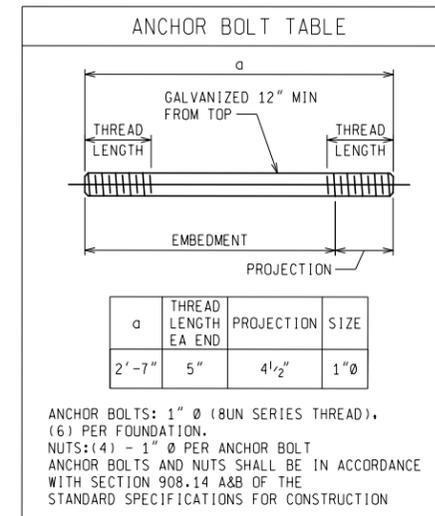
NOTES:

1. ALL LOCATIONS SHALL CONFORM TO NEC AND UTILITY COMPANY REQUIREMENTS.
2. POSITION OF THE METER AND DISCONNECT SHALL BE INTERCHANGED WHERE REQUIRED AS APPROVED BY THE MDOT ENGINEER.
3. METER TO FACE AS SPECIFIED BY THE UTILITY COMPANY.
4. ALL SERVICE DISCONNECTS SHALL BE LABELED IN ACCORDANCE WITH NEC 702.8 TO PROVIDE PROPER NOTIFICATION TO MAINTENANCE PERSONNEL THAT A STANDBY POWER SYSTEM (UPS) IS BEING USED.
5. SITE #26-DISCONNECT IS TO BE INSTALLED ON THE BACK SIDE OF EXISTING SERVICE WITH METER AND DISCONNECT. NEW DISCONNECT PANEL IS TO BE CONNECTED TO EXISTING METER AS NOTED ABOVE. WORK WILL BE PAID FOR AS: METERED SERV

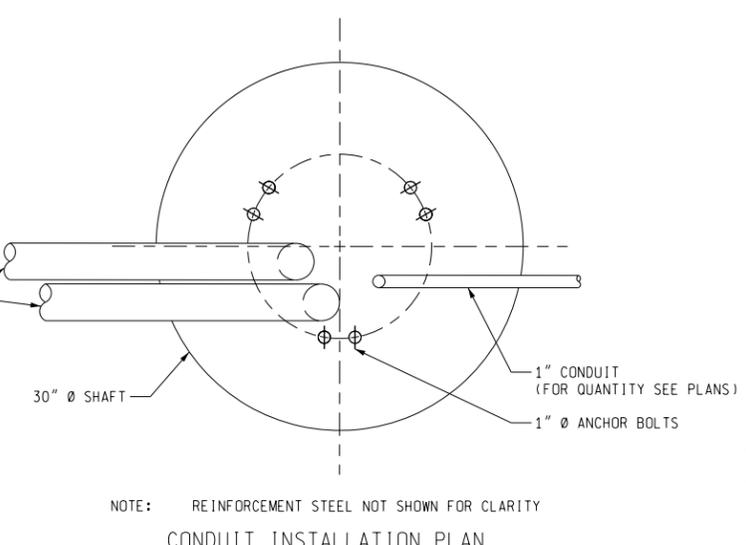
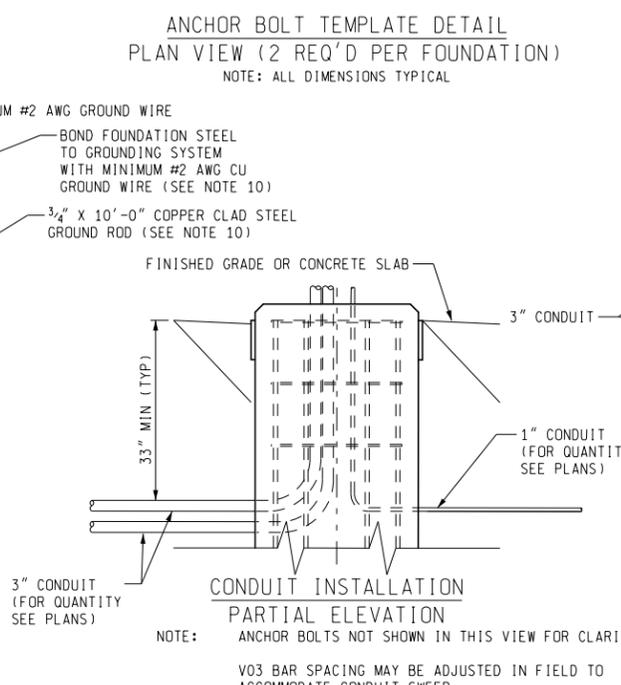
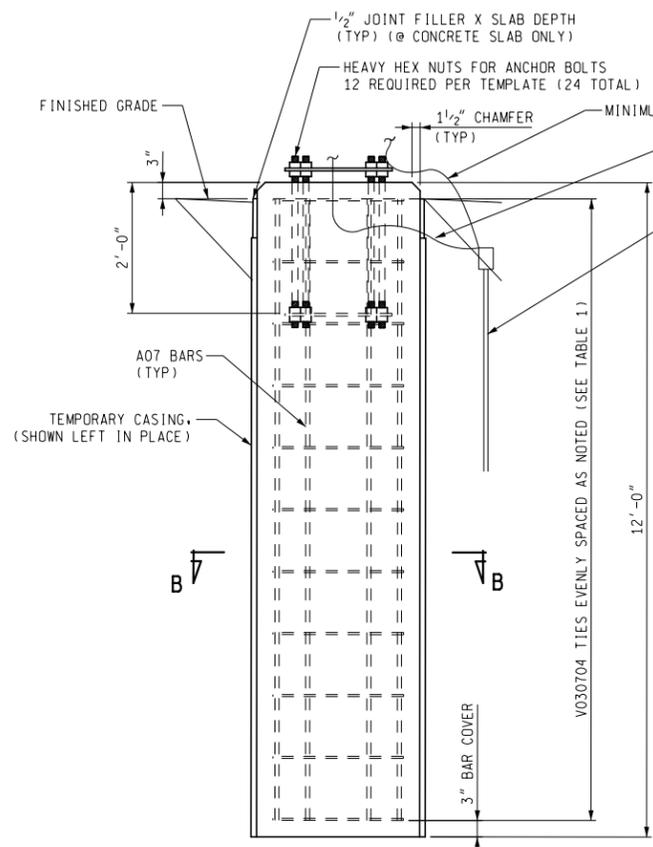
AS-LET PLAN REVISIONS								 <small>PARSONS BRINCKERHOFF, INC. 500 GRISWOLD ST. SUITE 2900 DETROIT, MI 48226 313-963-5760</small>	 <small>MDOT Michigan Department of Transportation</small>	NO SCALE	DATE: 4/4/12	CS: 84911	TYPICAL ESS POWER DETAIL SHEET 2	DRAWING	SHEET
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION				DESIGN UNIT: GUSTAFSON	JN: 107425A			
									FILE: \$FILESS	TSC: ISHPEMING					10



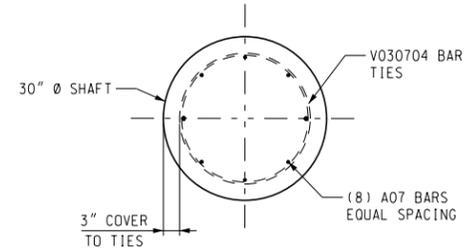
STEEL REINFORCEMENT BAR SCHEDULE							
BAR	a	b	c	SIZE	LENGTH	NO.	TOTAL WT.
A071106	11'-6"			7	11'-6"	8	188
V030704	6'-3 1/2"	1'-0 1/2"	11 5/8"	3	7'-4"	13	36
REINFORCEMENT WEIGHT PER FOUNDATION [Lb]							224
TOTAL WT. [Lb]							



- REINFORCEMENT BAR & ANCHOR BOLT NOTES:**
- REINFORCEMENT BARS FOR FOUNDATION SHALL BE GRADE 60 DEFORMED BARS AS SPECIFIED IN SECTION 905.03 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - CONTRACTOR SHALL VERIFY ANCHOR BOLT PATTERN PRIOR TO FABRICATION OF ANCHOR BOLTS AND TEMPLATES.
  - ANCHOR BOLTS ARE TO BE VERTICAL & POSITIONED AS SHOWN IN PLAN.
  - TEMPLATE PLATES & ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED, ASSEMBLED, AND APPROVED BY MDOT PRIOR TO SHIPPING.
  - DIAMETER OF BOLT HOLES IN TEMPLATES SHALL BE 1/16" LARGER THAN ANCHOR BOLT DIAMETER.
  - INSTALLATION SHALL BE ACCORDING TO SUBSECTION 810.03N OF THE STANDARD SPECIFICATIONS.
  - THE TEMPLATES SHALL BE WELL SUPPORTED, HORIZONTALLY LEVEL & FIRMLY ANCHORED IN PLACE FOR A MINIMUM OF 24 HOURS AFTER THE CONCRETE PLACEMENT IS COMPLETED.
  - DUE CARE SHALL BE TAKEN DURING THE CONCRETE PLACEMENT TO AVOID DISPLACING THE ANCHOR BOLTS.
  - NO HAMMERING ON OR CUTTING OF THE ANCHOR BOLTS OR TEMPLATES WILL BE ALLOWED. NO CHISELING OR DAMAGING OF GALVANIZED FINISH WILL BE PERMITTED.
  - AFTER TOP TEMPLATE IS REMOVED, THREAD NUTS ON TO THE BOLT FLUSH WITH THE BOLT END TO PROTECT THREADS UNTIL FRAME IS ERECTED.

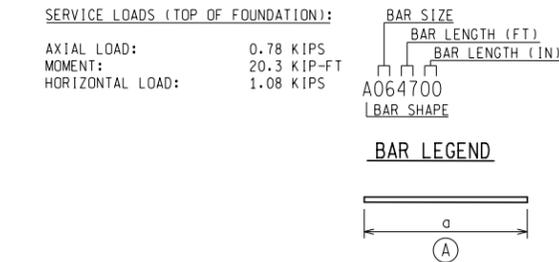


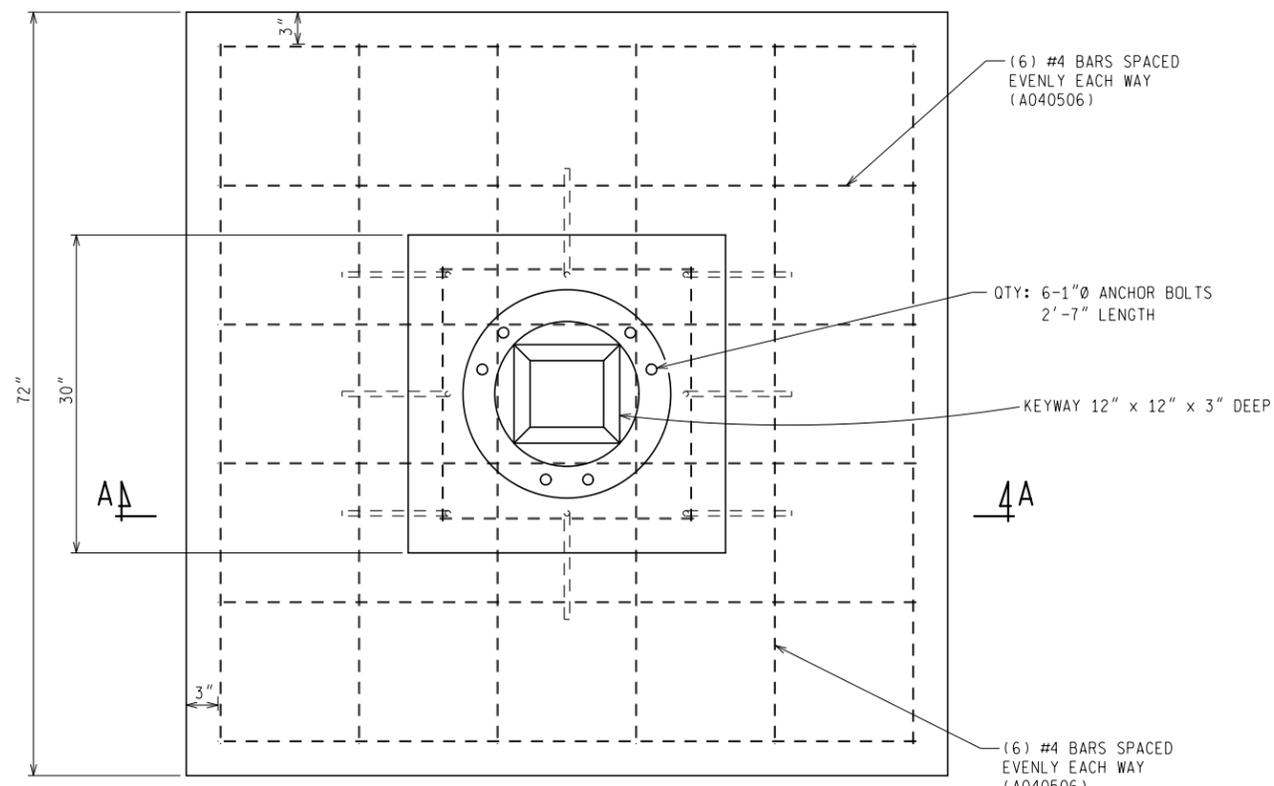
ESS DRILLED SHAFT SECTION A-A  
CONDUIT NOT SHOWN FOR CLARITY



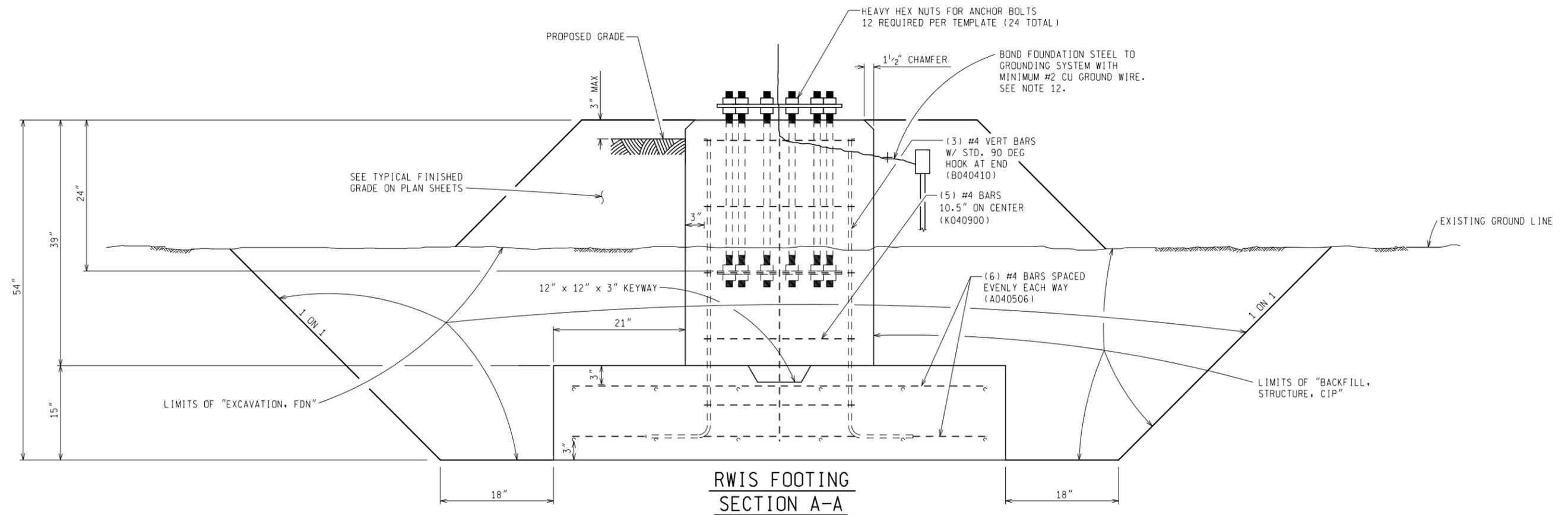
ESS DRILLED SHAFT SECTION B-B

- NOTES:**
- ALL MATERIALS & CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - CONTRACTOR MUST TAKE APPROPRIATE PRECAUTIONS TO PREVENT DAMAGING EXISTING STRUCTURES AND UTILITIES. ANY DAMAGE TO EXISTING STRUCTURES OR UTILITIES MUST BE REPAIRED AT THE CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE ENGINEER, INCLUDING ENGINEERING ANALYSIS AND REDESIGN, AND WITHOUT ANY EXTENSION OF THE COMPLETION DATES FOR THE PROJECT.
  - ALL DISTURBED AREAS SHALL BE RESTORED IN ACCORDANCE WITH THE SPECIAL PROVISION FOR, "Slope Restoration, Non-Freeway". CONTRACTOR IS TO MINIMIZE THE AREAS OF DISTURBANCE AS MUCH AS IT IS PRACTICAL.
  - CONCRETE MUST BE PROTECTED FROM FLOWING WATER AND DAMAGE FROM MECHANICAL EQUIPMENT AND NEARBY CONSTRUCTION VIBRATIONS. VIBRATIONS FROM CONSTRUCTION OPERATIONS (VIBRATORY CASING INSTALLATIONS, CONCRETE DEMOLITION, ETC.) WILL NOT BE PERMITTED WITHIN A RADIUS OF 25 FEET UNTIL THE CONCRETE HAS ATTAINED 75 PERCENT OF ITS SPECIFIED MINIMUM STRENGTH.
  - CONCRETE MUST BE PROTECTED FROM STRENGTH REDUCTION CAUSED BY HEAT, FROST OR FREEZING ACTIONS PER SECTION 706.03 OF THE STANDARD SPECIFICATIONS.
  - FINAL CONDUIT LOCATIONS AND HARDWARE INSTALLATION CONFIGURATION PLANS, INCLUDING WIRING CIRCUIT SCHEMATICS, TO BE SUBMITTED IN CONTRACTOR'S DRILLED SHAFT INSTALLATION PLANS FOR APPROVAL BY THE ENGINEER.
  - CONDUIT MUST BE AS SPECIFIED IN SECTION 819 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  - SEE PLANS FOR TOP OF SHAFT ELEVATION. IN ORDER FOR CONDUIT TO ENTER FOUNDATION, CONTRACTOR MAY CUT HOLES IN THE STEEL CASING OR STEEL CASING MAY STOP AT THE CONDUIT ENTRANCE TO FOUNDATION. CUT HOLES MUST BE LOCATED, CUT AND FINISHED SO AS NOT TO DAMAGE CONDUIT. TOP OF FOUNDATION MUST BE FORMED SEPARATELY IF THE STEEL CASING STOPS AT THE CONDUIT ENTRANCE TO THE FOUNDATION. THE COST OF ALL LABOR, MATERIALS, AND EQUIPMENT NECESSARY TO CUT HOLES IN THE STEEL CASING OR FORM, POUR, FINISH AND CURE THE PORTION OF THE FOUNDATION ABOVE THE CASING SHALL BE INCLUDED IN THE BID ITEM "Drilled Shaft, 30 inch". AT CONTRACTOR'S OPTION, THE CASING MAY STOP 1'-0" BELOW FINISHED GRADE ELEVATIONS.
  - COBBLES, BOULDERS OR RIPRAP MUST NOT BE CLASSIFIED AS OBSTRUCTIONS.
  - ALL GROUNDING WORK INCLUDING MATERIALS AND LABOR SHALL BE PAID FOR IN ACCORDANCE WITH THE SPECIAL PROVISION FOR "Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment".





**RWIS FOOTING  
PLAN VIEW**



**RWIS FOOTING  
SECTION A-A**

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

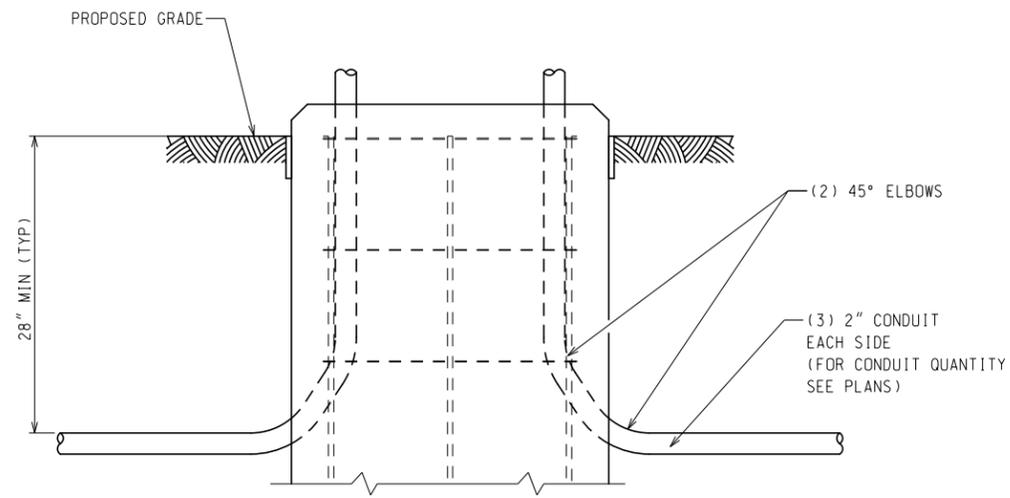
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CHK'D BY: GROTENHUIS CORR BY: AMB  
FILE: 849111 spreadftg 001.dgn

DATE: 04-02-12  
DESIGN UNIT: GARCIA  
TSC: ISHPERING

CS: 84911  
JN: 107425A

SPREAD FOOTING DETAILS

DRAWING SHEET  
SPREAD FTG 001  
12



**CONDUIT INSTALLATION  
PARTIAL ELEVATION**

\* NOTE: ANCHOR BOLTS NOT SHOWN FOR CLARITY

**ANCHOR BOLT TABLE**

a	THREAD LENGTH EA END	PROJECTION	SIZE
27"	5"	4 1/2"	1"Ø

ANCHOR BOLTS: 1"Ø (8UN SERIES THREAD), (6) PER FOUNDATION.  
NUTS: (4) - 1"Ø PER ANCHOR BOLT  
ANCHOR BOLTS AND NUTS SHALL BE IN ACCORDANCE WITH SECTION 908.15 A&B OF THE MDOT "STANDARD SPECIFICATIONS FOR CONSTRUCTION"

- NOTES :**
1. ALL MATERIALS & CONSTRUCTION SHALL CONFORM TO THE REQUIREMENTS OF THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  2. FOUNDATION CONCRETE SHALL BE GRADE S2.
  3. TOP OF FOUNDATION SHALL BE 3" ABOVE FINISHED GRADE.
  4. FOUNDATION SHALL RECEIVE RUBBED SURFACE FINISH FROM TOP OF FOUNDATION TO 6" BELOW GRADE.
  5. SUBSURFACE INFORMATION CAN BE OBTAINED FROM THE SOIL BORING DATA PLAN SHEET.
  6. ALL DISTURBED AREAS SHALL BE RESTORED IN ACCORDANCE WITH THE PROJECTS SPECIAL PROVISION FOR SLOPE RESTORATION. CONTRACTOR IS TO MINIMIZE THE AREAS OF DISTURBANCE AS MUCH AS IT IS PRACTICAL.
  7. PROVIDE ALL ACCESSORIES NECESSARY TO SUPPORT REINFORCEMENT AT THE POSITIONS SHOWN ON THE PLANS.
  8. FOOTING DESIGN BASED ON 1000 PSF SOIL BEARING PRESSURE ON NATIVE OR STRUCTURALLY COMPACTED SOIL. GEOTECHNICAL ENGINEER SHALL OBSERVE AND APPROVE EXCAVATION BASE PRIOR TO CONCRETE PLACEMENT.
  9. CONCRETE SHALL BE PLACED CONTINUOUSLY TO THE MAT OUTLINE INDICATED ON THE FOUNDATION DRAWING. DURING CONCRETE PLACEMENT, THE CONTRACTOR SHALL NOT ALLOW FOR A COLD JOINT IN THE FOUNDATION MAT. CONSTRUCTION JOINT BETWEEN PIER AND FOUNDATION MAT IS PERMITTED.
  10. CONTRACTOR SHALL VERIFY ANCHOR BOLT PATTERN PRIOR TO FABRICATION OF ANCHOR BOLTS AND TEMPLATES.
  11. FINAL CONDUIT LOCATIONS TO BE SUBMITTED IN CONTRACTOR'S INSTALLATION PLAN AND APPROVED BY ENGINEER.
  12. ALL GROUNDING WORK INCLUDING MATERIALS AND LABOR SHALL BE PAID FOR IN ACCORDANCE WITH THE SPECIAL PROVISION FOR "GROUNDING, BONDING, LIGHTING PROTECTION AND SURGE PROTECTION FOR ITS EQUIPMENT"

- REINFORCEMENT BAR & ANCHOR BOLT NOTES :**
1. REINFORCEMENT BARS FOR FOUNDATION SHALL BE GRADE 60 DEFORMED BARS AS SPECIFIED IN SECTION 905.03 OF THE MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION.
  2. ANCHOR BOLTS ARE TO BE VERTICAL & POSITIONED AS SHOWN IN PLAN.
  3. TEMPLATE PLATES & ANCHOR BOLT CAGE SHALL BE SHOP FABRICATED, ASSEMBLED, AND APPROVED BY MDOT PRIOR TO SHIPPING.
  4. DIAMETER OF BOLT HOLES IN TEMPLATES SHALL BE 1/16" LARGER THAN ANCHOR BOLT DIAMETER.
  5. INSTALLATION SHALL BE ACCORDING TO SUBSECTION 810.03N OF THE STANDARD SPECIFICATIONS.
  6. THE TEMPLATES SHALL BE WELL SUPPORTED, HORIZONTALLY LEVEL & FIRMLY ANCHORED IN PLACE FOR A MINIMUM OF 24 HOURS AFTER THE CONCRETE PLACEMENT IS COMPLETED.
  7. DUE CARE SHALL BE TAKEN DURING THE CONCRETE PLACEMENT TO AVOID DISPLACING THE ANCHOR BOLTS.
  8. NO HAMMERING ON THE ANCHOR BOLTS OR TEMPLATES WILL BE ALLOWED. NO CHISELING OR DAMAGING OF GALVANIZED FINISH WILL BE PERMITTED.
  9. AFTER TOP TEMPLATE IS REMOVED, THREAD NUTS ON TO THE BOLT FLUSH WITH THE BOLT END TO PROTECT THREADS UNTIL FRAME IS ERECTED.



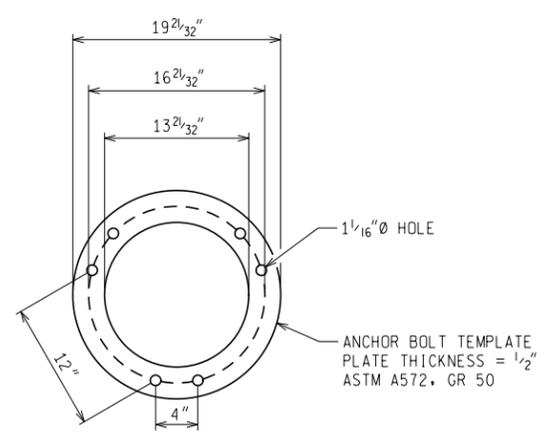
**REINFORCEMENT,  
STEEL,  
EPOXY COATED**

BAR	NO. REQ'D	TOTAL WT
A040506	48	177
B040410	16	52
K040900	10	61

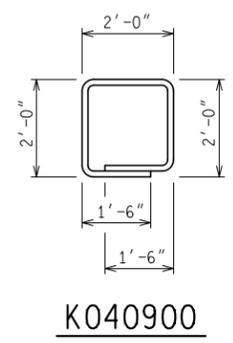
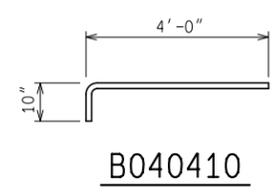
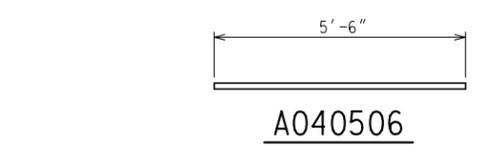
NOTE: TOTALS ARE FOR (2) FOUNDATIONS.

**SERVICE LOADS (TOP OF FOUNDATION):**

AXIAL LOAD: 0.78 KIPS  
MOMENT: 20.3 KIP-FT  
HORIZONTAL LOAD: 1.08 KIPS



**ANCHOR BOLT TEMPLATE DETAIL  
PLAN VIEW**



PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

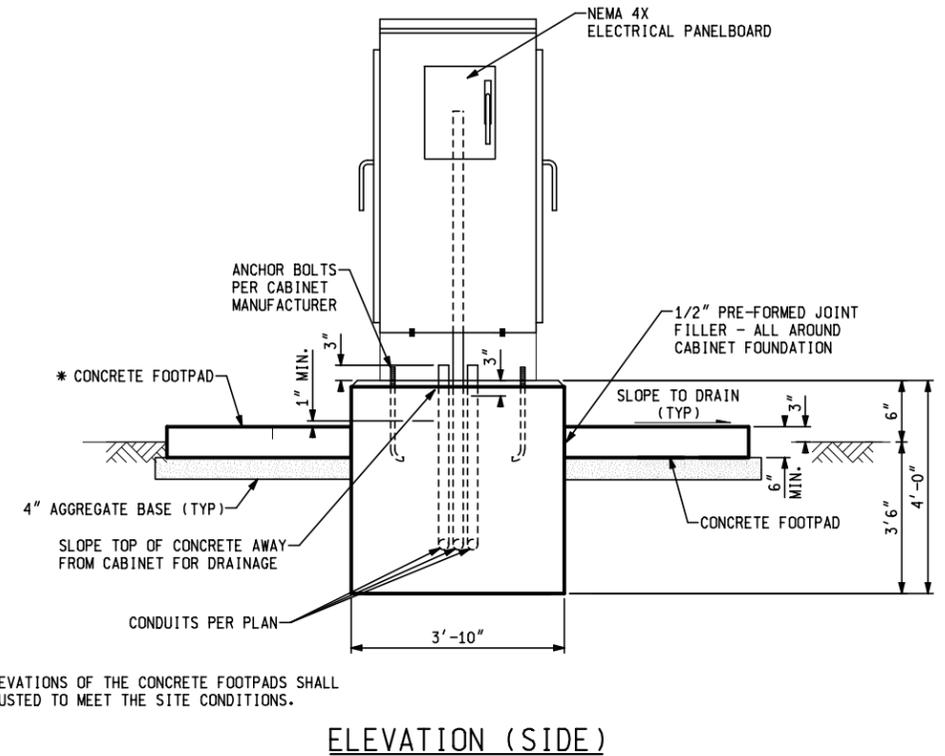
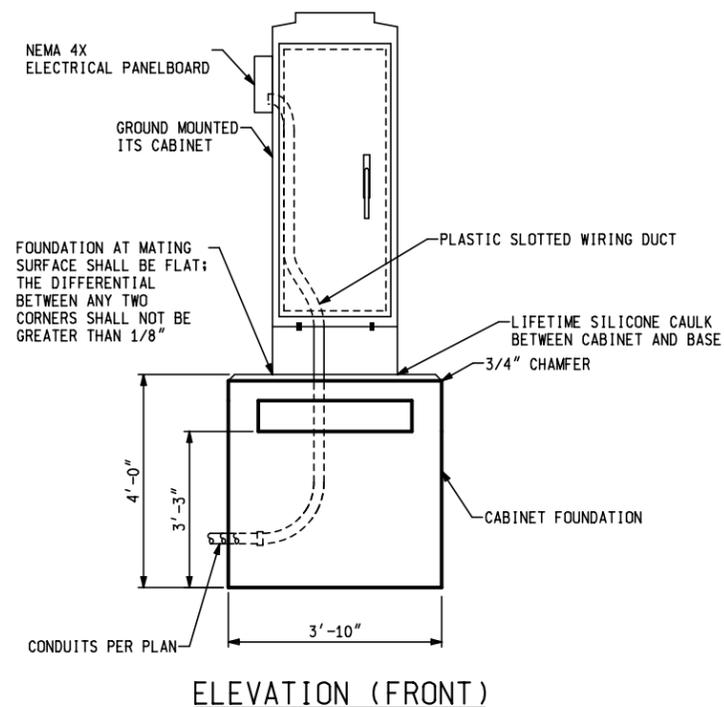
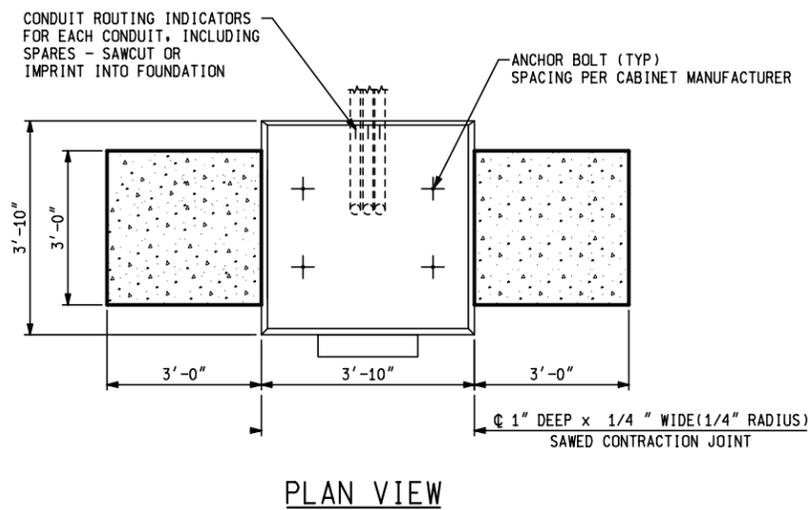
DRAWN BY: BEKMANIS  
CHK'D BY: GROTENHUIS CORR BY: AMB  
FILE: 849111 spreadftg 002.dgn

DATE: 04-02-12  
DESIGN UNIT: GARCIA  
TSC: ISHPERING

CS: 84911  
JN: 107425A

SPREAD FOOTING DETAILS

DRAWING	SHEET
SPREAD FTG 002	13



\* THE ELEVATIONS OF THE CONCRETE FOOTPADS SHALL BE ADJUSTED TO MEET THE SITE CONDITIONS.

**TYPICAL GROUND MOUNTED CABINET DETAIL**

NOT TO SCALE

CABINET ID#	SITE #	ROUTE	SHORT NAME	LOCATION
E-US2_MM120_Wakefield	1	US-2	Wakefield ESS	US-2 West of M-28
E-US45_MM135_Rockland	2	US-45	Rockland ESS	US-45 South of US-45/M-26
E-M28_MM000_TroutCreek	3	M-28	Trout Creek ESS	M-28 Houghton/Ontonagon County Line
E-M38_MM053_Nisula	4	M-38	Nisula ESS	M-38 Houghton/Ontonagon County Line
E-US41_MM108_Calumet	5	US-41	Calumet ESS	US-41 near Store Street
E-US41_MM010_Arnheim	6	US-41	Arnheim ESS	US-41 1 mile north of Houghton/Baraga County Line
E-M95_MM001_Republic	9	M-95	Republic ESS	M-95 north of the Marquette/Dickinson County Line
E-US41_MM112_Negaunee	10	US-41	Negaunee ESS	US-41/M-28 East of Negaunee
E-M35_MM346_CedarRiver	12	M-35	Cedar River ESS	M-35 South of Delta/Menominee County Line
E-US2_MM058_RapidRiver	14	US-2	Rapid River ESS	US-2/US-41 West of Rapid River
E-US41_MM162_Trenary	15	US-41	Trenary ESS	US-41 South of Trenary
E-US41_MM001_Kiva	16	US-41	Kiva ESS	US-41 North of Marquette/Alger County Line
E-M94_MM001_Sundell	17	M-94	Sundell ESS	M-94 East of the Marquette/Alger County Line
E-US2_MM041_Manistique	21	US-2	Manistique ESS	US-2 West of Manistique near Tannery Road
E-US2_MM229_BlaneyPark	22	US-2	Blaney Park ESS	US-2 at M-77
E-M28_MM066_Dafer	26	M-28	Dafer ESS	M-28 west of I-75

**CABINET ID NAMES**

**NOTE:**

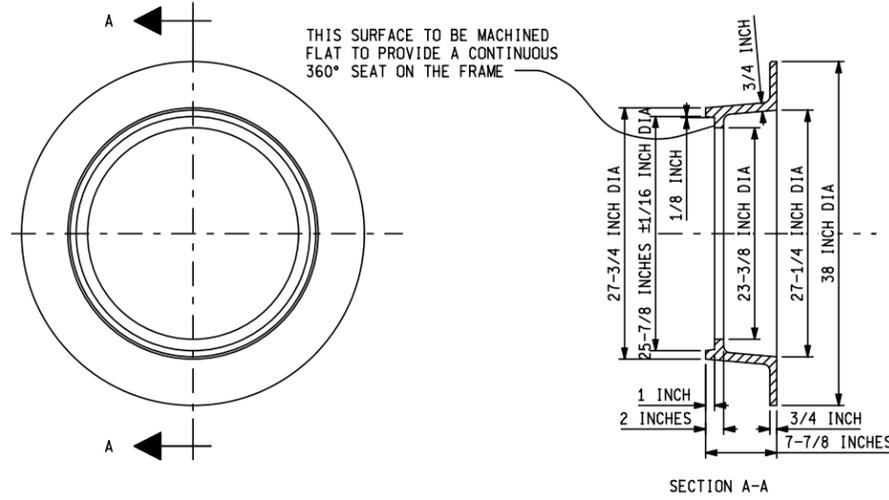
1. THE SOIL BENEATH THE CONCRETE FOOTPAD AND AGGREGATE SHALL BE COMPACTED IN PLACE WITH A PLATE COMPACTOR OR OTHER COMPACTION METHOD APPROVED BY THE ENGINEER, PRIOR TO PLACING THE AGGREGATE.

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DATE: 4/4/12	CS: 84911	TYPICAL GROUND MOUNTED ITS CABINET DETAIL	DRAWING	SHEET
									DESIGN UNIT: GUSTAFSON	JN: 107425A			
									TSC: ISHPERING				14



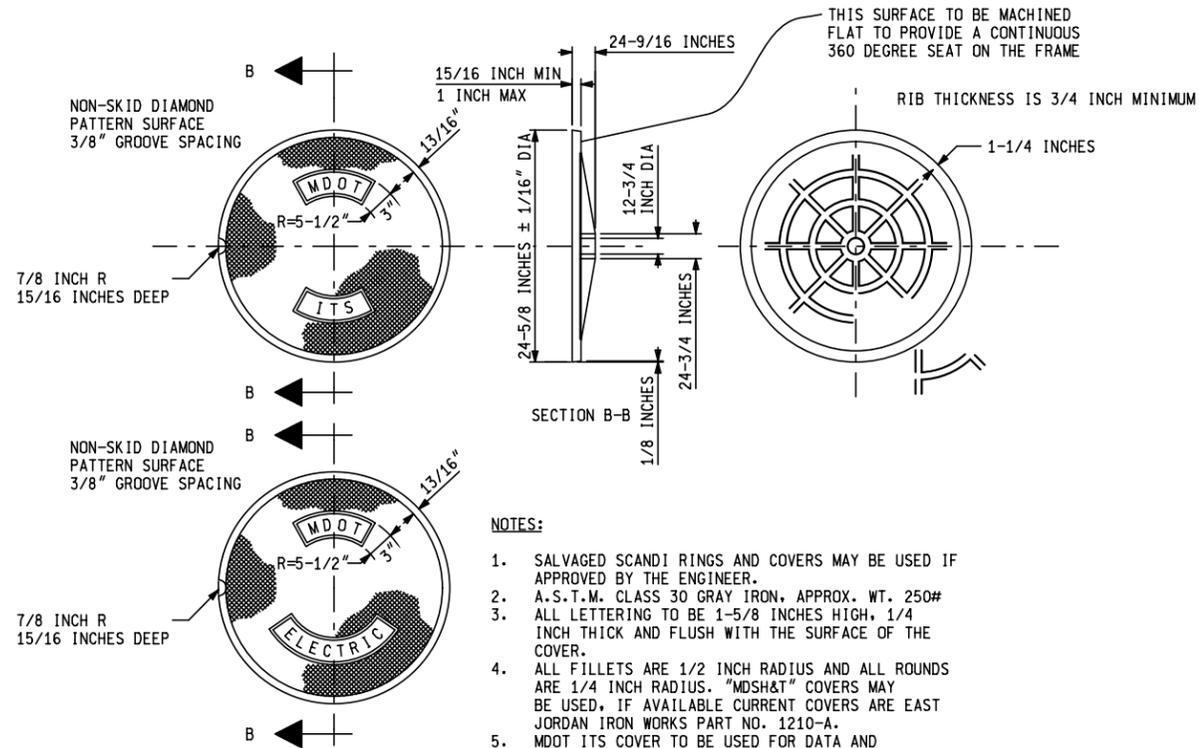
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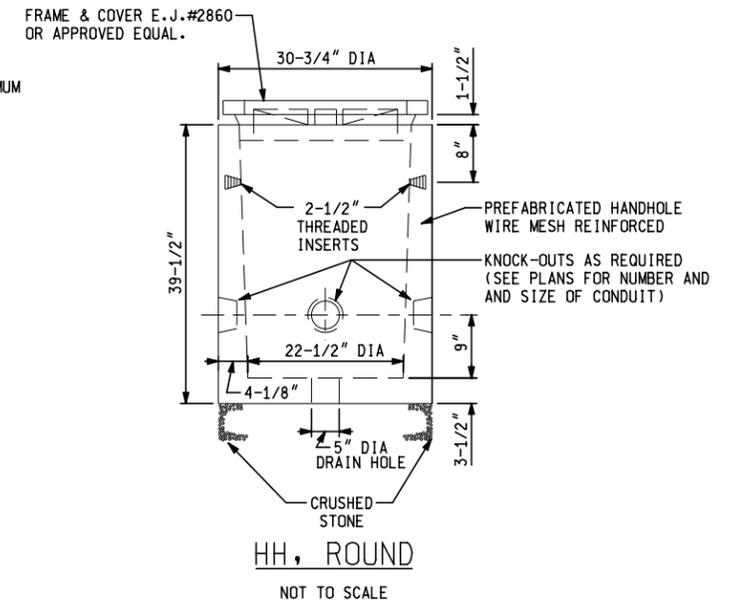
- NOTES:**
1. ALL FILLETS ARE 1/2 INCH RADIUS AND ALL ROUNDS ARE 1/4 INCH RADIUS.
  2. A.S.T.M. CLASS 30 GRAY IRON APPROX. WT. 250#

**HANDHOLE FRAME (TYP)**  
NOT TO SCALE

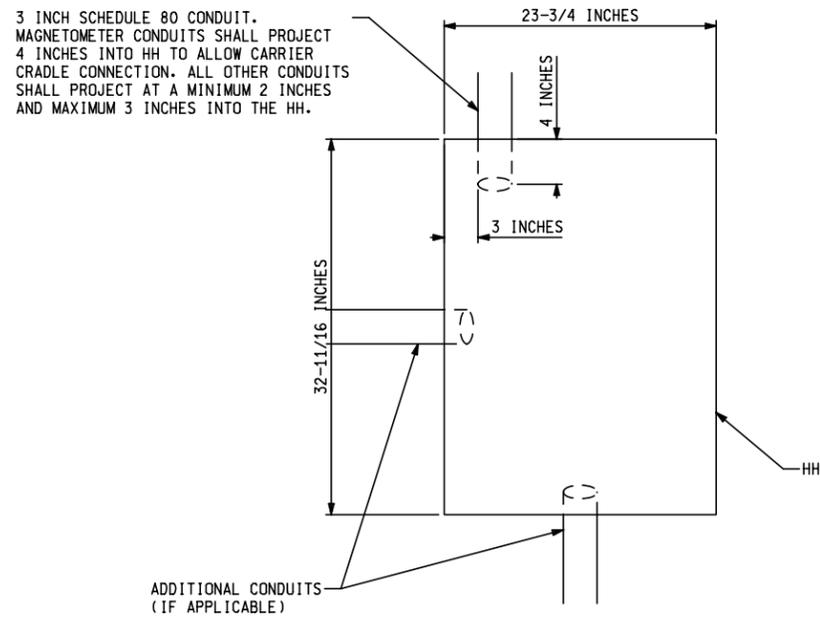


- NOTES:**
1. SALVAGED SCANDI RINGS AND COVERS MAY BE USED IF APPROVED BY THE ENGINEER.
  2. A.S.T.M. CLASS 30 GRAY IRON, APPROX. WT. 250#
  3. ALL LETTERING TO BE 1-5/8 INCHES HIGH, 1/4 INCH THICK AND FLUSH WITH THE SURFACE OF THE COVER.
  4. ALL FILLETS ARE 1/2 INCH RADIUS AND ALL ROUNDS ARE 1/4 INCH RADIUS. "MDSH&T" COVERS MAY BE USED, IF AVAILABLE CURRENT COVERS ARE EAST JORDAN IRON WORKS PART NO. 1210-A.
  5. MDOT ITS COVER TO BE USED FOR DATA AND COMMUNICATION CABLES FOR ITS DEVICES AND MDOT ELECTRIC COVER TO BE USED FOR POWER CABLES.
  6. TOP OF HANDHOLE SHALL BE SET AT 1" BELOW GRADE.

**HANDHOLE COVER (TYP)**  
NOT TO SCALE

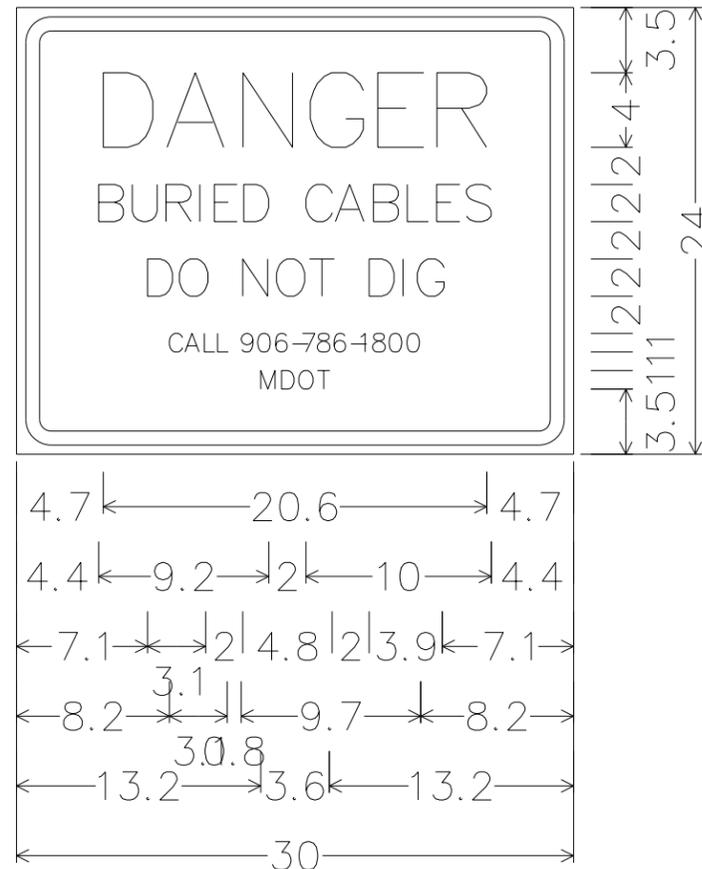


**HH, ROUND**  
NOT TO SCALE



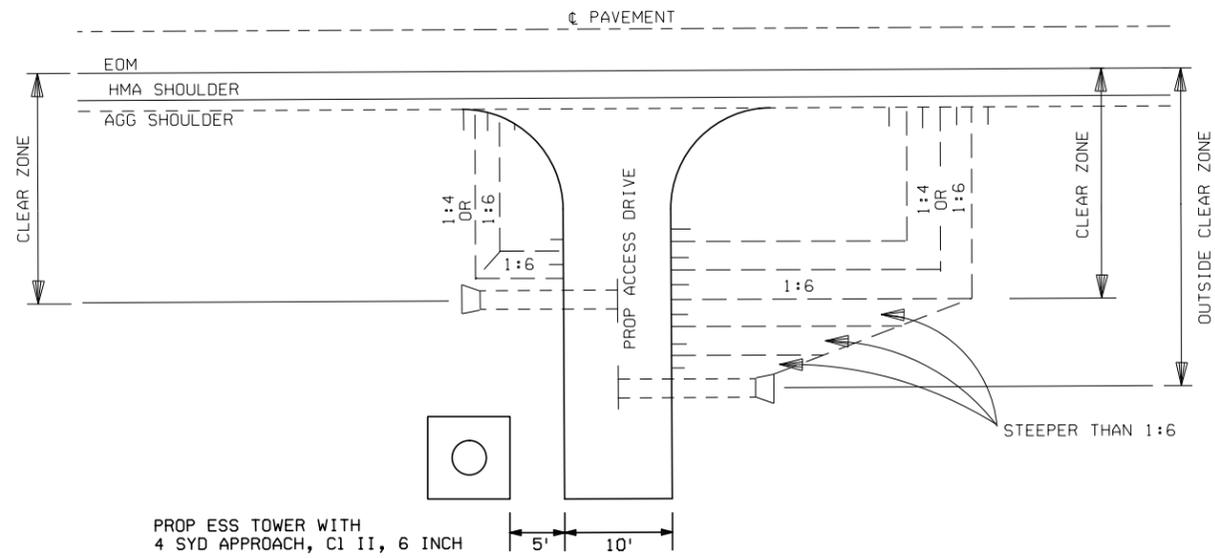
**CONDUIT ENTRIES INTO HANDHOLE (TYP)**  
NOT TO SCALE

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MDOT Michigan Department of Transportation		NO SCALE	DATE: 4/4/12	CS: 84911	HANDHOLE DETAILS		DRAWING	SHEET
											DESIGN UNIT:	JN: 107425A				15
											TSC:					

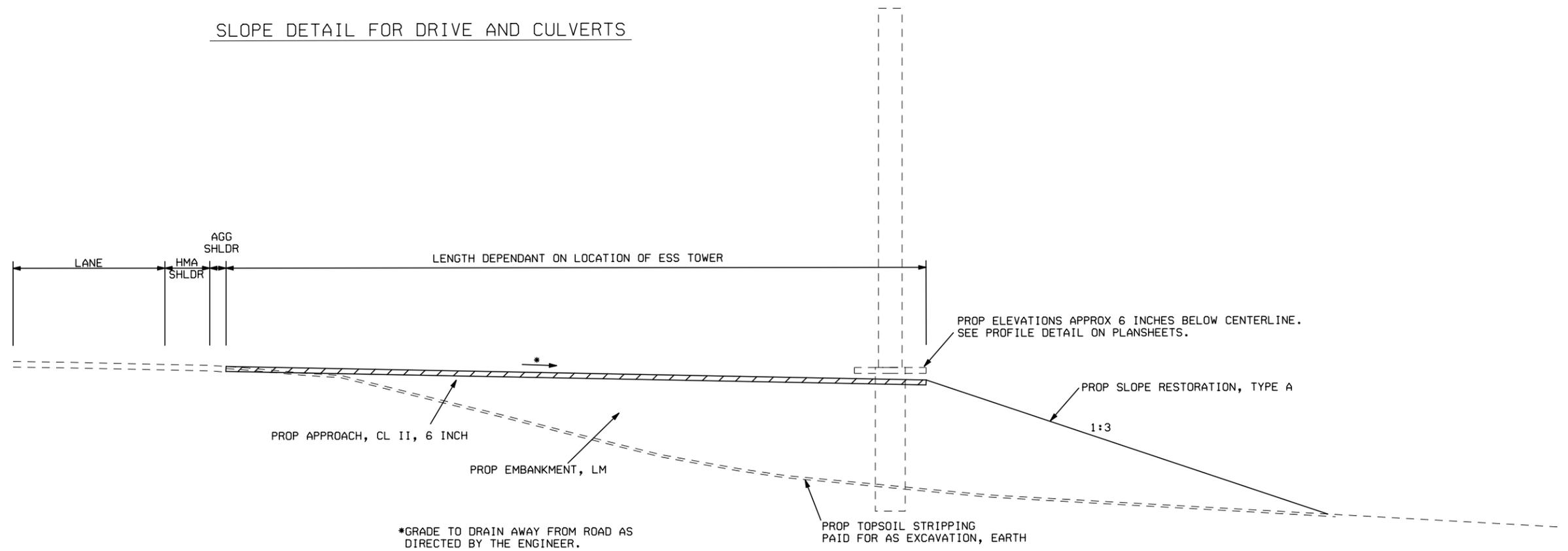


W-Var, Type IIIB, Danger Buried Cables;  
 0.8" Border, 0.5" Indent, Black on Yellow;  
 [DANGER] D;  
 [BURIED CABLES] D;  
 [DO NOT DIG] D;  
 [CALL 906-786-1800] D;  
 [MDOT] D;

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION			NO SCALE	DATE: 4/4/12	CS: 84911	BURIED CABLE SIGN DETAIL	DRAWING	SHEET
											DESIGN UNIT: GUSTAFSON	JN: 107425A			16
											FILE:	TSC: ISHPERING			



SLOPE DETAIL FOR DRIVE AND CULVERTS



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



**NO SCALE**

FILE: 107425 MISC ROAD DETAIL

DATE: 4/4/12  
 DESIGN UNIT:  
 TSC: ISHPEMING

CS: 84911  
 JN: 107425A

ACCESS DRIVE AND CULVERT DETAIL

DRAWING SHEET

## GENERAL NOTES

### UTILITIES

#### **UNDERGROUND UTILITIES / MISS DIG**

For protection of underground utilities and in conformance with Public Act 53, 1974, the Contractor shall dial 1-800-482-7171 a minimum of three full working days, excluding Saturdays, Sundays, and holidays prior to beginning each excavation in areas where public utilities have not been previously located. Members will thus be routinely notified. This does not relieve the Contractor of the responsibility of notifying utility owners who may not be a part of the "Miss Dig" alert system.

#### **MDOT ELECTRICAL SYSTEMS**

Contractors shall contact the maintenance representative at the MDOT Region / TSC Office to have MDOT electrical systems staked.

Superior Region 1-906-786-1800

If plan information indicates an existing underground utility is or will be out of service within the limits of this contract. The Contractor is cautioned to treat such a line as if it were still in service and notify "Miss Dig" when working in the area of the out of service facility.

### EARTHWORK

#### **EARTHWORK**

Earthwork quantities are computed based upon limited survey information. These quantities are for bidding purposes only and will be adjusted by the Engineer based upon actual field measurements.

#### **SOIL EROSION MEASURES**

Appropriate soil erosion and sedimentation control measures shall be in place prior to earth-disturbing activities. Place turf establishment items as soon as possible on potential erodable slopes as directed by the Engineer. Critical ditch grades shall be protected with either sod or seed/mulch or mulch blanket as directed by the Engineer.

### BASES

#### **AGGREGATE BASE**

Aggregate bases shall use aggregate 22A, unless otherwise specified.

### PAVEMENT

#### **SOIL BORINGS AND/OR PAVEMENT CORES**

The soil boring logs and/or pavement cores represent point information. No inference should be made that subsurface or pavement conditions are the same at other locations.

#### **.SIGNS**

#### **PERMANENT SIGNS**

Any permanent signs requiring relocation due to Contractor operations shall be salvaged and reset by the Contractor at locations designated by the Engineer. Signs and posts damaged during the removal and storage operations shall be replaced with new signs and posts. The cost of this work shall be borne by the Contractor.

## ENVIRONMENTAL

#### **RECREATIONAL PROPERTIES**

The Contractor shall not park any vehicles or store any equipment on any public recreational property. Access to the recreational site must be maintained at all times.

## PROJECT SPECIFIC NOTES

#### **TOWERS**

Final tower locations to be verified by MDOT Engineer.

Tower folds away from ITS cabinet and parallel to the roadway as shown on the plans or as directed by the Engineer.

#### **CONDUIT**

Conduit runs shall be a minimum of 4' from road signs.

All conduit shall be Schedule 80 PVC.

#### **EMBANKMENT**

All material used for Embankment, LM shall be Class III or better.

#### **PERMITS**

All permits necessary for the construction of this project are the responsibility of the Contractor.

#### **DRIVE PERMITS**

Houghton County Road Commission will require drive permits for the field access drive on site #5 and 6.

#### **PEDESTAL FOUNDATION**

All pedestal foundations shall be a minimum 20 foot height on a square aluminum base. Contractor shall submit documentation stating compliance to NCHRP-350.

#### REVISIONS

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



NO SCALE

FILE: 107425\_Note\_doc

DATE: 4/4/12

DESIGN UNIT: Gustafson

TSC: Ishpeming

CS: 84911

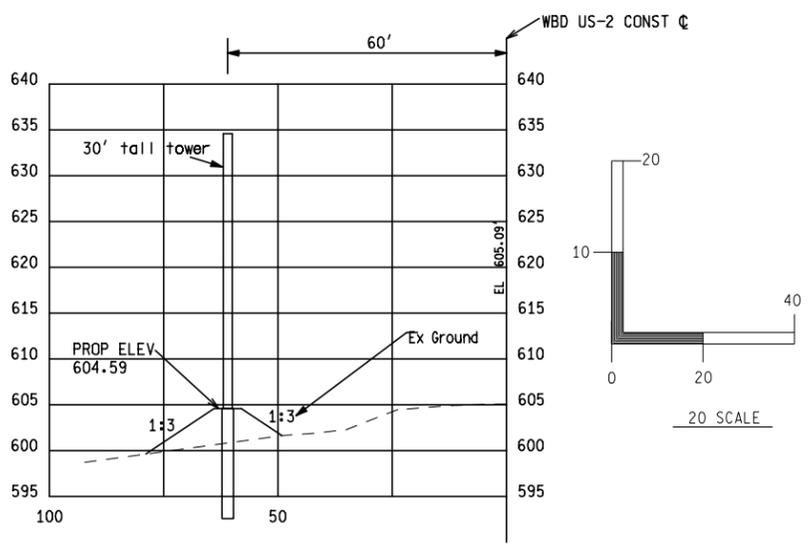
JN: 107425A

NOTE SHEET

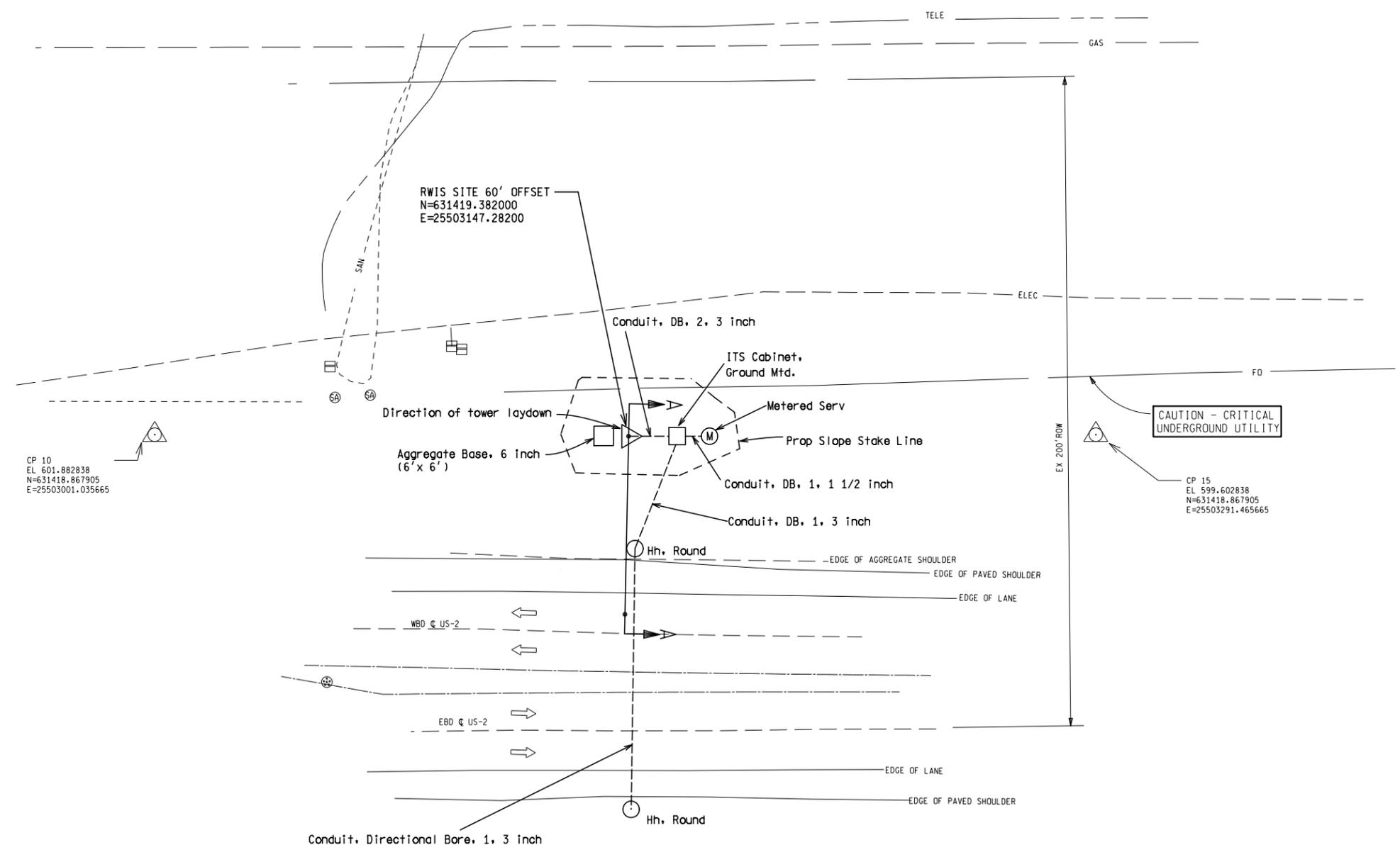
DRAWING SHEET

NOTE CONST

18



SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET

2	Ea	Hh, Round
10	Ft	Conduit, DB, 1, 1 1/2 inch
10	Ft	Cable, Sec. 600V, 3, 1/C#4
10	Ft	Cable, Equipment Grounding Wire, 1/C#4
40	Ft	Conduit, DB, 1, 3 inch
15	Ft	Conduit, DB, 2, 3 inch
80	Ft	Conduit, Directional Bore, 1, 3 inch
1	Ea	Metered Serv
4	Syd	Aggregate Base, 6 inch
4	Sft	Sign, Type III B
12	Ft	Post, Steel, 3 lb
100	Dir	Power Co. (Est. Cost to Contractor)
1	Ea	ESS Tower
1	Ea	ITS Cabinet, Ground Mtd.
1	Ea	Lightning Protection, Pole
4	Syd	Approach, CI II, 6 inch
46	Cyd	Embankment, LM
130	Syd	Slope Restoration, Type A
13	Cyd	Excavation, Earth
2.2	Cyd	Conc. Low Temperature Protection
12	Ft	Drilled Shaft, 30 inch
0.09	LS	Drilled Shaft Equipment, Furnished
1	Ea	Serv Disconnect

CP 10  
EL 601.882838  
N=631418.867905  
E=25503001.035665

CP 15  
EL 599.602838  
N=631418.867905  
E=25503291.465665



NO.	DATE	AUTH	DESCRIPTION

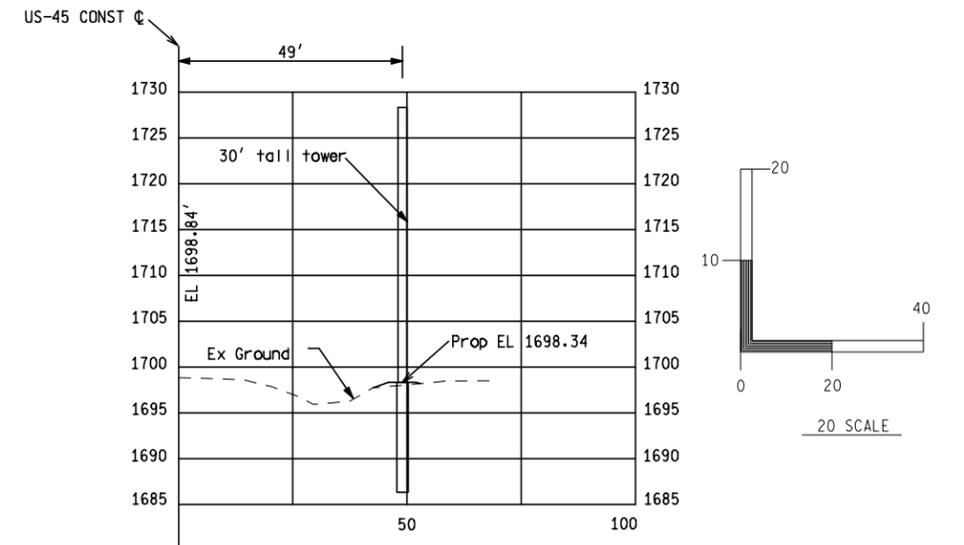
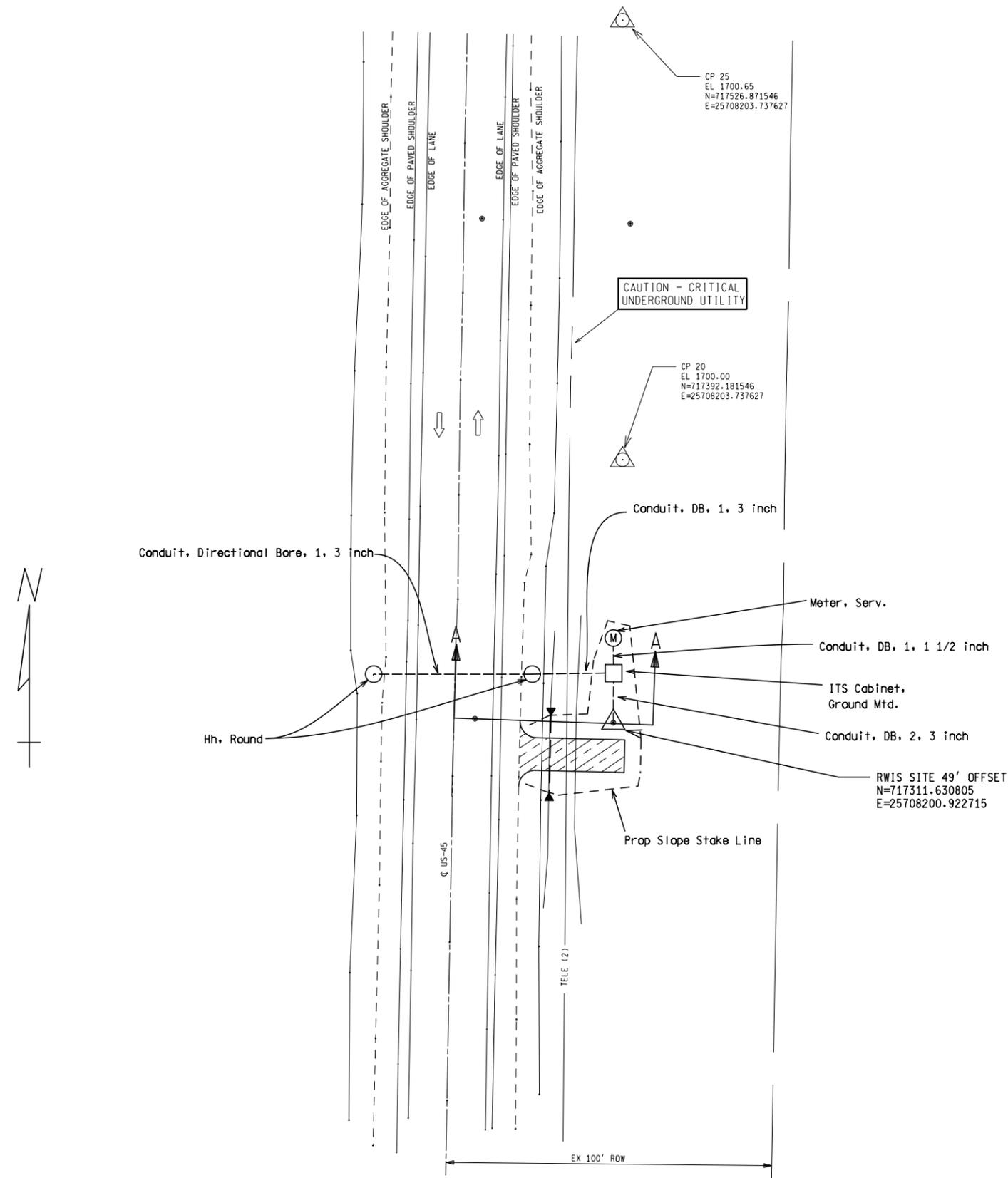


DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING  
FILE: 1 CF US2.dgn

CS: 84911  
JN: 107425A

ESS SITE #1 CONSTRUCTION SHEET  
US-2, GOGEBIC COUNTY

DRAWING SHEET  
CONST 19

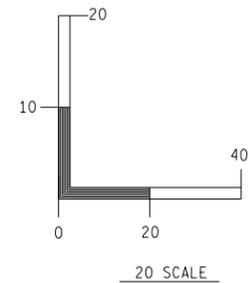
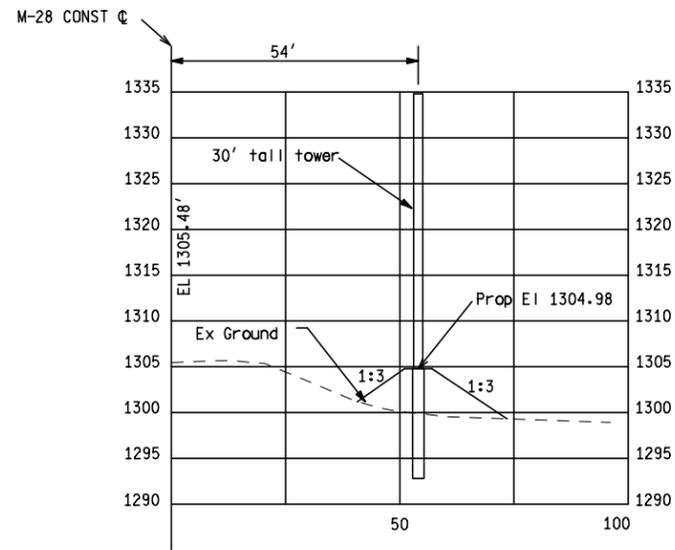


SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh. Round
10 Ft	Conduit, DB, 1. 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
25 Ft	Conduit, DB, 1. 3 inch
15 Ft	Conduit, DB, 2. 3 inch
50 Ft	Conduit, Directional Bore, 1. 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
133 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
41 Syd	Approach, Cl II, 6 inch
1 Ea	Lightning Protection, Pole
21 Cyd	Embankment, LM
75 Syd	Slope Restoration, Type A
24 Ft	Culv, Cl F, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
11 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
1 Ea	Serv Disconnect

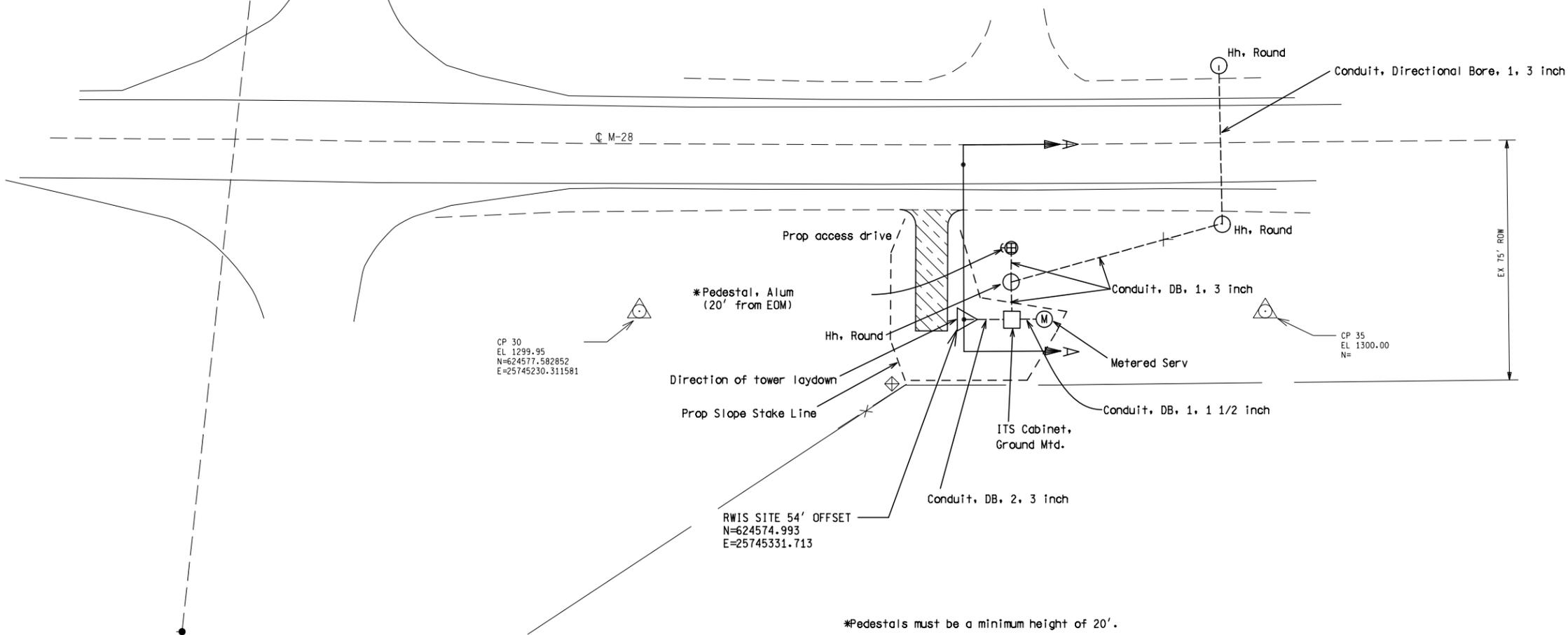
SECTION 7  
T47N-R37W  
DUNCAN TOWNSHIP



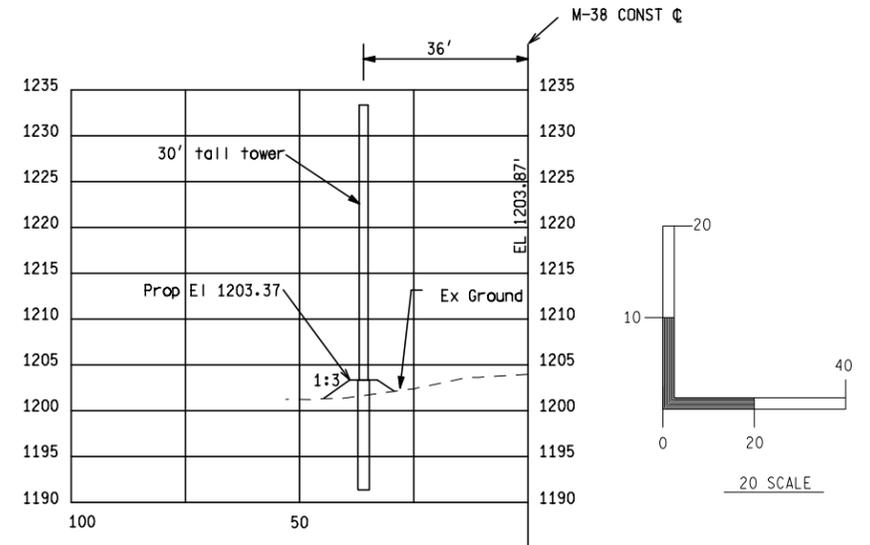
SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

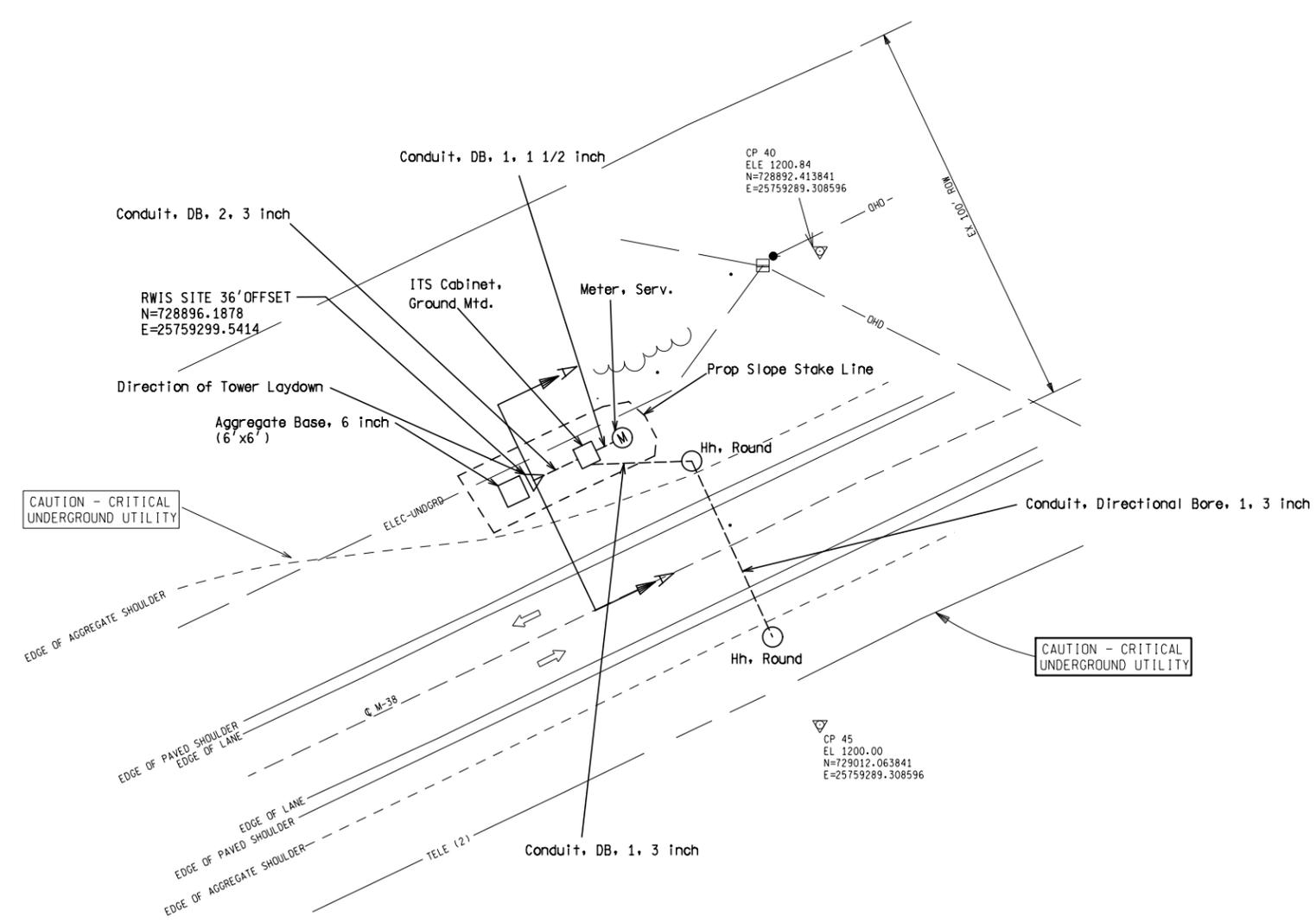
- 3 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 95 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 50 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 2000 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 1 Ea Pedestal, Alum
- 1 Ea Pedestal, Fdn
- 48 Syd Approach, CI II, 6 inch
- 1 Ea Lightning Protection, Pole
- 142 Cyd Embankment, LM
- 175 Syd Slope Restoration, Type A
- 17 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.08 LS Drilled Shaft Equipment, Furnished
- 12 Ft Temp Casing-Left in Place
- 1 Ea Serv Disconnect



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DATE: 4/4/12	CS: 84911	ESS SITE #3 CONSTRUCTION SHEET	DRAWING	SHEET
									DESIGN UNIT: GUSTAFSON	JN: 107425A	M-28, HOUGHTON COUNTY		CONST 21
									TSC: ISHPEMING				
								FILE: 3 CF M28.dgn					



SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET

- 2 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 30 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 50 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Syd Aggregate Base, 6 inch
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 600 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 7 Cyd Embankment, LM
- 70 Syd Slope Restoration, Type A
- 4 Syd Approach, CI II, 6 inch
- 8 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.08 LS Drilled Shaft Equipment, Furnished
- 1 Ea Serv Disconnect



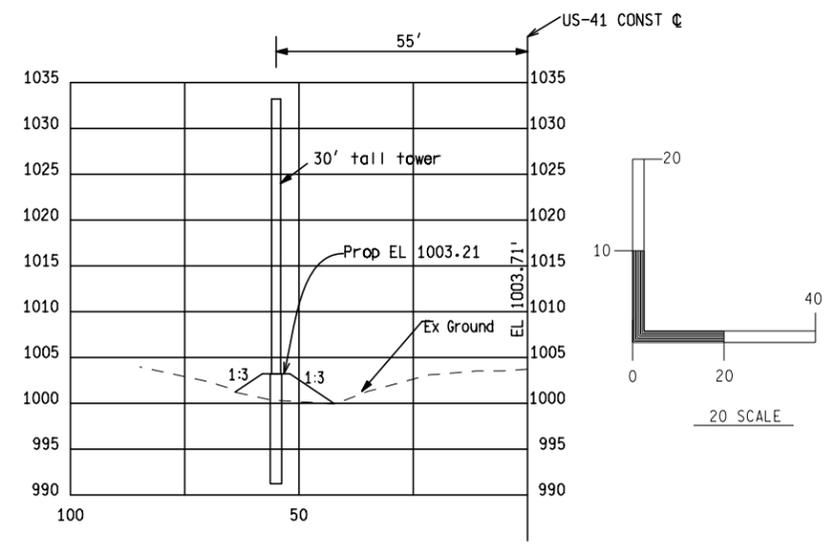
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION	MIDOT Michigan Department of Transportation		DATE: 4/4/12	CS: 84911	ESS SITE #4 CONSTRUCTION SHEET		DRAWING	SHEET
										DESIGN UNIT: GUSTAFSON	JN: 107425A	M-38, ONTONAGON COUNTY			CONST
										TSC: ISHPERING				22	

SECTION 26  
T56N.R33W  
OSCEOLA TOWNSHIP

CP 55  
ELEV 1001.145995  
N=891728.976709  
E=25884405.552000

RWIS SITE, 55' OFFSET  
N=891636.7725  
E=25884409.7417

CP 50  
ELEV 1000.00  
N=891587.545000  
E=25884405.552000



SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

- 2 Ea Hh, Round
- 10 Ft Conduit, DB, 1. 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 25 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 60 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 206 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 56 Syd Approach, CI II, 6 inch
- 1 Ea Lightning Protection, Pole
- 75 Cyd Embankment, LM
- 65 Syd Slope Restoration, Type A
- 16 Cyd Excavation, Earth
- 2.2 Cyd Conc, Low Temperature Protection
- 12 Ft Drilled Shaft, 30 inch
- 0.09 LS Drilled Shaft Equipment, Furnished
- 24 Ft Culv, CI F, 18 inch
- 2 Ea Culv, Slip End Sect, 1 on 6, 18 inch, Longit
- 1 Ea Serv Disconnect



NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION		DATE: 4/4/12	CS: 84911	ESS SITE #5 CONSTRUCTION SHEET	DRAWING	SHEET
								MIDOT Michigan Department of Transportation	DESIGN UNIT: GUSTAFSON	JN: 107425A	US-41, HOUGHTON COUNTY		CONST
									TSC: ISHPEMING				23

SECTION 26  
T53N,R33W  
CHASSELL TOWNSHIP

CP 65  
EL 614.51  
N=794844.912321  
E=25883879.0000

Pedestal, Alum  
(20' from lane)  
Pedestal must be a minimum  
height of 20'.

Conduit, DB, 1.3 inch

Conduit, DB, 1.1 1/2 inch

ITS Cabinet,  
Ground Mtd.

Conduit, DB, 2.3 inch

RWIS SITE, 101' OFFSET  
N=794759.905288  
E=25883846.620611

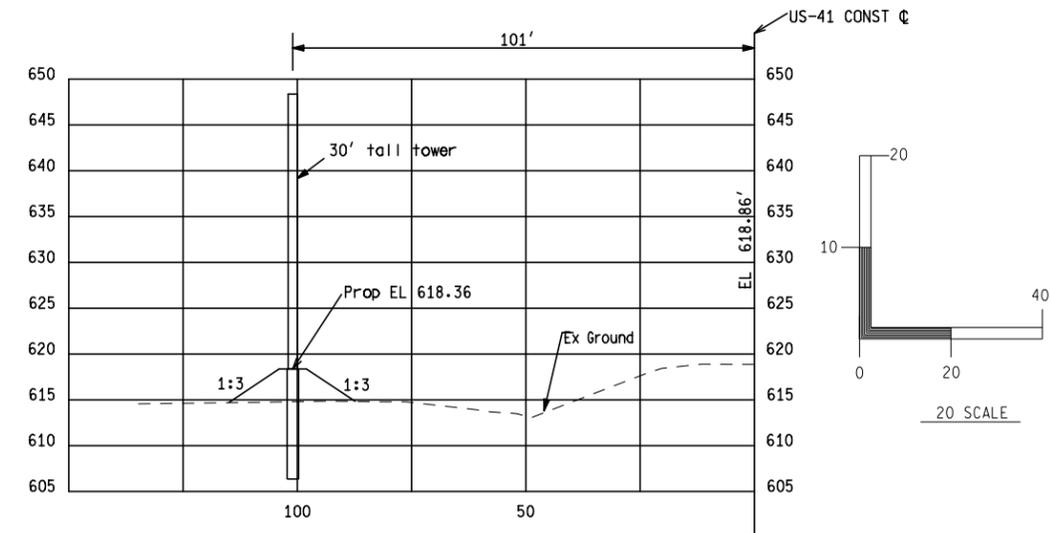
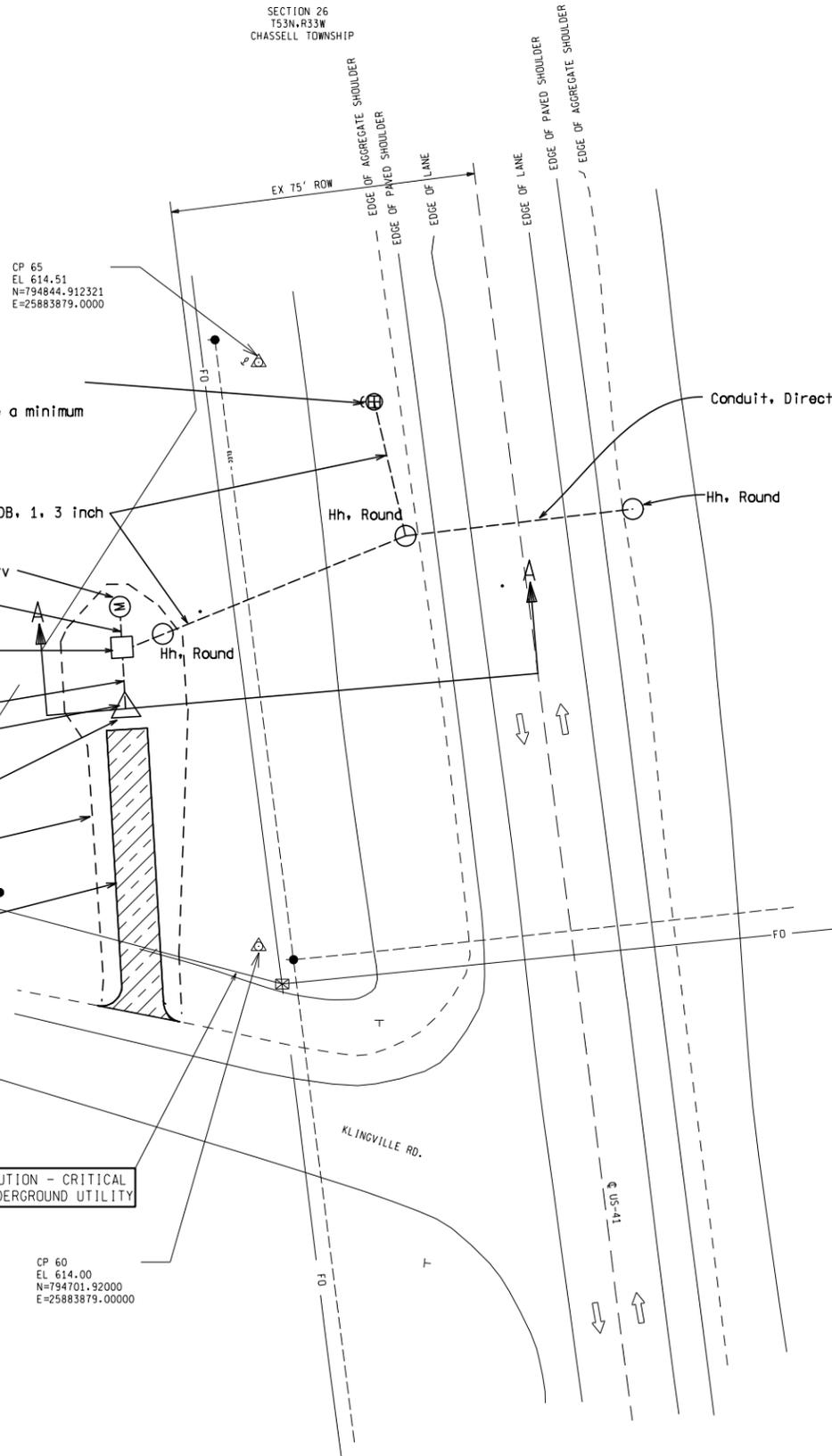
Direction of tower laydown

Prop Slope Stake Line

Prop access drive

CAUTION - CRITICAL  
UNDERGROUND UTILITY

CP 60  
EL 614.00  
N=794701.92000  
E=25883879.00000

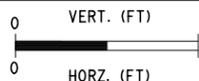


SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

3 Ea	Hh, Round
10 Ft	Conduit, DB, 1.1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
105 Ft	Conduit, DB, 1.3 inch
15 Ft	Conduit, DB, 2.3 inch
60 Ft	Conduit, Directional Bore, 1.3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
100 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Lightning Protection, Pole
83 Syd	Approach, CI II, 6 inch
186 Cyd	Embankment, LM
175 Syd	Slope Restoration, Type A
24 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
1 Ea	Pedestal, Alum
1 Ea	Pedestal, Fdn
1 Ea	Serv Disconnect

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

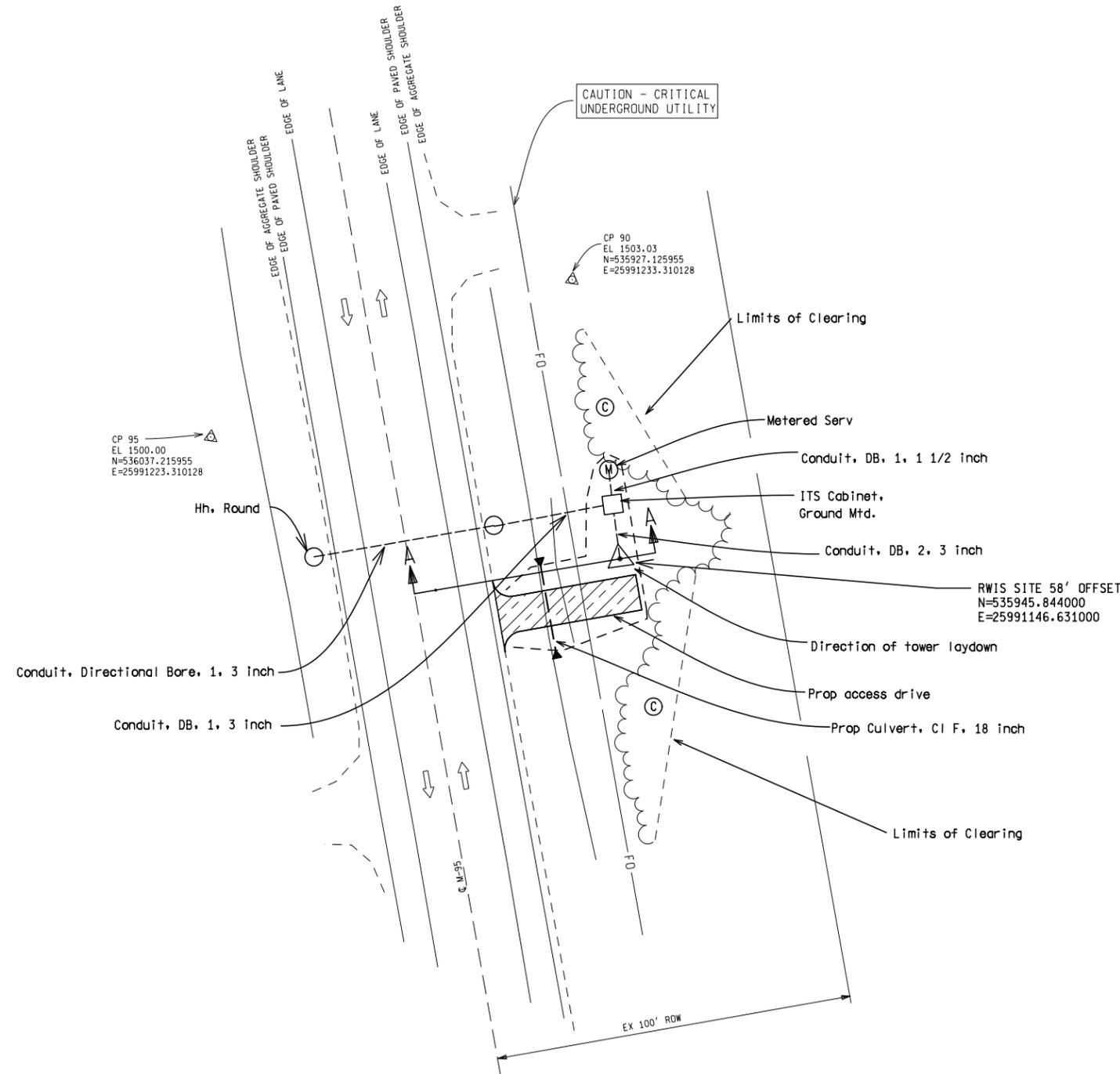


DATE: 4/4/12	CS: 84911
DESIGN UNIT: GUSTAFSON	JN: 107425A
TSC: ISHPEMING	

ESS SITE #6 CONSTRUCTION SHEET		DRAWING	SHEET
US-41, HOUGHTON COUNTY			CONST
			24

FILE: 6 ISH US41.dgn

SECTION 36  
T45N,R30W  
REPUBLIC TOWNSHIP



CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh, Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
35 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
55 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
2000 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
0.03 Acre	Clearing
1 Ea	Lightning Protection, Pole
50 Syd	Approach, CI II, 6 inch
42 Cyd	Embankment, LM
75 Syd	Slope Restoration, Type A
24 Ft	Culv, CI F, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
11 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
1 Ea	Serv Disconnect

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 9 ISH M95.dgn

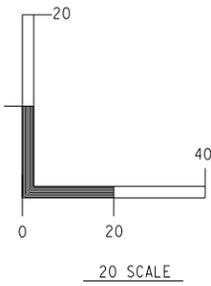
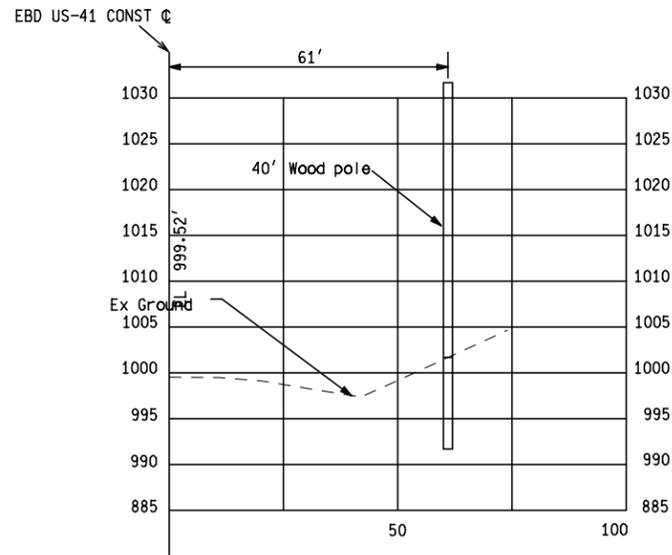
DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

CS: 84911  
JN: 107425A

ESS SITE # 9 CONSTRUCTION SHEET  
M-95, MARQUETTE COUNTY

DRAWING SHEET  
CONST 25

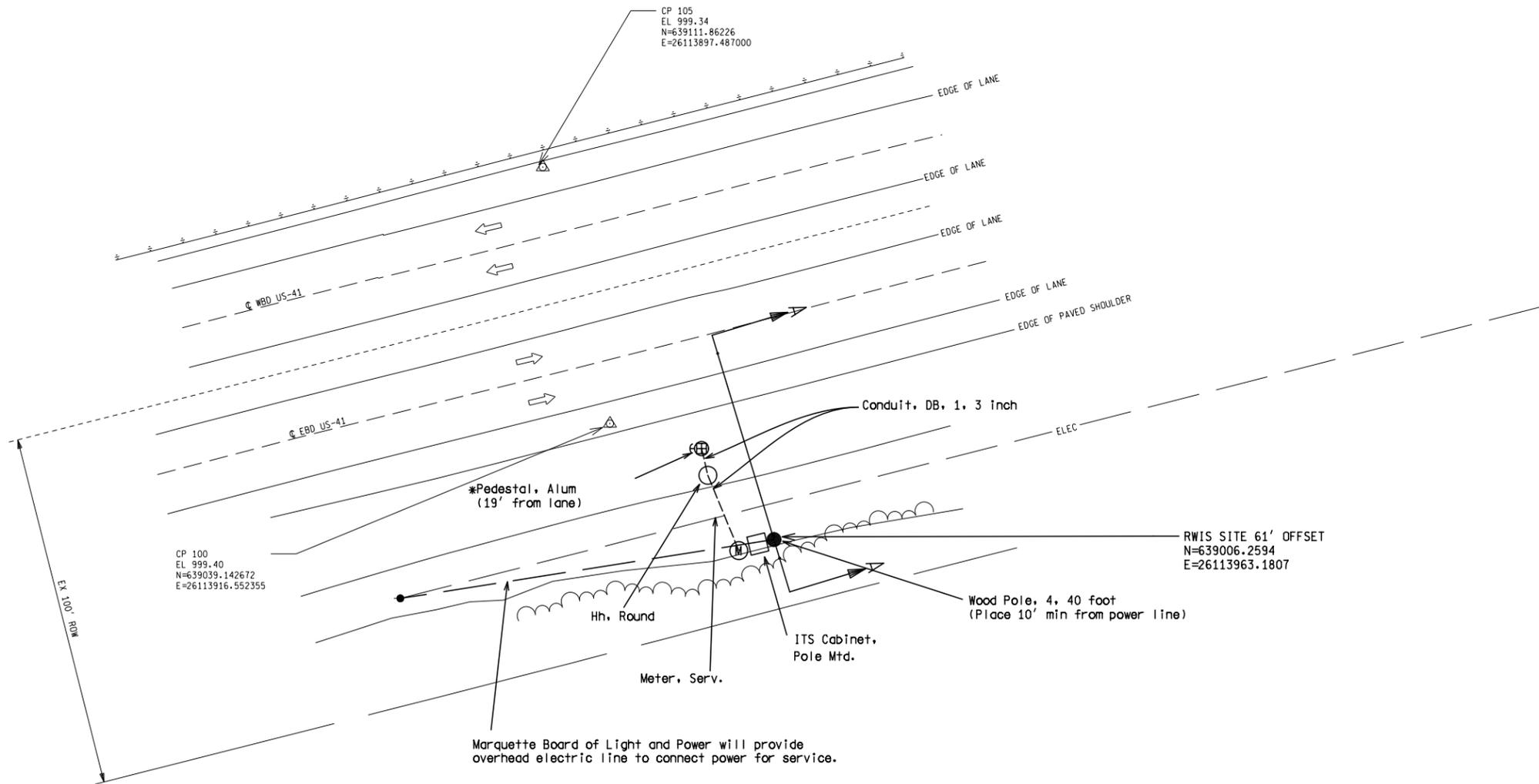
SECTION 26  
T48N,R26W  
NEGAUNEE TOWNSHIP



SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

- 1 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 30 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 300 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ITS Cabinet, Pole Mtd.
- 1 Ea Pedestal, Alum
- 1 Ea Pedestal, Fdn
- 1 Ea Lightning Protection, Pole
- 1 Ea Wood Pole, 4, 40 foot
- 10 Syd Slope Restoration, Type A
- 1 Ea Serv Disconnect



\*Pedestals must be a minimum height of 20'.

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



FILE: 10 ISH\US41.dgn

DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHP/EMING

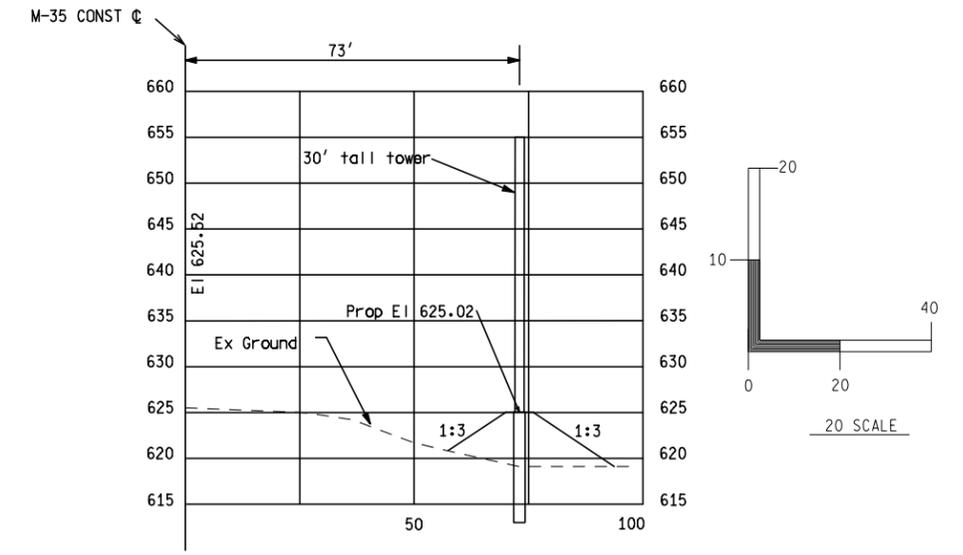
CS: 84911  
JN: 107425A

ESS SITE #10 CONSTRUCTION SHEET  
US-41, MARQUETTE COUNTY

DRAWING SHEET  
CONST 26

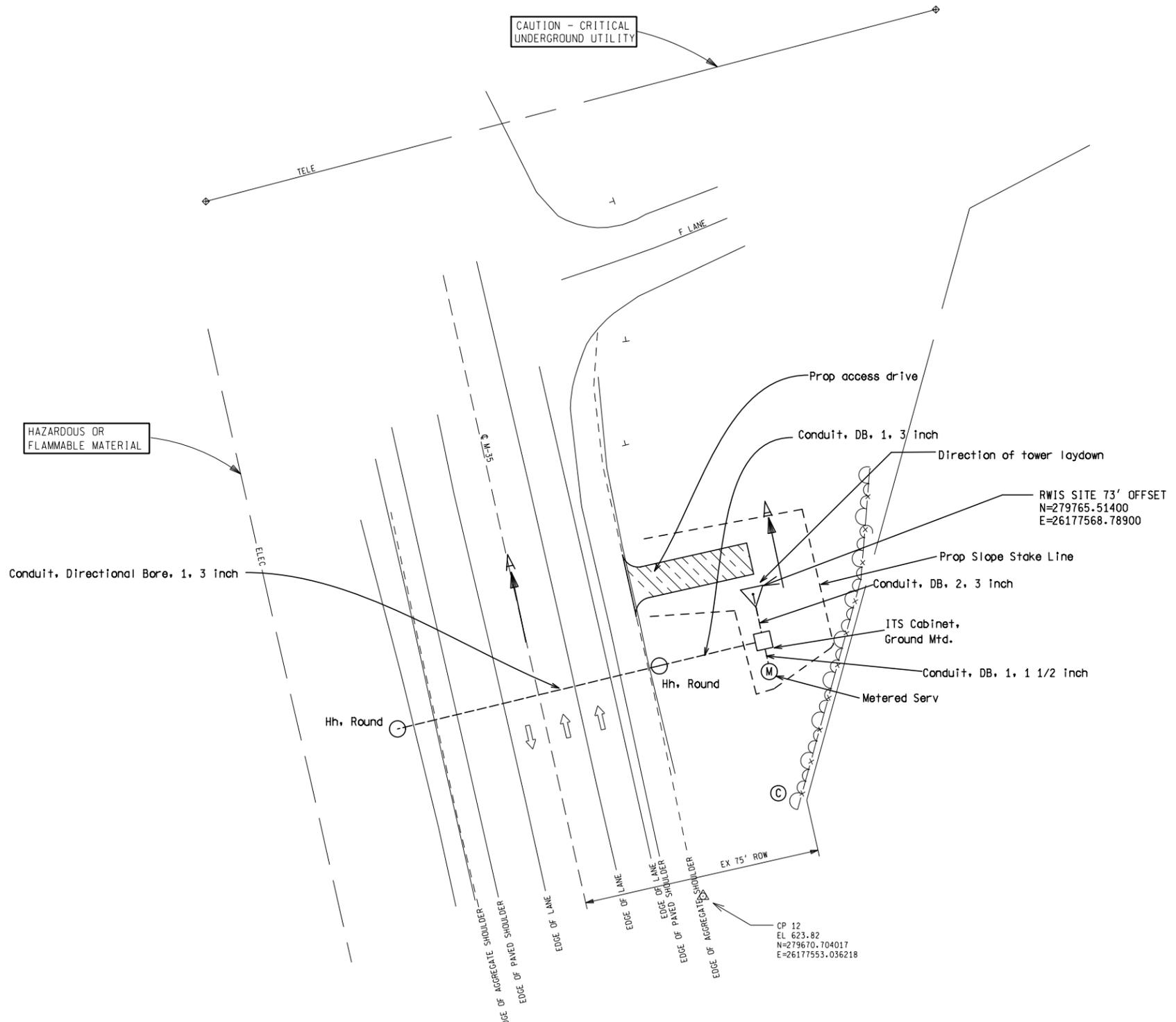
SECTION 4  
T36N.R24W  
CEDARVILLE TOWNSHIP

CAUTION - CRITICAL UNDERGROUND UTILITY



SECTION A-A

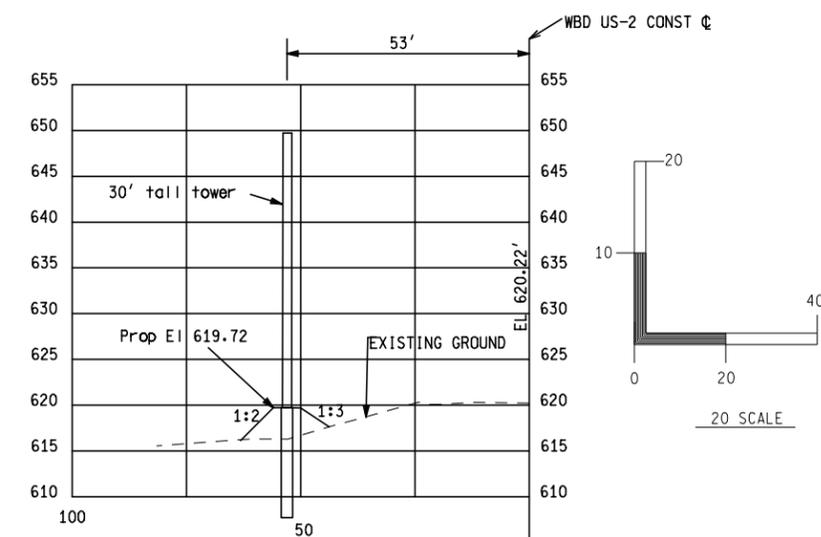
HAZARDOUS OR FLAMMABLE MATERIAL



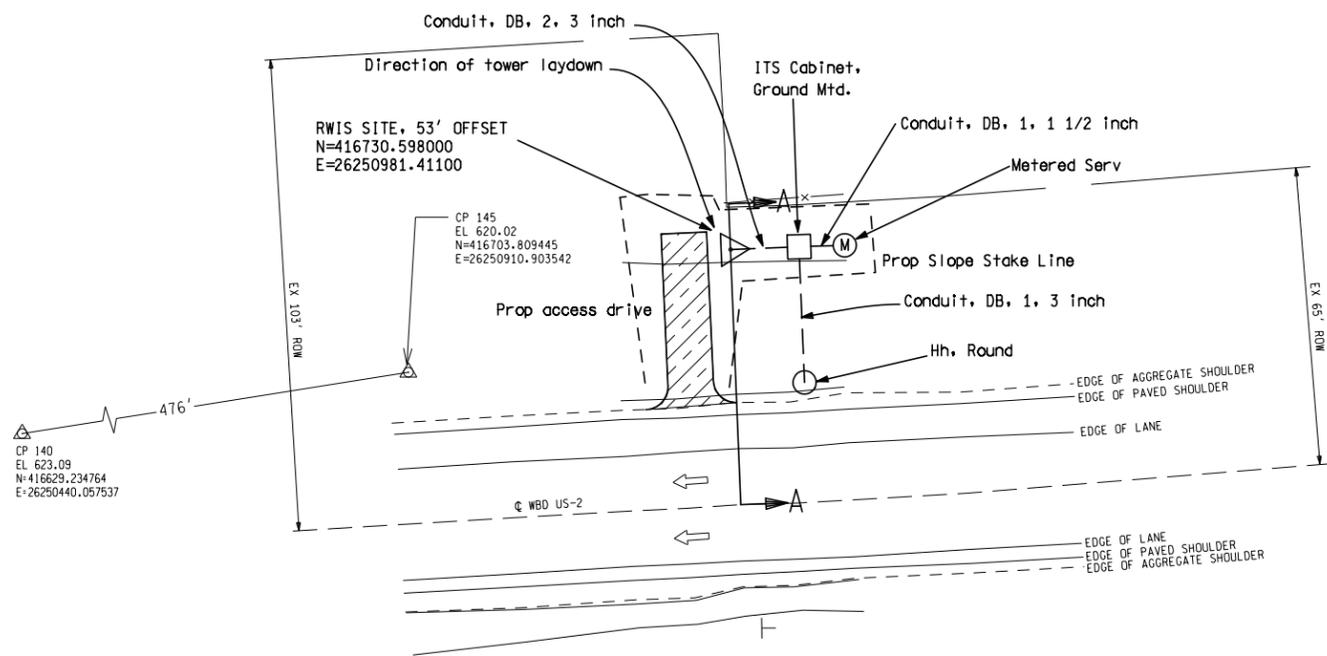
CONSTRUCTION QUANTITIES THIS SHEET	
2 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
35 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
85 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
3,800 Dir	Power Co. (Est. Cost to Contractor)
50 Syd	Approach, CI II, 6 inch
1 Ea	Lightning Protection, Pole
0.01 Acre	Clearing
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
190 Cyd	Embankment, LM
160 Syd	Slope Restoration, Type A
20 Cyd	Excavation, Earth
2.2 Cyd	Conc. Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.09 LS	Drilled Shaft Equipment, Furnished
1 Ea	Serv Disconnect

CP 12  
EL 623.82  
N=279670.704017  
E=26177553.036218

CP 12A (372' SOUTH)  
E1 622.30  
N=279309.241982  
E=26177636.486304



SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET

1 Ea	Hh, Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
15 Ft	Conduit, DB, 2, 3 inch
30 Ft	Conduit, DB, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
700 Dlr	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Lightning Protection, Pole
48 Syd	Approach, CI II, 6 inch
66 Cyd	Embankment, LM
100 Syd	Slope Restoration, Type A
13 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
1 Ea	Serv Disconnect

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION



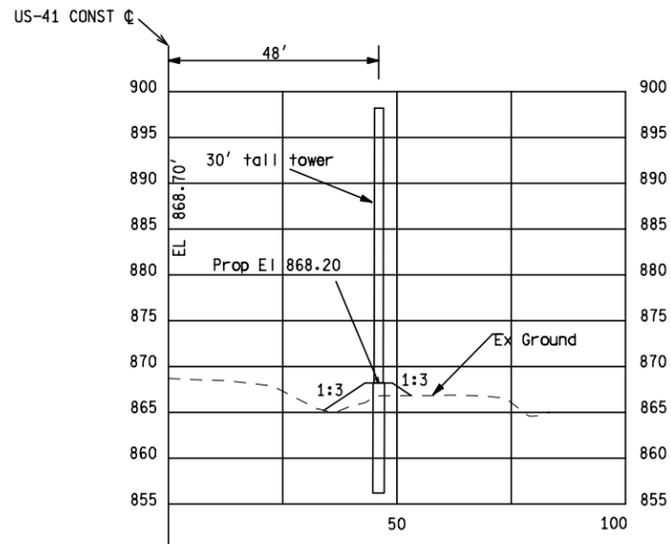
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DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

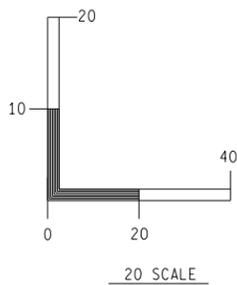
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JN: 107425A

ESS SITE #14 CONSTRUCTION SHEET  
US-2, DELTA COUNTY

DRAWING SHEET  
CONST 28



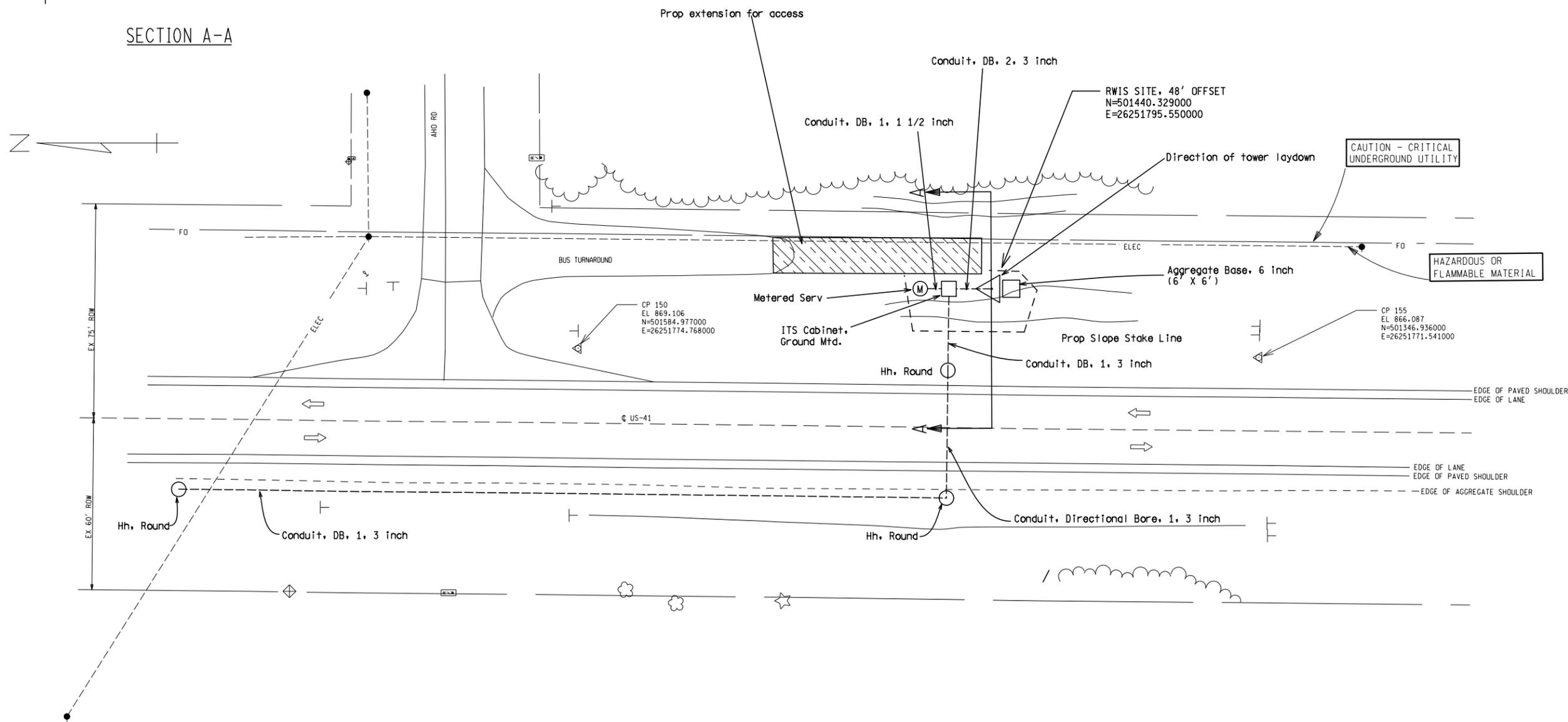
SECTION 6  
T43N,R21W  
MASONVILLE TOWNSHIP



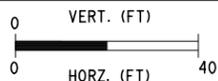
CONSTRUCTION QUANTITIES THIS SHEET

- 3 Ea Hh, Round
- 10 Ft Conduit, DB, 1, 1 1/2 inch
- 10 Ft Cable, Sec, 600V, 3, 1/C#4
- 10 Ft Cable, Equipment Grounding Wire, 1/C#4
- 300 Ft Conduit, DB, 1, 3 inch
- 15 Ft Conduit, DB, 2, 3 inch
- 50 Ft Conduit, Directional Bore, 1, 3 inch
- 1 Ea Metered Serv
- 4 Sft Sign, Type III B
- 12 Ft Post, Steel, 3 lb
- 1700 Dir Power Co. (Est. Cost to Contractor)
- 1 Ea ESS Tower
- 1 Ea ITS Cabinet, Ground Mtd.
- 15 Cyd Embankment, LM
- 104 Syd Approach, CI II, 6 inch
- 1 Ea Lightning Protection, Pole
- 80 Syd Slope Restoration, Type A
- 17 Cyd Excavation, Earth
- 1 Ea Serv Disconnect
- 10 Cyd Excavation, Fdn
- 8 Cyd Backfill, Structure, CIP
- 145 Lb Reinforcement, Steel, Epoxy Coated
- 2.5 Cyd Conc, Low Temperature Protection
- 2.5 Cyd Substructure Conc

SECTION A-A



NO.	DATE	AUTH	DESCRIPTION



FILE: 15 ESC US41.dgn

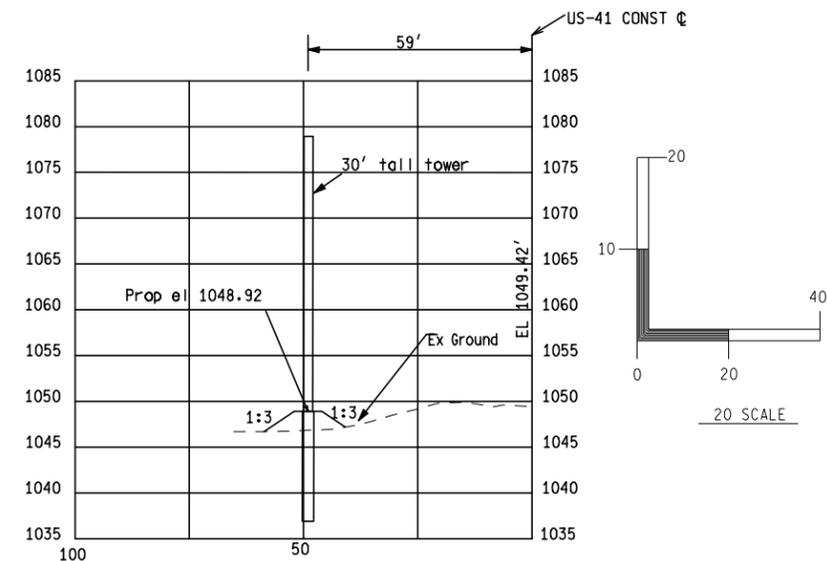
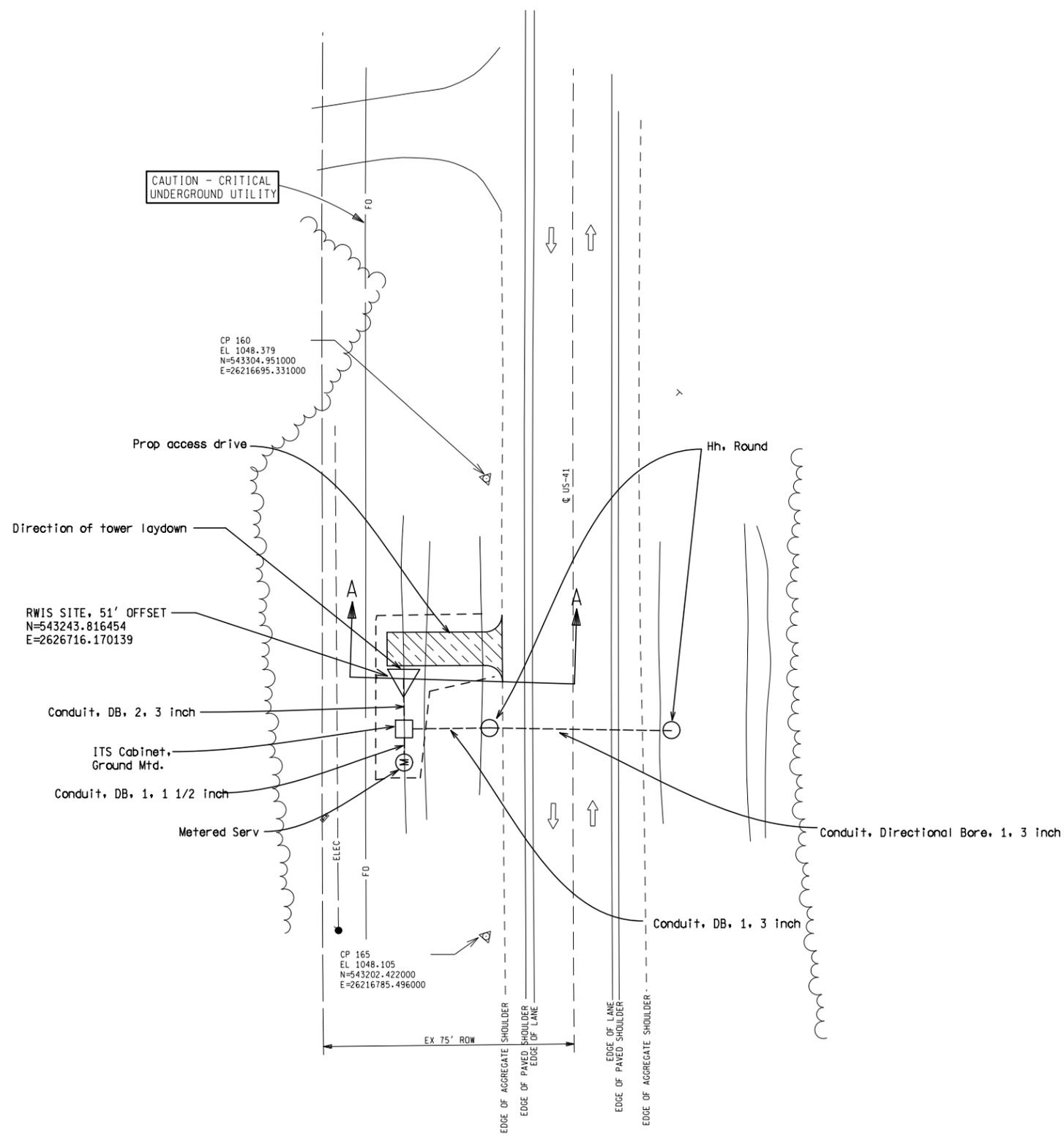
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TSC: ISHPEMING

CS: 84911  
JN: 107425A

ESS SITE #15 CONSTRUCTION SHEET  
US-41, DELTA COUNTY

DRAWING SHEET  
CONST 29

SECTION 25  
T45N.R23W  
SKANDIA TOWNSHIP

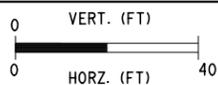


SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
25 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
55 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
1350 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
38 Cyd	Embankment, LM
45 Syd	Approach, CI 11, 6 inch
1 Ea	Lightning Protection, Pole
70 Syd	Slope Restoration, Type A
11 Cyd	Excavation, Earth
2.3 Cyd	Conc, Grade S2
8 Lb	Reinforcement, Steel
1 Ea	Serv Disconnect
10 Cyd	Excavation, Fdn
8 Cyd	Backfill, Structure, CIP
145 Lb	Reinforcement, Steel, Epoxy Coated
2.5 Cyd	Conc, Low Temperature Protection
2.5 Cyd	Substructure Conc

NO.	DATE	AUTH	DESCRIPTION



FILE: 16 ESC US41.dgn

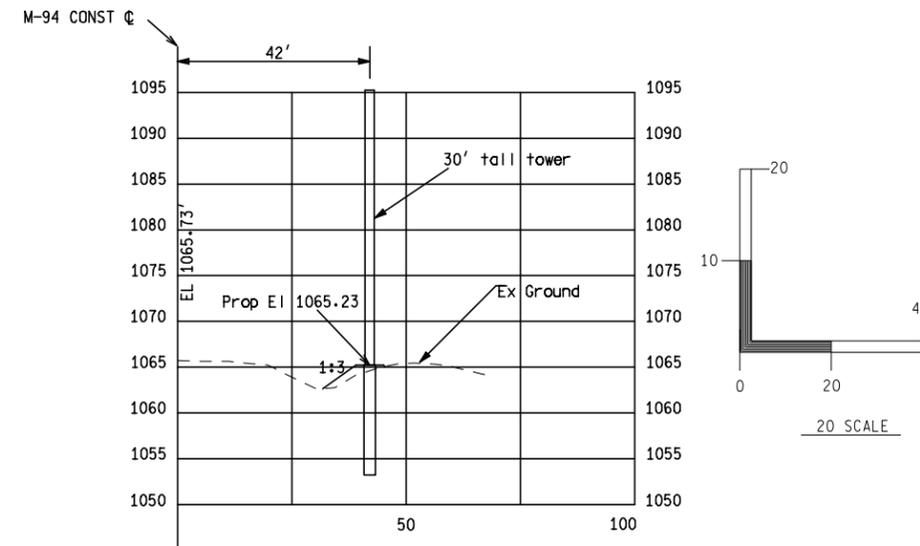
DATE: 4/4/12  
DESIGN UNIT: GUSTAFSON  
TSC: ISHPEMING

CS: 84911  
JN: 107425A

ESS SITE #16 CONSTRUCTION SHEET  
US-41, MARQUETTE COUNTY

DRAWING SHEET  
CONST 30

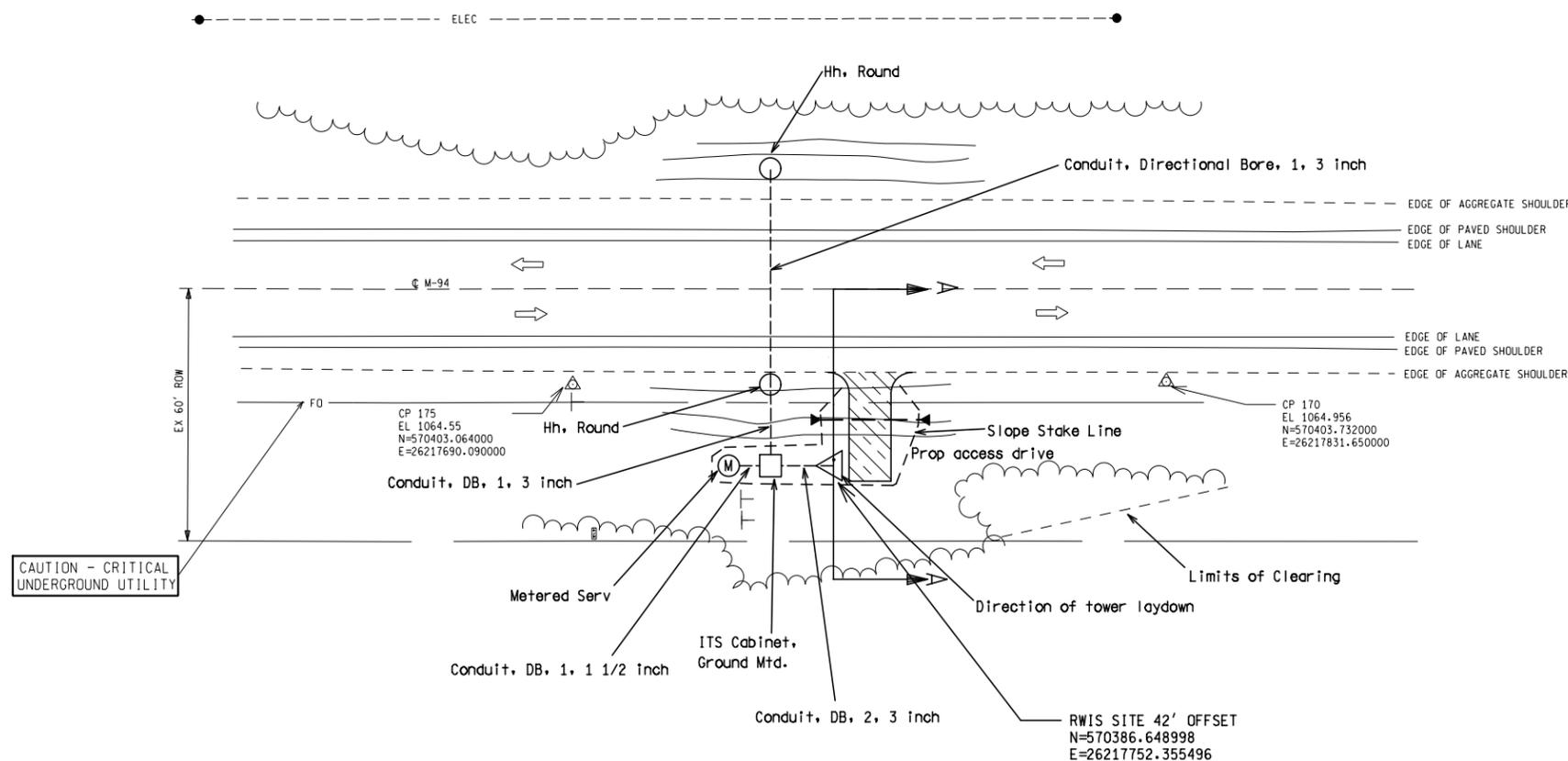
SECTION 31  
T46N.R22W  
ROCK RIVER TOWNSHIP



SECTION A-A

CONSTRUCTION QUANTITIES THIS SHEET

2 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
25 Ft	Conduit, DB, 1, 3 inch
15 Ft	Conduit, DB, 2, 3 inch
50 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
700 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Lightning Protection, Pole
24 Ft	Culv, CI A, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
30 Syd	Approach, CI II, 6 inch
24 Cyd	Embankment, LM
0.02 Acre	Clearing
50 Syd	Slope Restoration, Type A
7 Cyd	Excavation, Earth
2.2 Cyd	Conc, Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.08 LS	Drilled Shaft Equipment, Furnished
1 Ea	Serv Disconnect



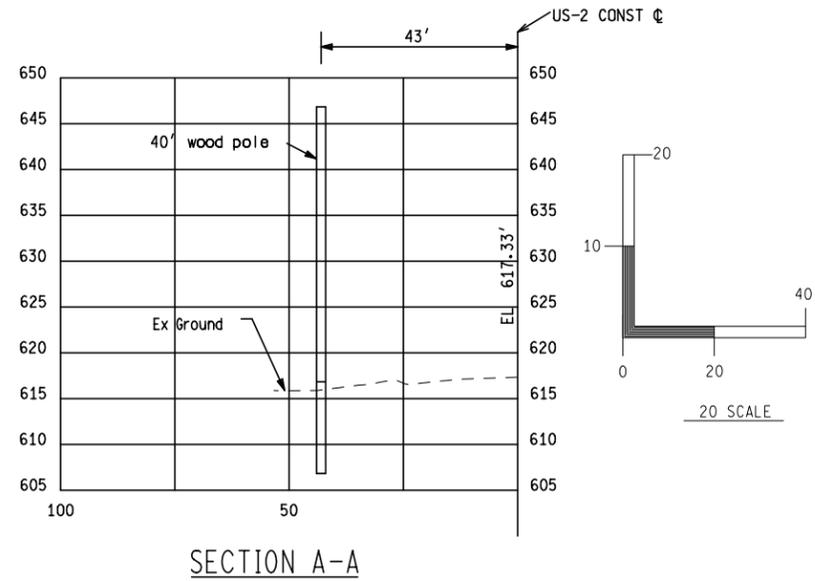
NO.	DATE	AUTH	DESCRIPTION



DATE: 4/4/12	CS: 84911
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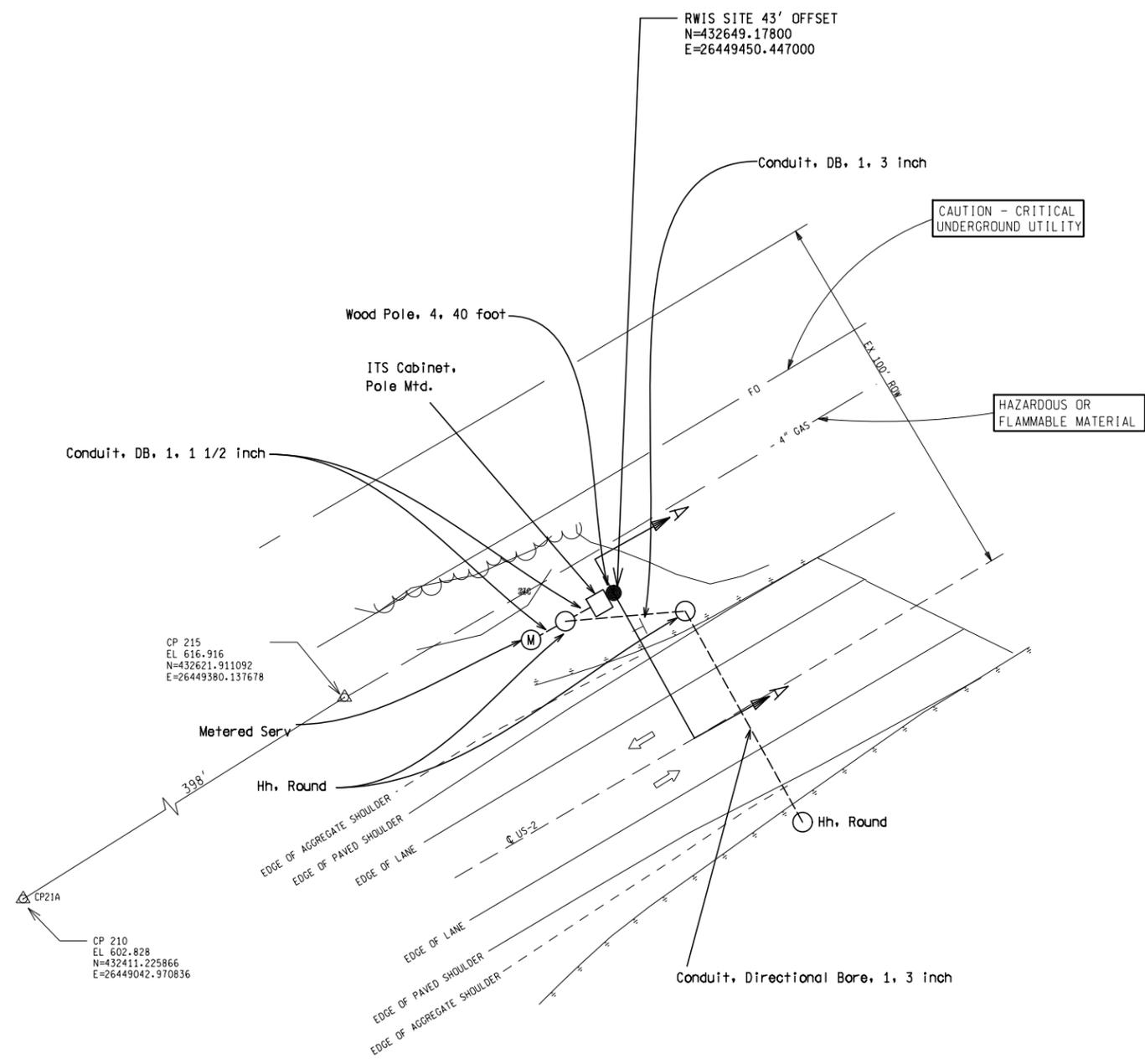
ESS SITE #17 CONSTRUCTION SHEET  
M-94, ALGER COUNTY

DRAWING	SHEET
	CONST
	31

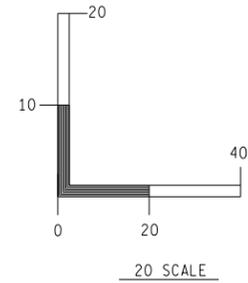
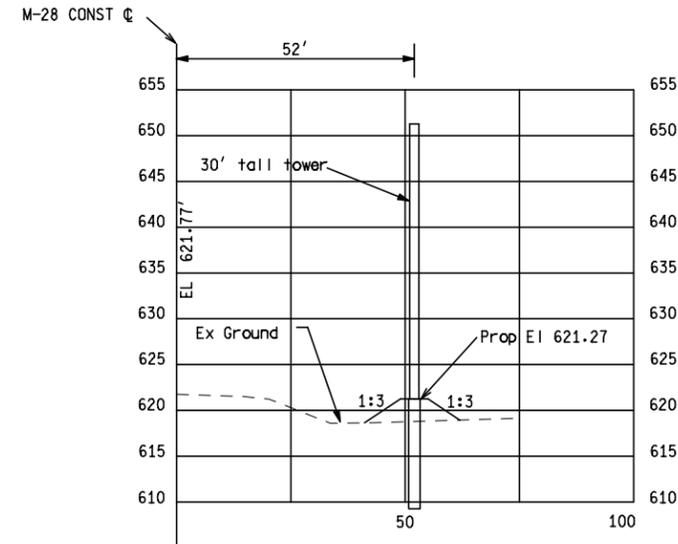


**CONSTRUCTION QUANTITIES THIS SHEET**

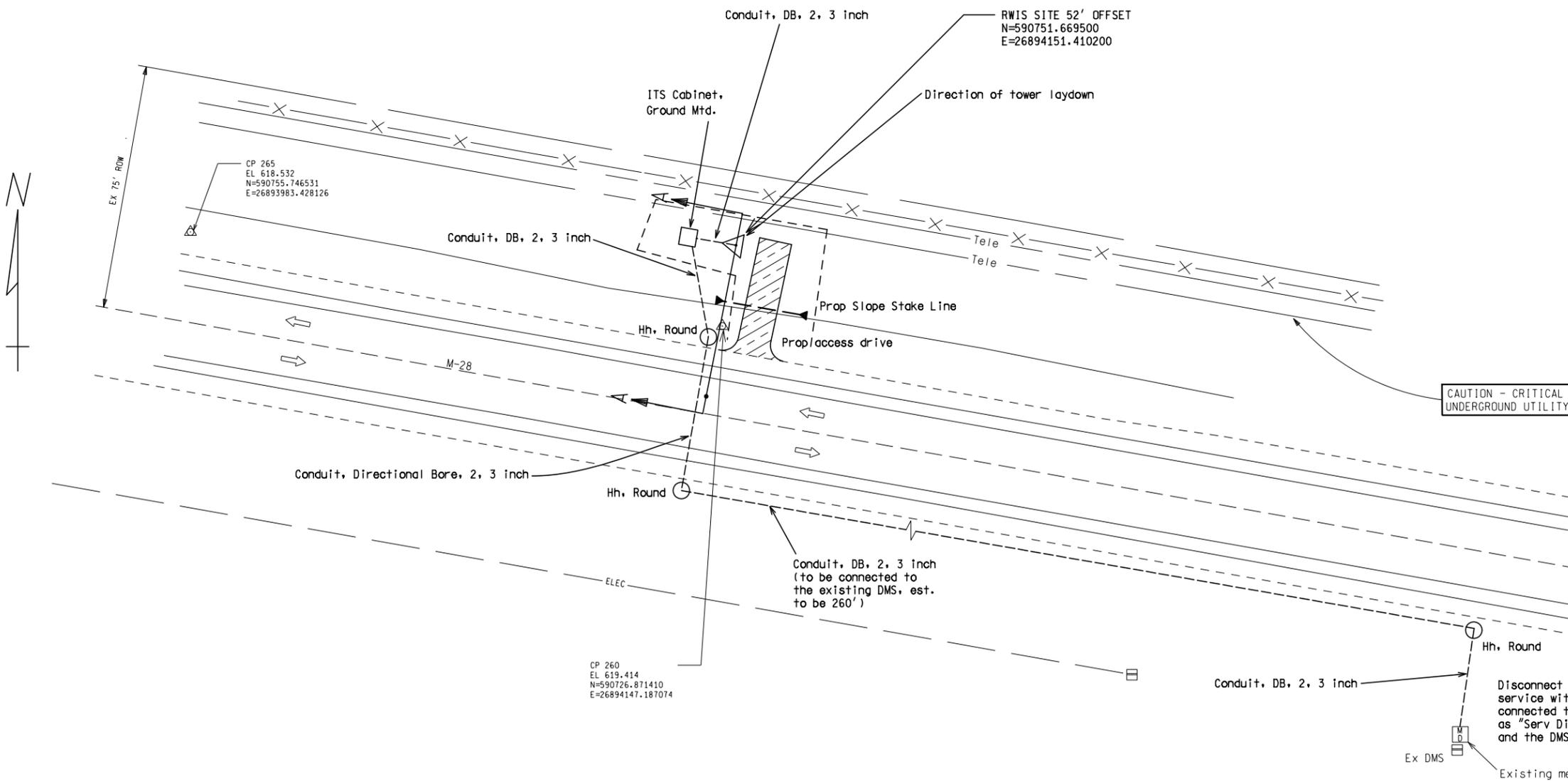
2 Ea	Hh, Round
30 Ft	Conduit, DB, 1, 1 1/2 inch
30 Ft	Cable, Sec, 600V, 3, 1/C#4
30 Ft	Cable, Equipment Grounding Wire, 1/C#4
35 Ft	Conduit, DB, 1, 3 inch
65 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Metered Serv
4 Sft	Sign, Type III B
12 Ft	Post, Steel, 3 lb
1 Ea	Wood Pole, 4, 40 foot
1 Ea	ITS Cabinet, Pole Mtd.
8500 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	Lightning Protection, Pole
5 Syd	Slope Restoration, Type A
1 Ea	Serv Disconnect







SECTION A-A



CONSTRUCTION QUANTITIES THIS SHEET	
3 Ea	Hh. Round
10 Ft	Conduit, DB, 1, 1 1/2 inch
10 Ft	Cable, Sec, 600V, 3, 1/C#4
10 Ft	Cable, Equipment Grounding Wire, 1/C#4
350 Ft	Conduit, DB, 2, 3 inch
50 Ft	Conduit, Directional Bore, 1, 3 inch
1 Ea	Serv Disconnect
4 Sft	Sign, Type III B
1 Ea	ESS Tower
12 Ft	Post, Steel, 3 lb
1440 Dir	Power Co. (Est. Cost to Contractor)
1 Ea	ESS Tower
1 Ea	ITS Cabinet, Ground Mtd.
1 Ea	Lightning Protection, Pole
115 Cyd	Embankment, LM
50 Syd	Approach, CI II, 6 inch
150 Syd	Slope Restoration, Type A
17 Cyd	Excavation, Earth
2.2 Cyd	Conc. Low Temperature Protection
12 Ft	Drilled Shaft, 30 inch
0.09 LS	Drilled Shaft Equipment, Furnished
12 Ft	Temp Casing-Left in Place
24 Ft	Culv, CI F, 18 inch
2 Ea	Culv, Slip End Sect, 1 on 6, 18 inch, Longit
1 Ea	Serv Disconnect

Disconnect is to be installed on the back side of existing service with meter and disconnect. New disconnect panel is to be connected to existing meter as noted above. Work will be paid for as "Serv Disconnect". Clearly label disconnects for the ESS tower and the DMS.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**POWER DISTRIBUTION UNIT**

ITS:DG

1 of 2

C&amp;T:APPR:LWB:YYY:00-00-12

**a. Description.** This work consists of furnishing, installing, and providing manufacturer warranty of an environmentally hardened Power Distribution Unit (PDU) and all communications cable, patch cords and jumpers required to connect it to power and an Ethernet switch. The PDU shall be switched, allowing for the unit to power cycle individual receptacles remotely through the network.

**b. Materials.**

1. General.

- A. PDU must have a minimum of 4 switched receptacles.
- B. PDU must be rack mountable in a 19" rack or be in a standalone configuration that is compatible with the enclosure as shown in the plans.
- C. PDU must have Simple Network Management Protocol (SNMP) V2 or V3 capabilities. The interface must be RJ-45 10/100 Mbps auto-negotiation, static and Dynamic Host Configuration Protocol (DHCP) Internet Protocol (IP) addressable, and have a Graphical User Interface (GUI) via a web browser that can be opened remotely for access and management of the PDU.

2. Electrical.

- A. The PDU must provide 120 Volt Alternating Current (VAC) power to a minimum of 4 NEMA 5-15R receptacles.
- B. PDU must be rated for a minimum of 15 Amps.
- C. PDU must be powered by either Alternating Current (AC) or Direct Current (DC) power. Any power conversion equipment required must be an appurtenance to the PDU and must not be paid for separately.

3. Environmental.

- A. PDU must have an operating temperature range of -29 to 165 degrees Fahrenheit (F) and a non-condensing humidity range of 5 to 90 percent.
- B. Provide parts that are made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass or gold-plated metal.

**c. Construction.**

1. Installation.

A. PDU must power ITS devices in order to provide remote monitoring and control of receptacles for Cameras, Digital Video Encoders (DVE), Wireless Radios and any other devices requested to be integrated into the PDU by the Engineer. The individual circuits must be able to be controlled and cycled separately.

B. PDU must be configured for access from the MDOT Traffic Operations Center (TOC) or head-end. Acceptance Testing must validate the remote power cycle of receptacles.

2. Manufacturer Warranty. The PDU must carry a manufacturer's standard warranty (parts, software and labor) of 5 years from the date of final acceptance.

**d. Measurement and Payment.** The work as described will be measured and paid for using the following pay item.

<b>Pay Item</b>	<b>Pay Unit</b>
Power Distribution Unit.....	Each

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**ATMOSPHERIC SENSOR(S)**

ITS:DG

1 of 7

C&amp;T:APPR:LWB:YYY:00-00-12

**a. Description.** This work consist of furnishing, installing, integrating, testing, and providing manufacturer warranty of an atmospheric sensor(s), as a part of an Environmental Sensor Station (ESS) installation as shown on the Plans. This work must be done in accordance with the latest Standard Specifications for Construction, except as modified herein. Device quantity, location, communications medium and power for each ESS will be shown on the Plans.

This special provision provides a modular framework for the specification of the device with functions and capabilities which can be selected to meet site specific needs and conditions.

1. General.

A. The Contractor must furnish, install, integrate, calibrate, test, and provide manufacturer warranty for all equipment and components necessary to provide complete functionality without additional expense to the Department.

B. Use identical and completely interchangeable equipment at each field location.

C. Final equipment selection, procurement, and installation must be approved and coordinated with the MDOT Engineer.

D. Different configurations of sensors and/or equipment may be specified at various ESS sites. Same function and range sensor and/or equipment shall be identical when used at each site. This is intended to minimize the number of variations of spare parts and software patches which are necessary to maintain the ESS sites.

E. The Contractor must furnish, install, integrate, test, and provide manufacturer warranty for the atmospheric sensor(s) and all ancillary components, which meets or exceeds all testing requirements as noted on the Plans and in accordance with this Special Provision.

2. Functional and Performance Requirements.

A. General.

(1) Ensure all atmospheric sensors are integrated with the remote processing unit (RPU) located in the field cabinet or the traffic management center (TMC) as designated on plans.

(2) Ensure all atmospheric sensors allow for interoperability between multiple vendors' field controllers. All sensors must be compatible with a *National*

*Transportation Communications for ITS Protocol (NTCIP)* based RPU for communication to MDOT current Advanced Traffic Management System (ATMS) software.

(3) Ensure all atmospheric sensors support at least one of the following communication protocols in order to transmit data to the RPU:

- (a) Serial (RS-232/RS-422/RS-485);
- (b) Analog/digital;
- (c) Ethernet.

(4) The specific sensor and devices selected at each ESS site must be shown on the plans. Each selected device must meet the minimum performance requirements identified in sections B thru section F and Table 1.

#### B. Visibility Sensor.

(1) Ensure the sensor obtains the average distance seen, under both daylight and hours of dark.

(2) The measurement algorithm must measure the visibility of a sample volume between the optics hoods for 2 minutes and then report the average visibility over the sampling interval.

(3) The visibility receiver and transmitter hoods must be heated to allow continuous operation in winter or icing conditions.

(4) The visibility sensor must use "look down" geometry to reduce window contamination and clogging from blowing snow.

(5) Visibility measurement device must use the forward scatter principle for the determination of optical visibility in the range designated in Table 1.

#### C. Air Temperature/Relative Humidity Sensor.

(1) The air temperature must be measured and obtained using a precise resistive platinum sensor. The relative humidity must be measured by a capacitive sensor.

(2) The air temperature sensor must send air temperature and relative humidity data to the RPU which will be used to calculate the dew point temperature and the minimum/maximum temperature recorded during the 24-hour period preceding the measurement. Dew point and minimum/maximum temperature should be within  $\pm 0.45$  degrees Fahrenheit (F) ( $\pm 0.25$  degrees Celsius (C)) over the operating range.

#### D. Wind Sensor.

(1) The wind sensor must be an ultrasonic sensor capable of obtaining the average speed and direction of the wind. The wind speed should be obtained at an

accuracy of  $\pm 2.3$  mph for range of 0 to 77 mph and maximum of 3% over 78 to 134 mph (1 m/s) and the direction should be accurate to 5 degrees.

(2) The wind sensor must continuously send wind data to the RPU which will use this data to calculate the maximum wind gust recorded during the ten minutes preceding the observation.

#### E. Barometric Pressure Sensor.

(1) Ensure the barometric pressure sensor obtains absolute atmospheric pressure.

(2) Ensure the barometric pressure sensor provides results in  $\pm 0.5$  millibar increments at 68 degrees F (20 degrees C) and linear to within  $\pm 1.0$  millibars over the operating temperature range.

(3) Ensure each device is calibrated for the altitudes encountered within the State of Michigan.

#### F. Precipitation Sensor.

(1) Precipitation, Classification. The precipitation sensor must detect visible precipitation in both liquid and frozen form. The device shall provide a Yes/No indicator until a classification has been determined. The device must also have the capability to add classification of the following types of precipitation:

- (a) Drizzle (light and moderate);
- (b) Rain (light, moderate and heavy);
- (c) Freezing Rain (light, moderate and heavy);
- (d) Snow (light, moderate and heavy);
- (e) Precipitation, not categorized (light, moderate and heavy);

(2) The precipitation sensor must be configured using NTCIP protocol to send classification data to the RPU which will calculate the precipitation start/end time, time since last precipitation, forecasted snow or rain accumulation (equal to previous time interval), and probability of precipitation.

(3) The precipitation sensor must use Doppler radar technology.

**Table 1 Sensor Performance Specifications**

Sensor	Sensor Measurement	Specifications	
		Typical Accuracy Range	Operating Range
Visibility	Visibility	$\pm 10\%$ (At 10,000m/5mi range)	10 to 16,000m (32 to 52,000ft)

Sensor	Sensor Measurement	Specifications	
		Typical Accuracy Range	Operating Range
Air Temperature	Air Temperature	$\pm 0.25$ °C ( $\pm 0.45$ °F)	- 40 to + 50 °C (-40 to 122 °F)
	Relative Humidity	$\pm 3\%$	0 – 100%
Wind	Wind Speed	$\pm 1$ m/s ( $\pm 2.3$ mph for 0-77 mph) $\pm 1.80$ m/s ( $\pm 3\%$ mph 78-134mph)	0 to 60m/s (1 to 134mph)
	Wind Direction	$\pm 5$ deg. (At Speed > 0.2m/s)	0 to 360 deg.
Pressure	Barometric Pressure	$\pm 1.0$ millibar	800 to 1080 millibars
Precipitation	Precipitation Type	Yes/No (90%)	N/A
	Precipitation Rate or Intensity	.05mm/hr (0.02in/hr)	0 to 200mm/hr (0 to 20in/hr)
	Precipitation Accumulation	.05mm (0.02in)	0 to 200mm (0 to 20in/hr)

## b. Materials.

### 1. General Requirements.

A. Ensure all materials furnished, assembled, fabricated, or installed under this section are new, corrosion resistant, and in accordance with the details shown on the Plans and in the Special Provisions.

B. Ensure all electrical components operate on 120 VAC ( $\pm 10$  %) 50/60 Hz electricity. The Contractor must provide appropriate DC conversion for any equipment requiring DC power. If the site is solar powered, the Contractor will be allowed to power the devices using DC equipment. The Contractor must provide appropriate DC to DC and DC to AC conversion as necessary.

C. Ensure the equipment used is designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

#### D. Field equipment requirements.

(1) Must meet the following minimum temperature and environmental requirements:

(a) Operating/Storage temperature range of -40 to 140 degrees F (-40 degrees C to +60 degrees C).

(b) Non-condensing operating humidity range of 5 percent to 95 percent.

(2) Survive exposure to either direct solar heating or to high temperatures within an enclosure, as stated in storage temperature range noted above.

(3) The Contractor must provide an aspirated radiation shield or sensor design to meet the performance requirements noted in Table 1.

**c. Construction.** All elements included in this special provision, including power and communications, must comply with the construction requirements stated in the MDOT Standard Specifications, this Special Provision, and any applicable state and local regulations.

1. Installation.

A. All installation must be done in a neat and professional manner. All cabling must be labeled on both ends, bundled and stressed.

B. Installation of atmospheric devices must be in conformance with the manufacturer's requirements for the device as specified, as it may be upgraded over its operational life.

C. Prior to installing the device, the Contractor must supply actual field test documentation that substantiates the atmospheric sensor(s) performance.

D. The installation must meet local and state electrical requirements including grounding. Grounding must be paid for and covered under the special provision for Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment.

E. The Contractor must ensure that a representative from the atmospheric sensors manufacturer or other certified company is in attendance during installation of the first atmospheric device.

F. Care must be taken not to damage any part or equipment during installation. Damaged parts or equipment will be replaced at no additional cost to the project or the Department. Repair is not an acceptable means of replacement. All equipment must be replaced with new parts.

G. The Contractor must obtain engineering support and have representative(s) from the equipment suppliers available at the site for this purpose.

H. Wiring joints and splices will be permitted only at the ESS cabinet (shown in Plans) or at access points shown in the detailed drawings for the tower.

I. All exterior cable installations must incorporate suitable drip loops and ice bridges.

J. All pole and/or tower mounting adapters must be electrically bonded as specified in the ITS special provision for Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment.

K. Air terminals must be installed as indicated on the Plans and in accordance with the ITS special provision for Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment.

L. The appropriate surge protector must protect the power, control, and return conductors along with all site equipment as specified by the ESS RPU and sensor manufacturers.

## 2. Testing.

A. Include the Atmospheric Sensors in Test Plan as detailed in the ITS special provision for System Integration and Testing.

B. The Contractor must furnish test equipment that is capable of testing procedures and those procedure's parameters that are equal or better than the minimum test parameters specified by the sensor manufacturers.

C. Post Construction Testing. After complete site integration, each device must be tested individually to demonstrate compliance with parameters indicated in Table 1 and verify full functionality of the ESS system as a whole.

D. Provide a complete detailed cut sheet and shop drawing showing all devices and their connectivity, for the Engineer's approval before procurement. All cut sheets must include device manuals, installation and operation guides and preventative maintenance schedules.

E. The Contractor must provide all calibration results of the atmospheric sensor for MDOT review prior to final system acceptance.

F. If the sensor's regular maintenance schedule or calibration comes overdue prior to final system acceptance, the Contractor must make arrangements to recalibrate the device and perform routine maintenance at no additional cost to the department.

G. Ensure all atmospheric devices provided require minimal routine maintenance and calibration. The Contractor must provide documentation prior to installation of the routine maintenance and calibration schedule for review and approval. Devices that require re-calibration in periods of less than 6 months will not be accepted.

## 3. Manufacturer Warranty.

A. Any defect in design, materials, or workmanship which may occur during proper and normal use through final system acceptance must be corrected by, repaired and/or replacement by the Contractor with no cost to the Department.

B. All Atmospheric sensors and equipment must carry a manufacturer's standard warranty (equipment and parts) of 2 years from the date of final acceptance. All warranties must be transferred to MDOT upon written final acceptance.

C. Warranty coverage must include expedited spare part supply to ensure replacement or repair of warranted equipment within 10 calendar days of the notification of equipment failure from MDOT or Maintenance Contractor.

**d. Measurement and Payment.** The completed work as described will be measured and paid for at the contract unit price using the following pay items.

<b>Pay Item</b>	<b>Pay Unit</b>
Visibility Sensor.....	Each
Air Temperature/Humidity Sensor.....	Each
Ultrasonic Wind Sensor.....	Each
Barometric Pressure Sensor.....	Each
Precipitation Sensor.....	Each

The Contractor may elect to provide a single device that provides for two or more of the sensors called for at an individual site location. Payment must be made for each pay item called for on the plans. No additional payment will be provided for sensors that are incorporated into the device that are not called for in the plans. The device must provide the full functionality required of each sensor type. In the event of a failure of one sensor type, the Contractor must provide a complete device to replace the faulty unit.

The above listed pay items must include all necessary materials, equipment, and labor to furnish, install, integrate, test, warranty, and make fully operational as noted on Plans and in accordance with this Special Provision.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIFICATION  
FOR  
**INFRARED ILLUMINATOR**

ITS:DG

1 of 2

C&amp;T:APPR:LWB:YYY:00-00-12

**a. Description.** This work consists of furnishing, installing, testing, and providing manufacturer warranty of an environmentally hardened infrared (IR) illuminator on a pole/tower as shown on the Plans. This includes all required communications cable, electrical connections, and mounting brackets required for a fully functional device.

**b. Materials.**

1. Furnish an IR illuminator that is pole or tower mountable.

2. Fixture Specification.

A. The IR Illuminator must be capable of producing clear night vision images at a minimum of 500 feet from the tower.

B. The IR Illuminator must evenly illuminate the roadway utilizing a minimum 30 degree spread illumination angle.

C. The enclosure must be sealed and pressurized rated for outdoor use utilizing a weatherproof housing.

D. The infrared Light Emitting Diode (LED) must have a minimum lifespan of 10,000 hours.

3. Electrical Specification.

A. Supply 120 Volt Alternating Current (VAC) to the unit. If the device requires operating voltages of less than 120 VAC, the appropriate voltage converter must be supplied at no additional cost.

4. Environmental Specification.

A. Provide parts that are made of corrosion-resistant materials, such as plastic, stainless steel, anodized aluminum, brass or gold-plated metal.

B. An operational temperature range of -29.2 degrees Fahrenheit (F) to 140 degrees F, without performance variation, is required of the IR illuminator device.

**c. Construction.**

1. All installation must be done in a neat and professional manner. All cabling must be labeled on both ends, bundled and stressed.

2. Affix the IR illuminator to the pole/tower to provide a minimum viewing angle of 30 degrees. Final placement of device must be approved by the MDOT Engineer.

3. The IR illuminator must be configured to work in conjunction with the closed circuit television (CCTV) camera at the locations shown on the plans.

4. All wires are to be cut to their proper length before assembly. No doubled-back of wire/cable to take up slack will be allowed.

5. Illuminator height and downward pitch angle are to be in accordance with the manufacturer recommendations for the roadway.

6. All required mounting hardware must be provided with the device to be pole/tower mountable as shown on the plans.

**d. Manufacturer Warranty.**

1. Any defect in design, materials, or workmanship which may occur during proper and normal use through final system acceptance must be corrected by, repaired and/or replacement by the Contractor without cost to the Department.

2. The Illuminator must carry a manufacturer's standard warranty (equipment and parts) of 2 years from the date of final acceptance. All warranties must be transferred to MDOT upon written final acceptance.

3. Warranty coverage must include expedited spare part supply to ensure replacement or repair of warrantied equipment within 10 calendar days of the notification of equipment failure from MDOT or Maintenance Contractor.

**d. Measurement and Payment.** The work as described will be measured and paid for using the following pay item.

<b>Pay Item</b>	<b>Pay Unit</b>
Infrared Illuminator .....	Each

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**SURVEILLANCE SYSTEM FOR ENVIRONMENTAL SENSOR STATIONS (ESS)**

ITS:DG

1 of 5

C&amp;T:APPR:LWB:YYY:00-00-12

**a. Description.** This work consists of the furnishing, installing, integrating, testing, and providing manufacturer warranty of an Internet Protocol (IP) Closed Circuit Television (CCTV) camera with an integrated Digital Video Encoder (DVE) at locations designated on the plans and in adherence to the requirements in this special provision.

1. General.

A. Furnish, install, configure, integrate, and test all equipment and required components and accessories necessary to provide full and complete ITS functionality in all respects, without additional expense to the Department.

B. The payment process, including partial payment, will be governed by section 109 of the most recent version of the Standard Specifications for Construction.

2. Summary.

A. Provide an IP surveillance system located as identified on the Plans. The CCTV camera must be powered by a single outdoor rated Power over Ethernet (POE) cable from a POE injector in the cabinet or enclosure. The CCTV camera must have an integrated DVE for the transmission of MPEG-4, H.264, or MJPEG encoded video streams.

B. The furnished surveillance system must be fully compatible and interoperable with the ITS network trunk Ethernet network interface including the backbone communications network.

C. Supply all equipment required for the installation, configuration, integration, and testing of devices and subsystems contained within this project at no additional cost to the Department.

3. Requirements of regulatory agencies. Comply with the latest edition of the following codes or standards:

A. *National Transportation Communications for ITS Protocol (NTCIP);*

(1) *NTCIP 1201,*

(2) *NTCIP 1205,*

(3) *NTCIP 1208,*

(4) *NTCIP 2104*,

(5) *NTCIP 2202*,

(6) *NTCIP 2301*, as it applies to the Simple Network Management Protocol (SNMP);

B. *National Television Systems Committee (NTSC)*;

C. *Moving Picture Experts Group (MPEG)*;

D. *Institute of Electrical and Electronics Engineers (IEEE) 802.3*;

E. *National Electrical Manufacturers Association (NEMA)*.

4. General Requirements.

A. Furnish, assemble, fabricate and/or install materials that are new, corrosion resistant and in accordance with the details depicted on the plans.

B. Use identical and completely interchangeable equipment at each field location.

C. Use equipment designed to protect personnel from exposure to high voltage during equipment operation, adjustments and maintenance.

D. Comply with working clearances and dedicated spaces per *NEC Articles 110, 384 and 800-5*, as well as all current NEC articles, and Federal, State and Local regulations.

**b. Materials.**

1. General Requirements.

A. CCTV Camera Functional Requirements:

(1) The camera must have a maximum resolution of D1 (720x480);

(2) The camera must include a pressurized dome housing with a configurable warning that can be shown in the video stream to indicate low pressure;

(3) The camera must have a Pan/Tilt/Zoom (PTZ) unit capable of 360 degree continuous pan with a 90 degree tilt;

(4) The camera must have a minimum of 18x optical zoom;

(5) The camera must have an image sensor capable of providing full color images at low levels of light and black/white images in the dark;

(6) The camera must be capable of providing both full motion video and still images;

(7) The camera must be capable of sending still images to a File Transfer Protocol (FTP) server. The FTP server must be configured by the installer to transmit images to a local or remote based remote processing unit (RPU).

(8) The camera must be configurable for up to 20 user definable camera presets, stored on-board.

(9) The camera must have the ability to set continuous tours for the preset locations.

(10) The camera must have the ability to set privacy zones to black out areas.

(11) The camera must support both NTSC and Phase Alternating Line (PAL).

#### B. DVE Functional Requirements.

(1) The integrated DVE must provide MJPEG encoding, as well as either MPEG-4 or H.264 encoding. The DVE must be capable of providing both full motion video and still images.

(2) The DVE must support 1 to 30 frames per second (fps) frame rate at resolutions including CIF (352x240), 4CIF (704x480), and D1 (720x480). The Contractor is responsible for integrating the optimal resolution, bit rate, and frame rate that will deliver the best video into the Advanced Traffic Management Software (ATMS) or web server.

(3) The DVE must encapsulate and pass-through PTZ and control data compliant with NTCIP.

(4) The DVE must not exceed 250 milliseconds of latency for PTZ controls.

#### C. Equipment and port specifications.

(1) The data sub-channels must be software programmable, directly or over the Network, as defined by the Electronic Industries Association (EIA) for the recommended standard (RS)-232/422/485 data format, data rate, and data structure (e.g., the number of bits, parity, stop bits, etc.) and be IP addressable.

(2) The network connection must be Ethernet-compliant IEEE 802.3, 802.3u, and 802.3x; 10/100 Megabits per second (Mbps), static or dynamic host configuration protocol (DHCP), auto sensing full/half-duplex and compatible by way of a Registered Jacks (RJ)-45 connector, allowing transmissions over a Category 5 Enhanced (CAT-5e) cable to an attached fiber optic media converter, an Ethernet switch or an IP wireless device.

(3) The video input performance measures must comply with NTSC and EIA requirements, including the EIA-170 standard, with a composite video of 1.0 to 1.2 volts peak-to-peak (Vp-p). The equipment must have an electrical resistance of 75 Ohms at 60 hertz (Hz).

#### D. Network Parameter Specifications.

(1) The 10/100BASE-TX, as required in the IEEE 802.3 standards and amendments, must be the network connection to the network devices with Type RJ-45 connectors.

(2) Conform to version 4 of the user datagram protocol (UDP), version 2 of the internet group management protocol (IGMP), and transmission control protocol (TCP)/IP Version 4.

(3) Require the following network protocols: Unicast/Multicast, UDP, TCP, IP, HyperText Transfer Protocol (HTTP), Real Time Streaming Protocol (RTSP), Telnet, IGMP 2.0, Internet Control Message Protocol (ICMP), DHCP, Simple Network Management Protocol (SNMP) and Real-time Transport Protocol (RTP).

#### E. Environmental Specifications.

(1) The CCTV camera must operate within an ambient temperature of -29 degrees Fahrenheit (F) to 140 degrees F with 100 percent relative humidity, condensing.

(2) The dome-type environmental housing enclosure must be able to sustain a minimum of 3 second winds gusts from any direction of 120 miles per hour (MPH) as required by ASCE 7.

(3) The pressurized housing dome assembly must include a thermostat-controlled, heater and be in compliance with NEMA 4X/IP-67.

(4) The POE injector must operate within an ambient temperature of -29 degrees F to 140 degrees F with 5 to 90 percent relative humidity, non-condensing.

(5) The CCTV camera must provide a clear, focused image in all weather conditions.

#### c. Construction.

##### 1. General.

A Before commencing installation, the Contractor must submit in writing to the Engineer the exact locations, height, and field of view for the CCTV camera.

B The contractor must work with the Engineer to determine the preferred configuration settings on the surveillance system. This includes but is not limited to the privacy zones, presets and tours, on-screen labels or identifiers, azimuth display, and low pressure warnings.

C The Contractor must submit and coordinate the configuration of all IP addresses with the Engineer and/or their representative.

2. Manufacturer's Warranty. The IP Surveillance system must carry a manufacturer's standard warranty (parts, software and labor) of 5 years from the date of final acceptance.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

<b>Pay Item</b>	<b>Pay Unit</b>
IP Surveillance System, ESS .....	Each

**IP Surveillance System** includes furnishing, installing, integrating and testing the device in a cabinet or shelter, as shown on the plans.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**PAVEMENT SENSOR**

ITS:DG

1 of 8

C&amp;T:APPR:LWB:YYY:00-00-12

**a. Description.** This work consists of furnishing, installing, integrating, testing, and providing manufacturer warranty of a pavement sensor, as a part of an Environmental Sensor Station (ESS) as shown on the Plans. This work must be done in accordance with the most recent version of the Standard Specifications for Construction, except as modified herein. The Plans indicate the type of device invasive or non-invasive, number of devices, locations, and components required for each site, communications medium and power for each device location.

This special provision provides a modular framework for the specification of the device with functions and capabilities which can be selected to meet site specific needs and conditions.

1. General.

A. The Contractor must furnish, install, integrate, calibrate, test, and provide manufacturer warranty for all equipment and components necessary to provide complete functionality without additional expense to the Department.

B. Use identical and completely interchangeable equipment at each field location.

C. Final equipment selection, procurement, and installation must be approved and coordinated with the MDOT Engineer.

D. Different configurations of sensors and/or equipment may be specified at various ESS sites. Same function and range sensor and/or equipment must be identical when used at each site. This is intended to minimize the number of variations of spare parts and software patches which are necessary to maintain the ESS sites.

E. The Contractor must furnish, install, integrate, test, and provide manufacturer warranty for the pavement condition sensor(s) and all ancillary components, which meets or exceeds all testing requirements as noted on the Plans and in accordance with this special provision.

2. Functional and Performance Requirements.

A. General.

(1) The pavement sensors must be integrated with the remote processing unit (RPU) located in the field cabinet or the traffic management center (TMC) as designated on the plans.

(2) The pavement sensors must allow for interoperability between multiple vendors' field controllers. All sensors must be compatible with a National Transportation Communications for ITS Protocol (NTCIP) based RPU for communication to MDOT's current Advanced Traffic Management Software (ATMS).

(3) All sensors must support at least one of following communication protocols in order to transmit data to the RPU:

(a) Serial (RS-232/RS-422/RS-485);

(b) Analog/Digital;

(c) Ethernet.

(4) The sensor selected at each ESS site must be shown on the plans. Each selected device must meet the minimum performance requirements identified in Section 2.B thru Section 2.D, Table 1 and Table 2.

#### B. Invasive Pavement Condition Sensor.

(1) The invasive pavement condition sensor(s) must be a single solid-state electronic "puck type" passive device with no moving parts, capable of measuring and recording road surface conditions and temperatures. This sensor must be installed in the roadway pavement at the locations shown on the Plans.

(2) The passive pavement condition sensor(s) must be thermally passive, providing stable operation over the temperature range indicated in Table 1 below. Weather conditions, traffic, or ice control chemicals must not degrade the sensor's performance.

(3) The sensor must obtain the temperature roughly 0.2 inches (3 mm) below the surface.

(4) The sensor must provide the temperature reading every 3 minutes.

(5) Readings must be accurate to  $\pm 3$  percent over the operating temperature range.

(6) The sensor must obtain the condition of the pavement surface including whether it is dry, wet, damp, or shows trace moisture.

(7) The sensor must obtain freezing point temperature, chemical percentage or factor, ice percentage, depth of water layer, and the conductivity.

(8) The sensor must output the surface condition data to the RPU which will be used to calculate or determine the snow/ice warning, snow/ice watch, wet below freezing, and frost.

**Table 1: Invasive Pavement Condition Sensor Performance Specifications**

Sensor	Sensor Measurement	Specifications	
		Typical Accuracy Range	Operating Range
Surface Temperature	Surface Temperature	$\pm 0.2^{\circ}\text{C}$ ( $\pm 0.36^{\circ}\text{F}$ )	-40 to $+60^{\circ}\text{C}$ (-40 to $+140^{\circ}\text{F}$ )
Surface Status	Dry	NA	0.5 inches
	Wet	$\pm 0.01\text{mm}/0\text{in}$ ( $\pm 20\%$ of measurement)	
	Chemical Wet	95% Classification	-40 to $+50^{\circ}\text{C}$ (-40 to $+122^{\circ}\text{F}$ )
	Damp		
	Trace Moisture		
Surface Condition	Freezing Point	$\pm 1.0^{\circ}\text{C}$	-15 to $0^{\circ}\text{C}$ ( $+5$ to $+32^{\circ}\text{F}$ )
	Chemical Percentage or Factor	$\pm 1.0^{\circ}\text{C}$	0 to 100% NaCl 0 to 20% All Others
	Ice Percentage	95% Classification	0 to 100%
	Depth of Water Layer	$\pm 0.01\text{mm}/0\text{in}$ ( $\pm 20\%$ of measurement)	0.25 to 4mm (0 to 0.2in)
	Conductivity	NA	

### C. Non-Invasive Pavement Condition Sensor.

(1) The non-invasive pavement condition sensor must be a pole or tower mounted sensor capable of recording surface temperatures and conditions at the locations shown on the Plans.

(a) The sensor must be able to provide stable operation over the temperature range indicated in Table 2 below. Weather conditions must not degrade the sensor's performance.

(b) The sensor must measure the temperature using infrared technology.

(c) The sensor must provide the temperature reading every 3 minutes.

(d) Readings must be accurate to  $\pm 3$  percent over the operating temperature range.

(e) The sensor must obtain the condition of the pavement surface including whether it is dry, wet, damp, or shows trace moisture.

(f) The surface condition sensor must obtain freezing point temperature, ice percentage, and depth of water layer.

(g) The status sensor must output the surface condition data to the RPU which will be used to calculate or determine the snow/ice warning, snow/ice watch, wet below freezing, and frost.

(h) The sensor must be mounted such that the distance between the surface measurement location and the sensor is between 20 feet (6 meters) and 49 feet (15 meters).

(i) The mounting height and downward pitch angle are to be in accordance with the manufacturer recommendations for the roadway.

**Table 2: Non-Invasive Pavement Condition Sensor Performance Specifications**

Sensor	Sensor Measurement	Specifications	
		Typical Accuracy Range	Operating Range
Surface Temperature	Surface Temperature	±0.8° C (33.4° F)	-40 to +60° C (-40 to + 140° F)
Surface Status	Dry	95% Classification	
	Wet		
	Damp	95% Classification	
	Trace Moisture		
Surface Condition	Freezing Point	±0.8° C (33.4° F)	
	Ice Percentage	Resolution 1%	
	Depth of Water Layer	±0.01mm/0in (±20% of measurement)	

#### D. Pavement Temperature Sensor.

(1) The pavement temperature sensor must be a single solid-state electronic passive device with no moving parts, capable of measuring and recording road surface temperature. This sensor must be installed in the roadway pavement at the locations shown on the Plans.

(2) The temperature sensor must meet the requirements for surface temperature readings set forth in Table 1 above. The sensor must obtain the temperature roughly 0.2 inches (3 mm) below the surface.

(3) The sensor must provide the temperature reading every 3 minutes.

(4) Readings must be accurate to ±3 percent over the operating temperature range.

#### b. Materials.

##### 1. General Requirements.

A. All materials furnished, assembled, fabricated, or installed under this section must be new, corrosion resistant, and in accordance with the details shown on the Plans and in this special provision.

B. All electrical components must operate on 120 Volt Alternating Current (VAC) ( $\pm 10$  percent) 50/60 Hertz (Hz) electricity. The Contractor must provide appropriate Direct Current (DC) conversion for any equipment requiring DC power. If the site is solar powered, the Contractor will be allowed to power the devices using DC equipment. The Contractor must provide appropriate DC to DC and DC to AC conversion as necessary.

C. The equipment used must be designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

D. All field equipment must:

(1) Meet the following minimum temperature and environmental requirements:

(a) Operating/Storage temperature range of -40 to +140 degrees F;

(b) Non-condensing operating humidity range of 5 to 95 percent;

(2) Survive exposure to either direct solar heating or to high temperatures within an enclosure, as stated in storage temperature range noted above;

(3) The Contractor is required to provide an aspirated radiation shield or sensor design to meet the performance requirements noted in Table 1.

**c. Construction.** All elements included in this specification, including power and communications, must comply with the most recent version of the MDOT Standard Specifications for Construction, this special provisions, and any applicable state and local regulations.

1. Installation.

A. All installation must be done in a neat and professional manner. All cabling must be labeled on both ends, bundled and stressed.

B. No installation of pavement sensors will be permitted without the prior installation of a site power drop, including sites identified for a stand-alone power source (solar power or other) on the Plans.

C. The Contractor will not be permitted to install any pavement sensors without the prior installation of a site communications drop, unless the site is identified for a wireless communications connection on the Plans.

D. Installation of pavement sensors must be in conformance with the manufacturer's requirements for the device as specified, as it may be upgraded over its operational life.

E. The installation must meet local and state electrical requirements including grounding. Grounding must be paid for and covered under the special provision for Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment.

F. The Contractor must ensure that a representative from the manufacturer or other certified company is in attendance during installation of the first ESS site, associated communications, power equipment and terminations.

G. Care must be taken not to damage any part or equipment during installation. Damaged parts or equipment must be replaced at no additional cost to the project or the Department. Repair is not an acceptable means of replacement. All equipment must be replaced with new parts.

H. The Contractor must obtain engineering support and have representative(s) from the equipment suppliers available at the site for this purpose.

I. Wiring joints and splices must be permitted only at the ESS cabinet (shown on Plans) or at access points shown on the detailed drawings for the tower.

J. All exterior cable installations must incorporate suitable drip loops and ice bridges.

K. The appropriate surge protector must protect the power, control, and return conductors along with all site equipment as specified by the ESS RPU and sensor manufacturers.

L. Invasive pavement sensor installations must use a pavement cut to be normal saw blade size to hold sensor cable. Pavement cut must be filled with appropriate flexible sealant as recommended by manufacturer (3M DBR-6, Q-SEAL 290S, or approved equal). Pavement cut and sealant must be covered by this special provision.

M. Conditions of the materials under the roadway surface are unknown and any costs incurred while installing equipment in roadway must be covered under this special provision.

## 2. Testing:

A. Include the pavement sensor in the Test Plan as detailed in the ITS special provision for System Integration and Testing.

B. The Contractor must furnish test equipment that is capable of testing procedures and those procedure's parameters that are equal or better than the minimum test parameters specified by the sensor manufacturers.

C. Post-Construction Testing must be conducted. This is a site test to demonstrate after the completion of each pavement condition sensor installation, the operation of the device and ESS as a fully integrated system as required by this specification and the anticipated use by MDOT. Testing of the device must consist of demonstrating all capabilities and parameters indicated in Tables 1 and 2 of this special provision.

D. Provide a complete detailed cut sheet and shop drawing showing all devices and their connectivity, for the Engineer's approval before procurement. All cut sheets must include device manuals, installation and operation guides and preventative maintenance schedules.

E. The Contractor must provide all calibration results of the pavement sensor for MDOT review prior to final system acceptance.

F. If the sensor's regular maintenance schedule or calibration comes overdue prior to final system acceptance, the Contractor must make arrangements to recalibrate the device and perform routine maintenance at no additional cost to the Department.

G. The pavement sensor provided must require minimal routine maintenance and calibration. The Contractor must provide documentation prior to installation of the routine maintenance and calibration schedule for review and approval. Devices that require re-calibration in periods of less than 6 months will not be accepted.

3. Manufacturer Warranty.

A. Any defect in design, materials, or workmanship which may occur during proper and normal use through final system acceptance must be corrected by repair and/or replacement by the Contractor without cost to the Department.

B. All Pavement sensors and equipment must carry a manufacturer's standard warranty (equipment and parts) of 2 years from the date of final acceptance. All warranties must be transferred to MDOT upon written final acceptance.

C. Warranty coverage must include expedited spare part supply to ensure replacement or repair of warranted equipment within 10 calendar days of the notification of equipment failure from MDOT or Maintenance Contractor.

**d. Measurement and Payment.** The completed work as described will be measured and paid for at the contract unit price using the following pay items.

<b>Pay Item</b>	<b>Pay Unit</b>
Pavement Condition Sensor, Invasive .....	Each
Pavement Condition Sensor, Non-Invasive .....	Each
Pavement Temperature Sensor, Invasive .....	Each

No additional payment will be provided for sensors that are incorporated into the device that are not called for in the plans. The device must provide the full functionality required of each sensor type. In the event of a failure of one sensor type, the Contractor must provide a complete device to replace the faulty unit.

The above listed pay items must include all necessary materials, equipment, and labor to furnish, install, integrate, test, warrant, and make fully operational as noted on the Plans and in accordance with this special provision. The following provides a summary for the pay items listed above.

**Pavement Condition Sensor, Invasive:** This sensor includes a passive pavement condition sensor capable of reporting surface temperature, condition and status, cabling, and communications connections for a fully functional sensor.

**Pavement Condition Sensor, Non-Invasive:** This sensor includes a non-invasive pavement condition sensor capable of reporting surface temperature, condition and status. The sensor includes all cabling, mounting hardware, accessories and power and communications connections for a fully functional sensor.

**Pavement Temperature Sensor, Invasive:** This sensor includes an invasive pavement temperature sensor capable of reporting surface temperature only. The sensor includes all cabling, accessories and power and communications connections for a fully functional sensor.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**SUBSURFACE TEMPERATURE PROBE**

ITS:DG

1 of 5

C&amp;T:APPR:LWB:YYY:00-00-12

**a. Description.** This work consists of furnishing, installing, integrating, testing, and providing manufacturer warranty of a subsurface temperature probe as part of an Environmental Sensor Station (ESS) as shown on the Plans. This work must be done in accordance with the most recent version of the Standard Specifications for Construction, except as modified herein. The Plans will indicate device quantity, location, communications medium and power for each ESS.

This special provision provides a modular framework for the specification of the device with functions and capabilities which can be selected to meet site specific needs and conditions.

1. General

A. The Contractor must furnish, install, integrate, calibrate, test, and provide a manufacturer warranty for all equipment and components necessary to provide complete functionality that meets or exceeds all testing requirements as noted on the Plans and in accordance with this special provision, without additional expense to the Department.

B. Use identical and completely interchangeable equipment at each field location.

C. Final equipment selection, procurement, and installation must be approved and coordinated with the MDOT Engineer.

D. Different configurations of sensors and/or equipment may be specified at various ESS sites. The sensors must have the same function and range and/or equipment must be identical when used at each site.

E. The subsurface temperature probe may require multiple sensors or probes to achieve the functional and performance requirements detailed below. All sensors and probes required to meet the requirements detailed below are included in the cost of the item and will not be paid for separately.

2. Functional and Performance Requirements.

A. General

(1) The subsurface temperature probe must be integrated with the remote processing unit (RPU) located in the field cabinet or the Traffic Operations Center (TOC) as designated on the Plans.

(2) The subsurface temperature probe must allow for interoperability between multiple vendors' field controllers. Ensure all sensors are compatible with a National

Transportation Communications for ITS Protocol (NTCIP) based RPU for communication to MDOT's currently hosted system and/or Advanced Traffic Management Software (ATMS).

(3) All subsurface temperature probes must support at least one of the following communication protocols in order to transmit data to the RPU:

- (a) Serial (RS-232, RS-422, RS-485);
- (b) Analog/Digital;
- (c) Ethernet.

(4) The subsurface temperature probe must meet the minimum performance requirements identified in Table 1.

#### B. Sub-Surface Temperature Probe.

(1) Ensure the sensor provides a temperature reading every 3 minutes.

(2) Ensure the subsurface temperature probe measures the temperature at the following depths below the pavement layer: 3 inches (in), 6 in, 9 in, 12 in, 24 in, 36 in, for a total of 6 measurements, unless otherwise indicated on the Plans.

(3) Ensure the sensor outputs the temperature data to the RPU which will be used to present temperature data incrementally by depth of reading.

**Table 1: Sensor Performance Specifications**

Sensor	Sensor Measurement	Specifications	
		Typical Accuracy Range	Measuring Range
Subsurface Temperature Probe	Subsurface Temperature	±0.2° Celsius (C) (±0.36° Fahrenheit (F))	-30 to +50° C (-22 to +122° F)

#### b. Materials.

##### 1. General Requirements.

A. All materials furnished, assembled, fabricated, or installed under this section must be new, corrosion resistant, and in accordance with the details shown on the Plans and in this special provision.

B. All electrical components must operate on 120 Volt Alternating Current (VAC) (±10 percent) 50/60 Hertz (Hz) electricity. The Contractor must provide appropriate Direct Current (DC) conversion for any equipment requiring DC power. If the site is solar powered, the Contractor will be allowed to power the devices using DC equipment. The

Contractor must provide appropriate DC to DC and Alternating Current (AC) to DC conversion as necessary.

C. The equipment used must be designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

D. All field equipment must:

(1) Meet the following minimum temperature and environmental requirements:

(a) Operating/Storage temperature range of -40 to +140 degrees F.

(b) Non-condensing operating humidity range of 5 percent to 95 percent.

(2) Survive exposure to either direct solar heating or to high temperatures within an enclosure, as stated in storage temperature range noted above.

(3) The Contractor is required to provide an aspirated radiation shield or sensor designed to meet the performance requirements noted in Table 1 above.

**c. Construction.** All elements included in this specification, including power and communications, must comply with the MDOT Standard Specifications for Construction, this special provision, and any applicable state and local regulations.

1. Installation.

A. All installation must be done in a neat and professional manner. All cabling must be labeled on both ends, bundled and stressed.

B. The Contractor will not be permitted to install any subsurface temperature probe without the prior installation of a site power drop, including sites identified for a stand-alone power source (solar power or other) on the Plans.

C. The Contractor will not be permitted to install any subsurface temperature probe without the prior installation of a site communications drop, unless the site is identified for a wireless communications connection on the Plans.

D. Installation of subsurface temperature probe devices must be in conformance with the manufacturer's requirements for the device as specified, as it may be upgraded over its operational life.

E. The installation must meet local and state electrical requirements including grounding. Grounding must be paid for and covered under the special provision for Grounding, Bonding, Lightning Protection and Surge Protection for ITS Equipment.

F. The Contractor must ensure that a representative from the subsurface temperature probe manufacturer or other certified company is in attendance during installation of the first ESS site, associated communications, power equipment and terminations.

G. Care must be taken not to damage any part or equipment during installation. Damaged parts or equipment must be replaced at no additional cost to the project or the Department. Repair is not an acceptable means of replacement. All equipment is to be replaced with new parts.

H. The Contractor must obtain engineering support and have representative(s) from the equipment suppliers available at the site for this purpose.

I. Wiring joints and splices are permitted only at the ESS cabinet (shown on the Plans) or at access points shown on the detailed drawings for the tower.

J. All exterior cable installations must incorporate suitable drip loops and ice bridges.

K. The appropriate surge protector must protect the power, control, and return conductors along with all site equipment as specified by the ESS RPU and sensor manufacturers.

L. The subsurface temperature probe must be installed 2.0" below the pavement surface. The sensor must be installed in the roadway or the shoulder as shown on the Plans. Any deviation from the Plans must be approved by the Engineer.

M. Conditions of the materials under the roadway surface are unknown and any costs incurred while installing equipment in the roadway must be covered under this special provision.

## 2. Testing.

A. Include the subsurface temperature probe in the test plan as detailed in the ITS special provision for System Integration and Testing.

B. The Contractor must furnish test equipment that is capable of testing procedures and those procedure's parameters that are equal or better than the minimum test parameters specified by the sensor manufacturer.

C. Post-Construction Testing must be conducted. This is a site test to demonstrate, after the completion of each subsurface temperature probe, the operation of the device and ESS as a fully integrated system as required by this specification and the anticipated use by MDOT. Testing of the device must consist of demonstrating all capabilities and parameters indicated in Table 1 above.

D. Provide a complete detailed cut sheet and shop drawing showing all devices and their connectivity, for the Engineer's approval before procurement. All cut sheets must include device manuals, installation and operation guides and preventative maintenance schedules.

E. The Contractor must provide all calibration results of the subsurface temperature probe for MDOT's review prior to final system acceptance.

F. If the sensor’s regular maintenance schedule or calibration comes overdue prior to final system acceptance, the Contractor must make arrangements to recalibrate the device and perform routine maintenance at no additional cost to the Department.

G. All subsurface temperature probes provided must require minimal routine maintenance and calibration. The Contractor must provide documentation prior to installation of the routine maintenance and calibration schedule for review and approval. Devices that require re-calibration in periods of less than 6 months will not be accepted.

3. Manufacturer Warranty.

A. Any defect in design, materials, or workmanship which may occur during proper and normal use through final system acceptance must be corrected by repair and/or replacement by the Contractor without cost to the Department.

B. All subsurface temperature probes and equipment must carry a manufacturer’s standard warranty (equipment and parts) of 2 years from the date of final acceptance. All warranties must be transferred to MDOT upon written final acceptance.

C. Warranty coverage must include expedited spare part supply to ensure replacement or repair of warranted equipment within 10 calendar days of the notification of equipment failure from MDOT or Maintenance Contractor.

**d. Measurement and Payment.** The completed work as described will be measured and paid for at the contract unit price using the following pay item.

<b>Pay Item</b>	<b>Pay Unit</b>
Subsurface Temperature Probe .....	Each

No additional payment will be provided for sensors that are incorporated into the device that are not called for on the Plans. The device must provide the full functionality required of each sensor type. In the event of a failure of one sensor type, the Contractor must provide a complete device to replace the faulty unit.

The above listed pay item must include all necessary materials, equipment, and labor to furnish, install, integrate, test, warranty, and make fully operational as noted on the Plans and in accordance with this special provision. The following provides a summary for the pay item listed above:

**Subsurface Temperature Probe.** This sensor includes the sensor, cabling, mounting accessories, and power and communications connections for a fully functional sensor. All sensors and probes required to meet the requirements detailed below are included in the cost of the item and will not be paid for separately.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**CELLULAR MODEM**

ITS:CLC

1 of 4

ITS:APPR:CLC:DBP:02-01-12

**a. Description.** This work consists of the complete furnishing, installation, integration and testing of an environmentally hardened cellular modem and service necessary to complete an end-to-end communications link. The cellular modem, as designated on the plans, provides Ethernet connectivity from the Intelligent Transportation Systems (ITS) field device(s) to the Traffic Management/Operations Center (TMC/TOC). This work must be performed in accordance with the standard specifications, except as modified herein.

1. General.

A. The Contractor must furnish, install, integrate and test all equipment and required components, including antennas and antenna cables necessary to provide full and complete functionality in all respects, without additional expense to the MDOT.

B. All cellular service will be provided by the MDOT statewide cellular service agreement. It is the Contractor's responsibility to determine the optimal cellular service to be used at the proposed location. Contractor must coordinate with MDOT and provide all information required to obtain cellular service for cellular modems including cell service type (CDMA or GSM HSUPA).

C. Final equipment selection, procurement, and provisioning must be coordinated with MDOT and the Michigan Department of Technology, Management, and Budget (DTMB).

D. Use identical and completely interchangeable equipment at each field location.

2. Functional and Performance Requirements.

A. Support Virtual Private Network (VPN) connections.

B. Support firewall capabilities, such as, Internet Protocol (IP) block/allow listings.

B. Provide an "always-on" connection, without dialing.

D. Support local and remote management.

E. Fully upgradeable "over-the-air/network".

F. Domain name addressable.

G. Dual band receive diversity.

H. Provide no moving parts.

I. Provide a broadband communications link between field cabinet location(s) and the TMC/TOC via the public cellular network.

3. List of Acronyms.

CDMA	Code Division Multiple Access
GSM	Global System for Mobile Communications
GPRS	General Packet Radio Service
EDGE	Enhanced Data-rates for GSM Evolution
HSUPA	High Speed uplink Packet Access
HSPA	High Speed Packet Access
UMTS	Universal Mobile Telecommunications System
MHz	Megahertz
GHz	Gigahertz
RTT	Radio Transmission Technology

**b. Materials.** Provide equipment that meets the following requirements.

1. Transceiver. Full duplex.

2. Band.

A. Dual-band support for both 800 MHz and 1.9 GHz for CDMA models.

B. Tri-band Support for 850/1900/2100 MHz for UMTS/HSDPA/HSUPA and Quad-band support for 850/900/1800/1900 MHz for GRPS/EDGE (GSM).

3. Interface.

A. Support 1xEV-DO (Evolution Data only) (min Rev A) or GSM HSUPA.

B. Minimum Forward/download throughput of 2 Megabits per second (Mbps).

C. Minimum Reverse/upload throughput of 512 Kilobits per second (Kbps).

D. CDMA models must be backward compatible with CDMA 1xRTT and CDMA Interim Standard (IS)-95.

E. HSUPA models must be backward compatible with UMTS, EDGE, GPRS, and GSM.

4. Ethernet Interfaces.

A. Support Transmission Control Protocol (TCP)/IP and User Datagram Protocol (UDP)/IP.

B. Registered Jacks (RJ)-45, IEEE 802.3 standard 10 Base-T Ethernet port.

C. All shielded twisted pair (STP) network cables must be Electronic Industries Alliance (EIA)/Telecommunications Industry Association (TIA)-568-A complaint.

5. Antenna.

A. Field mountable external antenna.

B. Minimum 50 Ohm Threaded Neill-Concelman (TNC) Radio Frequency (RF) connector.

C. Provide an antenna cable per the manufacturer's recommendation.

6. Management, Security and diagnostic.

A. Light-emitting diode (LED) indicators for Ethernet, power, cellular link/activity and signal strength.

B. Support signals for Transmit Data (TXD), Receive Data (RXD), Request To Send (RTS), Clear To Send (CTS), Data Terminal Ready (DTR), Data Set Ready (DSR), Data Carrier Detect (DCD) and hardware and software flow control.

C. Provide compatibility with Hypertext Transfer Protocol (HTTP)/HTTP Secure (HTTPS), Dynamic Host Communications Protocol (DHCP), Simple Network Management Protocol (SNMP), Simple Mail Transfer Protocol (SMTP), Secure Socket Layer (SSL), Secure Shell (SSH)-2, SNMPv2.

D. Web-based Graphical User Interface (GUI).

E. Command Line Interface (CLI) access via TELNET connection.

F. SNMP Management Information Base (MIB)-II and SNMP Traps.

7. Environment.

A. Operating Temperature. -22 degrees F to 158 degrees F.

B. Storage Temperature. -22 degrees F to 158 degrees F.

C. Relative humidity. 5 percent to 95 percent non-condensing.

8. Power. Required power supply must be supplied with device.

9. Mounting. All mounting hardware must be supplied with device.

**c. Construction.**

1. General.

A. The cellular modem must be installed as indicated in the plans.

B. Contractor must conduct a cellular site survey prior to the procurement of materials that measures the signal strength and throughput of cellular coverage at the locations in order to determine the optimal service to be provided at each location. The testing must include upload/download speeds, latency, and received signal strength. Testing is an appurtenance to the cellular modem and will not be paid for separately.

C. Mount the antenna on the top of the ITS cabinet.

D. Install using settings that were approved at equipment mock up (if required per the Special Provision for Testing and Integration) or as approved by the Engineer to ensure interoperability and security, including VPN settings, local IP address, port forwarding and Network Address Translation (NAT), and IP-based filtering.

E. Integrate and test to meet MDOT specifications for integration.

2. Warranty. The cellular modem must carry a manufacturer standard warranty (parts, software and labor) of 2 years from the date of final acceptance.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

<b>Pay Item</b>	<b>Pay Item</b>
Cellular Modem .....	Each

**Cellular Modem** includes all labor, material, and equipment necessary to complete the communications link in accordance with the plans and the special provisions.

**Cellular Modem** also includes the Contractor application and any necessary payments to the telephone utility company for furnishing and testing the communications link at the locations indicated on the plans and in this special provision. The Contractor is responsible for scheduling, coordination, installation, and payment of work provided by the telephone company, as indicated on the plans, special provisions, and as directed by the Engineer.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**GROUNDING, BONDING, LIGHTNING PROTECTION  
AND SURGE PROTECTION FOR ITS EQUIPMENT**

ITS:CLC

1 of 6

ITS:APPR:MEC:WHS:02-02-12

**a. Description.** This work consists of grounding and bonding, lightning protection, and surge protection at project locations with Intelligent Transportation Systems (ITS) equipment. The work covered in this special provision consists of labor, materials, and services required for a functional and unobtrusive grounding system, surge protection, and lightning protection system.

1. General.

- A. Provide comprehensive grounding and bonding for ITS equipment.
- B. Equip all poles and structures that exceed 15 feet in height with appropriate lightning protection.
- C. Protect all conductors entering or leaving equipment cabinets or camera housings with a surge protector.

2. Applicable documents. Comply with the latest edition of the following codes and/or standards:

- A. *National Fire Protection Association (NFPA) 70 - National Electrical Code (NEC).*
  - B. *NFPA 780 - Lightning Protection Code.*
  - C. *Underwriters Laboratory (UL) listings as indicated throughout this document.*
  - D. *National Electrical Safety Code (NESC)*
3. Identify to the Engineer any conflicts between the requirements of regulatory agencies and the plans and specifications for this project.

4. Submittals.

- A. Provide product data of each type of product used (i.e. "shop drawings") per the MDOT Special Provision for Basic Materials and Methods for ITS work for approval by the Engineer before work commences.
- B. Provide a system plan, locating air terminals, conductor routing, supports, connectors, ground rods, and connection, mounting, and splicing details.

**b. Materials.**

## 1. Components.

## A. Grounding and bonding.

(1) Grounding electrodes (driven rods). Provide ground rods that are 3/4 inch diameter by 10 feet long, made of copper-clad steel with a minimum of 10 mils copper cladding, and comply with *ANSI/UL 96/96A* and *ANSI/NEMA GR-1*.

(2) Ground bus. Provide copper bar stock, 1/4 inch by 4 inch by length as shown on plans, 12 inch minimum length, wall mounted, complete with standoff insulators and steel wall mounting brackets. Provide copper bars that are factory-perforated to accept 2-hole crimp lugs with 3/4, 1, or 1 3/4 inch hole spacing

## B. Lightning protection.

(1) Ensure all lightning protection materials are *UL 96* listed for lightning protection, Class II.

(2) Use all Class II materials for all lightning protection applications, regardless of structure height.

(3) Do not use a combination of materials that may cause electrolytic coupling of such a nature that corrosion is accelerated.

## C. Surge protection.

(1) Protect twisted pair cable with protectors that are *UL 497B* listed and that meet or exceed the following minimum requirements:

(a) Max clamping voltage: Common-mode: twice peak signal voltage  
Differential-mode: 50 volts to ground.

(b) Technology: two stage using gas discharge tube and metal-oxide varistor or approval equal.

(c) Overcurrent protection: integral polymeric positive temperature coefficient (PPTC) device.

(d) Maintainability: replaceable without tools.

(2) Protect microwave vehicle detection system (MVDS) and DC power cables with grounded metal oxide varistors of appropriate voltages. Provide devices with surge capacity of at least 3,000 Amperes. Surge protection for these devices must be in accordance with device manufacturer specific guidelines.

(3) Protect 120/240 volt incoming power service to equipment cabinet with *UL 1449* (3<sup>rd</sup> Edition) listed Type 2, devices at each end. They must meet the following requirements:

- (a) Terminals: 12 AWG.
- (b) Nominal discharge current of 20,000 amps.
- (c) Line protection: L-N, L-G, L-L, and N-G.
- (d) Indicators: Light-emitting Diode (LED) status indication

(4) Protect coaxial cables for video signals at each end, including the top of the pole, with *UL* listed surge protection designed for baseband Closed-circuit Television (CCTV) camera signals that meet or exceed the following minimum requirements:

- (a) Surge capacity: 18,000 Amperes (8/20 $\mu$ s pulse)
- (b) Turn-on time: 4ns for 2 kV/ns
- (c) Voltage Standing Wave Ratio (VSWR): 1.1:1 or less
- (d) Insertion loss: 0.3 dB or less
- (e) Frequency range: 0 to 2 GHz
- (f) Bayonet Neill – Concelman (BNC) connectors
- (g) Operating voltage: 1.5 Volts
- (h) Impedance: 75 Ohms

### c. Construction.

#### 1. General.

A. Install equipment, materials, and devices in accordance with equipment manufacturer's written instructions and in compliance with applicable installation standards.

#### B. Connections.

(1) Provide exothermically welded connections below grade and in areas exposed to visible moisture.

(2) Provide heavy-duty bolted clamped connections, *UL* listed, above grade and in areas where safety to personnel and structures dictate.

C. Terminate every conductor, except a conductor contained entirely within a single piece of equipment, either in a *UL* listed connector or on a terminal block. Provide and install the connectors and terminal blocks where needed, without separate payment. Use connectors that are keyed to preclude improper hookups.

D. Use clips, harnesses, or ties in cabinets to keep wiring, including fiber optic pigtails, out of the way of service activities. Ensure that any removable assembly can be removed without disturbing wiring that is not associated with the assembly being removed.

E. Do not install conductors over 30V AC in the same raceway, gutter, cable tray, or wiring harness as communications cable or 24V DC power cabling.

F. Permanently affix distinct wire numbers or alphanumeric labels to each cable.

## 2. Grounding and bonding.

A. Furnish and install insulated and/or bare wire and cables, sized per *NEC* requirements, as indicated within the plans.

### B. Installation.

(1) Bond metallic items, such as poles, towers, horizontal and vertical structures, metal conduit junction boxes, fences, and pad mounted equipment to form a low-impedance ground plane.

(2) Use a minimum of 2 ground rods each separated by one rod length.

(3) Provide equipment grounding conductors that conform to the *NEC*. Use of metallic conduit to replace grounding conductors is not permitted. Provide conduit terminations with grounding bushings for metallic conduit. Ground conduit bushings, boxes, and cabinets. Connection of grounding conductor to neutral (grounded) conductor must only occur at service disconnect.

(4) Bond all metallic conduits to the grounding system.

(5) Bond electrical grounding conductors to lightning protection system grounding conductors below grade.

(6) Ground all manhole, handhole, and junction box frames with a solid 6 American Wire Gauge (AWG) conductor for power service handholes. Drive a grounding electrode through the base of each handhole to attach to the grounding system.

### C. Testing.

(1) Measure ground grid resistance using 3-point method per *IEEE 81* with earth ground test meter. Install additional ground rods and conductors as required and re-measure until resistance to ground is equal to or less than 10 Ohms. Provide documentation to the Engineer of ground grid measurement results for each ITS site location tied to a single grounding system.

(2) Furnish all test equipment required to test the copper cabling in accordance with the parameters specified.

## 3. Lightning protection.

### A. Installation.

(1) Install down conductors, per *NFPA 780*, in a direct path from air terminals to ground connections free of splices and sharp bends. No bend of a conductor is to form a final included angle of less than 90 degrees nor have a bend radius of less than 8 inches.

(2) Conceal and protect down conductors and interior wiring from view at all exterior locations above grade as practical. Cable down conductors may be concealed within structural elements or enclosed within non-metallic conduit. Use guards to protect the conductor to a point 10 feet above grade where down conductors are exposed to environmental hazards at grade level.

(3) Secure exposed cable conductors to the structure at intervals not exceeding 3 feet. Use fasteners, nails, screws, straps, or bolts for the intended application and of the same material as the conductor or of electrolytically compatible materials. Galvanized or plated steels are not acceptable.

(4) Use a grounding electrode for the lightning protection system, located as close to the down conductor as possible.

(5) Bond the lightning protection system to common grounding system underground.

(6) Install air terminals on concrete spun poles as detailed in the plans. Bond the air terminal to the cast-in-place down conductor.

(7) Dynamic Message Sign (DMS) structures are capable of acting as a down conductor per *NFPA 780*. Install air terminals into the air terminal bases located on the roof of the sign housing and bond the air terminals to the DMS structure, as shown in the plans.

4. Surge protection.

A. Install the required number and type of modular Surge Protector Devices, as determined by the number and type of incoming lines.

B. Arrange the equipment and cabinet wiring to minimize leader length to surge protector.

C. Avoid sharp bends in leaders to surge protectors.

**d. Measurement and Payment.** The completed work, as described, is to be measured and paid for at the contract unit price using the following pay items:

<b>Pay Item</b>	<b>Pay Unit</b>
ITS Grounding, Bonding, and Surge Protection.....	Lump Sum
Lightning Protection, Pole .....	Each
Lightning Protection, Structure, Large DMS.....	Each
Lightning Protection, Structure, Small DMS.....	Each

**ITS Grounding, Bonding, and Surge Protection** is to be measured and paid for as lump sum for all work to ground each ITS component as described by this special provision and as shown in the plans. Partial payments will be made based on this table:

Approved Equipment Submittals	50%
Completed Installation	75%
Inspection by State of Michigan Electrician	100%

**Lightning Protection, Pole** is to be measured and paid for as each lightning protection system provided for protection of equipment on a pole, with class II materials.

**Lightning Protection, Large DMS** and **Lightning Protection, Small DMS** is to be measured and paid for as each lightning protection system provided for protection of a Dynamic Message sign, using the structure as a down conductor.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**MICROWAVE VEHICLE DETECTION SYSTEM (MVDS)**

ITS:CLC

1 of 5

ITS:APPR:XXX:YYY:00-00-12

**a. Description.** This work consists of the furnishing, installation, integration, and testing of a Microwave Vehicle Detection System (MVDS). The MVDS is a noninvasive detection system installed above ground on the side of the road (i.e., side-fire). Its express purpose is vehicle detection and reporting of specified data by way of the Intelligent Transportation Systems (ITS) communication network to the designated Advanced Traffic Management System (ATMS) software. The MVDS consists of a radar detection unit pole-mount assembly; mounting hardware; UL approved power supply; lightning and surge protection; all required cable; and communications patch cords.

1. Furnish, install, integrate and test all equipment and components necessary to provide full and complete ITS functionality in all respects, without additional expense to the Department.

2. The payment process, including partial payment, is governed by section 109 of the Standard Specifications for Construction.

3. This detection system uses a Federal Communications Commission (FCC) certified, but non-site-licensed, low-power microwave radar beam technology to measure vehicle presence, volume, occupancy, and speed. The system is to transmit data via serial and Ethernet communication protocols and must be compatible with the ITS network.

**b. Materials.**

1. Functional Specifications.

A. Provide a complete side-fire mounted MVDS. The equipment includes, but is not limited to, a microwave detection unit (sensor within a weatherproof housing), i.e. the detector; composite cable required to connect the microwave detection unit to the power source and the ITS network; various control and communications equipment to be contained within an ITS equipment cabinet (cabinet paid for under a separate special provision); an Ethernet adapter appliance (if required); mounting brackets; and all ancillary equipment and/or incidental items as required to make a complete and fully operational detection system.

B. The detection process must utilize a microwave signal to accurately detect and measure vehicle classification, vehicle volume, speed, true presence (including stopped vehicles), and occupancy in all weather conditions without performance degradation.

C. The microwave circuitry within the MVDS must be designed utilizing active control that dynamically adjusts to compensate for temperature and aging variations in component performance.

D. No field calibration or adjustment after the initial setup is allowed. If calibration or adjustment is required after initial setup, the particular MVDS is considered defective and must be replaced at no additional cost to the Department.

E. The MVDS unit must support Point-to-Point Protocol (PPP) and Point-to-Multi-Point Protocol (PMPP) via Ethernet communications either by a MVDS internal Ethernet port or vendor-supplied external terminal server and vendor-supplied Ethernet appliances. The MVDS is to be addressable and capable of downloading detection data when polled by the ATMS software.

F. Provide a detector capable of switching between data pushing and data polling.

G. All traffic measurements or traffic parameter data defined within the plans are to be stored in nonvolatile memory within the MVDS detector. The MVDS is to be capable of transferring this traffic parameter data from the detector's nonvolatile memory to the ATMS software by way of the managed field Ethernet switch (MFES) and ITS communications network.

## 2. Performance Specifications. Required minimum performance of the MVDS:

A. Detection of vehicles in multiple discreet lanes within the detection zone of up to 10 discreet lanes and in both directions providing accurate, real-time presence, volume, average speed and occupancy data. Detections must be correctly categorized into 3 length-based classifications. True vehicle detection must occur at a range of 10 feet to 250 feet from the MVDS.

B. The reporting of classification, presence, volume, occupancy and speed data for each discreet lane of the 10 travel lane detection zones.

D. Accuracy required: volume ( $\pm 5$  percent); average speed ( $\pm 10$  percent); occupancy ( $\pm 10$  percent); and classification data under nominal traffic conditions and in all weather conditions over a range of 10 feet to 250 feet from the MVDS; must perform accurately without cleaning or maintenance.

## 3. MVDS Housing and Mounting Hardware Specifications.

A. Accomplish MVDS detection unit to external equipment connectivity by a composite cable and a single connector. The connector/cable must provide power to the unit and allows the generation of contact closure via output pairs for interface with traffic controller inputs, if required.

B. The MVDS detection device is to be mounted in a NEMA 4X polycarbonate box with the electrical connection located at the bottom of the box.

C. Provide a universal mounting bracket capable of pole- or wall-mounting of the MVDS. The universal mounting bracket is required to be adjustable on two axes.

D. Stainless steel bands with a minimum width of 0.75 inch and 0.025 inch thick are required to strap the universal mounting bracket to a pole; for wall/bridge mounting, 2 stainless steel expansion bolts with sufficient length and diameter to support a minimum

of 40 pounds is required. If the stainless steel bands are installed on galvanized poles, the Contractor is to place non-conductive material approved by the Engineer between the band and the pole.

#### 4. Power, Communications, and Cable Specifications.

A. All power and communications cables are to be a polyurethane-jacketed cable, Belden #9516, outdoor rated Category 5e (CAT-5e), outdoor rated Category 6 (CAT-6), or an approved equal. This cable's minimum rating is 300 volt with a minimum temperature rating of 140 degrees F.

B. Conductor size. American Wire Gauge (AWG) #24 or larger conductors, as recommended by the MVDS manufacturer.

#### 5. Electrical Specifications.

A. The MVDS is to consume no more than 8 watts with a direct current (DC) input between 12 and 24 volts DC (VDC). The equipment must be designed such that the failures of the equipment do not cause the failure of any other unit of equipment. Automatic recovery from power failure within 15 seconds after resumption of power is required.

B. FCC certification of the detector is required. The FCC's identification number must be displayed on an external label. Transmission frequency band of 24.125 gigahertz (GHz), using the K band, or another approved spectral band is required. FCC's 2001 Code of Federal Regulations (CFR), Title 47 - Telecommunication, Volume 2, Part 15, Radio Frequency Devices compliance is required.

C. Internal lightning suppression and electrical isolation is required.

#### 6. Environmental specifications.

A. All materials are required to be corrosion resistant and approved by the Engineer.

B. The MVDS's operation must not be affected by a minimum vibration range of 0.5 grams to 30 Hz and a shock ratio of 5 grams for 10 millisecond half sine waves.

C. An operational temperature range of -29.2 degrees F to 165 degrees F, without performance variation, is required of the MVDS.

D. All system components, while housed in their associated environmental enclosures, are to comply with NEMA TS-2 environmental specifications. The housing must be capable of wind loads of up to 120 miles per hour (MPH) sustained.

### c. Construction.

#### 1. General Requirements.

A. Prior to submitting shop drawings, a pre-construction site survey is to be conducted by a factory-trained and certified representative. The site survey is designed

to identify the exact location and details for each detection station. The site survey report is to be submitted to the Engineer for approval, including specific location and detail information.

B. Mount detection units in a side-fired configuration. The detector is to be mounted level from side to side. Software and a laptop computer are to be furnished by the Contractor and used for zone calibration. Detector height and downward pitch angle are to be in accordance with the manufacturer recommendations for the roadway, median width, and number of lanes being detected at each site.

C. All detection zones are to be contained within the specified elevation angle as suggested by the manufacturer.

D. When installing the detector near metal structures, such as buildings, bridges, or sign supports, the detector is to be mounted and aimed so the detection zone is not under and does not pass through the structure to avoid distortion and reflection.

E. All wires are to be cut to their proper length before assembly. No doubled-back wire/cable to take up slack is allowed.

## 2. Required Documentation.

A. Shop drawings that detail the complete detector and all other components to be supplied and constructed are to be submitted to the Engineer for approval. These drawings detail the exact location and placement of system components and include installation details for the required cables. All cabling is to be installed in accordance with manufacturer recommendations.

B. Provide a training and maintenance manual for the MVDS, including detailed specifications and information regarding the inventory of installed assemblies by location and corresponding serial number.

## 3. Testing.

### A. General.

(1) Notify the Engineer a minimum of 10 working days prior to the proposed installed MVDS site test date.

(2) The Engineer or designee will witness such tests.

(3) Furnish all equipment, appliances and labor necessary to test the installed MVDS and the network communication device.

### B. Site Inspection.

(1) All control cabinet components will be inspected for their proper installation and cable termination.

(2) Apply power to the components and verify that they are functioning as anticipated.

(3) Verify that physical construction has been completed as specified herein, within the plan set, and/or in the contract.

C. Detector Test.

(1) A radar gun is required for the verification and calibration of speed detection. Manufacturer recommended procedures for calibration are to be followed.

(2) Each installed MVDS's volume counts and speed measurements are to be verified utilizing the MVDS vendor-supplied test software running on a laptop connected locally to the detector communication port. Compare the counts from the detector to visual counts or counts from permanent or temporary traffic detection devices of known accuracy. Compare the speed measured by the detector to the speeds measured by the radar gun. Confirm that the accuracy is within the range required by this special provision.

4. Manufacturer Warranty. The MVDS system, consisting of the microwave detection sensor, network interface devices, and all cabling must carry a manufacturer's warranty of 2 years from the date of final acceptance. Software updates are to be provided free of charge during the warranty period.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

<b>Pay Item</b>	<b>Pay Unit</b>
Microwave Vehicle Detection System .....	Each

**Microwave Vehicle Detection System** consists of a radar detection unit pole or truss mount assembly, pole or truss mounting hardware, UL approved power supply, lightning and surge protection, all required cable, communications patch cords, and any and all ancillary items required for a fully operational MVDS remote site installation.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION  
  
SPECIFICATION  
FOR  
**MANAGED FIELD ETHERNET SWITCH (MFES)**

ITS:MRM

1 of 5

ITS:APPR:XXX:YYY:00-00-12

**a. Description.** Provide an environmentally hardened Ethernet switch and all required power supplies, cables, patch cords, and jumpers.

**b. Materials.** This switch must be fully compatible and interoperable with MDOT's Intelligent Transportation System (ITS) network.

1. General.

A. Furnish a switch that is suitable for an ITS cabinet without the need for special environmental conditioning. The switch must have no fan or other moving parts.

B. Ensure the switch supports full-duplex Ethernet communication.

C. Provide a switch that complies with the Institute of Electrical and Electronics Engineers (IEEE) networking standards IEEE-802.1 and IEEE-802.3. Specifically, the switch must comply with the following IEEE 802.1 standards:

(1) IEEE 802.1D Media Access Control (MAC) Bridges, including Rapid Spanning Tree Protocol (RSTP).

(2) IEEE 802.1Q Virtual Local Area Network (VLAN) tagging and Multiple Spanning Tree Protocol (MSTP).

(3) IEEE 802.1X (Port Based Network Access Protocol).

D. Provide a switch that can be managed using Simple Network Management Protocol (SNMP) Version 3.

E. Provide a power supply that interfaces the switch to 120 volts alternating current (VAC) power, 60 hertz (Hz), single-phase power.

F. Provide a switch resistant to electromagnetic interference (EMI).

G. Switch and power supply must have an operating temperature range of at least -40 degrees C to 70 degrees C.

H. Switch and power supply must have an operating humidity range of at least 10 percent to 95 percent relative humidity (RH).

I. Provide a switch with diagnostic light-emitting diodes (LED)s. These indicators must include link, activity, and power LEDs.

J. The switch must use Secure File Transfer Protocol (SFTP) to transfer configuration files to and from a central server.

K. Provide power cables and Category 5e (CAT-5e) or Category 6 (CAT-6) patch cords as required.

L. Provide a switch that has American Standard Code for Information Interchange (ASCII) based configuration files for offline editing and bulk configuration.

M. Provide all mounting hardware needed to mount the switch and power supply. If the switch is mounted on a shelf, provide a grid-type shelf that minimizes the interference with air flow.

N. The switch must have a manufacturer's warranty (parts, software, and labor) of three years from the date of final acceptance.

O. The switch must be configurable using a web browser or Graphical User Interface (GUI), in addition to the terminal emulation.

## 2. Layer 2 Switch.

A. Provide eight copper ports with Type Registered Jacks (RJ)-45 connectors that are capable of 10/100Base-TX communications.

B. Provide two fiber ports with LC-type connectors that are 2-fiber 100Base-FX. These may be Small Form Factor Pluggable (SFP) ports equipped with transceivers. Ensure that the launch power of the optical ports is great enough such that when coupled with the receiver sensitivity of the connecting device, the optical budget of the link is not exceeded.

C. Provide a switch capable of mounting on a DIN rail, and provide all DIN rail hardware necessary to mount the switch.

D. The switch must consume no more than 30 watts of power.

E. The switch must perform multicast filtering using Internet Group Management Protocol (IGMP) snooping,

## 3. Layer 2 Switch, Gigabit.

A. Compliant with IEEE 802.3-2008.

B. The switch must meet the requirements of a Layer 2 switch.

C. The fiber ports must be capable of 1000Base-LX or 1000Base-ZX communication, depending on the transmission distance between switches.

## 3. Layer 3 Switch.

A. Provide eight ports capable of 10/100Base-TX communications. The copper

ports must have RJ-45 connectors and may be SFP ports fitted with appropriate transceivers.

B. Provide two SFP ports equipped with 1000Base-LX or 1000Base-ZX transceivers depending on the transmission distance between switches. Ensure the launch power of the modules is great enough such that when coupled with the receiver sensitivity of the connecting device, the optical budget of the link is not exceeded.

C. Ports must be independently configurable to operate as Layer 2 or Layer 3.

D. The switch must consume no more than 30 watts of power.

E. The switch must have full Layer 3 capabilities, including:

(1) Internet Protocol Version 4 (IPv4).

(2) Internet Protocol Version 6 (IPv6).

(3) Open Shortest Path First (OSPF).

(4) Generic Routing Encapsulation (GRE)

(5) Border Gateway Protocol (BGP).

(6) Inter-VLAN Internet Protocol (IP) routing for full Layer 3 routing between two or more VLANs.

(7) Virtual Router Redundancy Protocol (VRRP).

(8) Address Resolution Protocol (ARP).

(9) IP multicast routing utilizing Protocol Independent Multicast (PIM) and Internet Group Management Protocol, Version 2 (IGMPv2). Support for PIM sparse mode (PIM-SM) and PIM dense mode (PIM-DM).

(10) Quality of Service (QoS).

(11) Security utilizing Access Control Lists (ACLs).

4. Layer 3 Switch, 24 Port.

A. The switch must meet the requirements of a Layer 3 switch.

B. The switch must have at least 22 SFP ports capable of Gigabit Ethernet communications.

(1) Provide 1000Base-LX or 1000Base-ZX transceiver modules with LC-type connectors for each of the fiber ports shown on the communications plan, with one additional transceiver for future use.

(2) Provide 1000Base-T transceiver modules with RJ-45 type connectors for each of the copper ports shown on the communications plan, with one additional transceiver for future use. The copper transceivers must be capable of auto negotiation for 10/100/1000 speeds and duplexity.

C. The switch must have at least two SFP+ or XFP ports equipped with 10GBase-LR or 10GBase-ER transceiver modules depending on the transmission distance between switches.

D. The switch must have redundant power supplies.

E. The switch must be stackable.

**c. Construction.**

1. Mount Layer 2 switches in the cabinet on a DIN rail, and mount Layer 3 switches on a DIN rail or on a shelf. Mount switches so they are fully accessible by field technicians.

2. Connect the switch to the communications network and ensure connections are made to each Ethernet/IP appliance within the cabinet. Use CAT-5e or CAT-6 patch cords for twisted pair connections to the switch.

3. Configure and test the switch using settings that were approved at equipment mock up (if required per the special provision for *System Integration and Testing* or as approved by the Engineer to ensure interoperability and security. The configuration settings described in this special provision are minimum requirements. Coordinate all configuration settings with the Engineer, and provide backup configuration files on CD-ROM.

4. If any switch installed in the project is connected to equipment that originates a multicast stream, develop an IP multicasting plan, including multicast addressing and quality of service parameters, using PIM-SM. Revise the plan until it is satisfactory to the Engineer and then configure the switches and other devices accordingly.

5. On Layer 3 switches, configure gateway IP addresses for all subnets that connect to that switch. Configure OSPF routing, and confirm that routes to those subnets are being advertised to adjacent switches. Configure ACLs. Work with the Engineer to determine IP ranges, ports, and other settings to be used in configuring the ACLs.

6. On Layer 2 switches, configure VLANs as shown on the plans. Configure trunking ports between switches and access ports between switches and equipment. Set VLAN Trunk Protocol (VTP) to transparent mode on all switches. Configure port security to only allow the MAC addresses of equipment connected to the switch to pass traffic. Configure Rapid Spanning Tree Protocol (RSTP) to prevent bridging loops and provide redundant paths.

7. Disable any ports not in use.

8. Provide a manufacturer's warranty (parts, software and labor) of three years from the date of final acceptance.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

<b>Pay Item</b>	<b>Pay Unit</b>
Managed Field Ethernet Switch, Layer 2 .....	Each
Managed Field Ethernet Switch, Layer 2, Gigabit .....	Each
Managed Field Ethernet Switch, Layer 3 .....	Each
Managed Field Ethernet Switch, Layer 3, 24 Port.....	Each

MICHIGAN  
DEPARTMENT OF TRANSPORTATION  
  
SPECIAL PROVISION  
FOR  
**SYSTEM INTEGRATION AND TESTING**

ITS:MS

1 of 14

C&amp;T:APPR:XXX:YYY:00-00-12

**a. Description.** Conduct system integration and acceptance testing work in accordance with Standard Specifications for Construction, except as modified herein.

1. General.

A. System Integration and Testing includes network integration of Intelligent Transportation Systems (ITS) devices into the communication network and testing to prove functionality and operation for local, subsystem and final system.

2. Location.

A. The integration services include all necessary configuration and programming work at communication aggregations points, subsystem locations, and the Traffic Management Center/Transportation Operations Center (TMC/TOC). All individual field device integration and equipment configurations are paid for under the individual device Special Provisions pay item.

**b. Materials.** None Specified.

**c. Construction.**

1. Prior to construction, in addition to the requirements outlined in equipment specific special provisions and the Basic Methods and Materials for ITS Work special provision, the Contractor must provide the following:

2. Equipment Integration Plan (EIP).

A. After all equipment shop drawings have been approved, and 14 days prior to any ITS device field installation, submit a complete EIP to MDOT for review and acceptance. The EIP must follow the procedures and integration requirements described in the Project Overview special provision. Any deviations from these specifications must be noted in the EIP and must not be executed in the field without the approval of the Engineer. Field installation and integration must not begin before approval of the EIP.

(1) The EIP includes, but is not limited to, the following:

(a) Revised ITS field device location plan in response to any device relocation or layout adjustment.

(b) Revised ITS field device interconnection and wiring layout plans in response to any construction field changes.

(c) Detailed step-by-step integration procedures for each local and TMC/TOC integration. Typical site integrations can be grouped in one integration procedure by approval of the Engineer.

(d) Typical devices interconnect diagrams for local, Hub/Node, and TMC/TOC locations. All device interconnect diagrams must be generated in Visio, CAD, or Microstation and must clearly identify equipment model numbers and cable types.

(e) Overall system network diagram, including full logical network and Internet Protocol (IP) configuration details for all devices in a system diagram and tabulated formats.

(f) Equipment programming/configurations for each ITS device type included in the Bill of Materials (BOM) and as stated in the Project Overview special provision.

(2) Advanced Traffic Management System (ATMS) Software Integration.

(a) The Contractor is responsible for procuring material compatible with the MDOT Statewide ATMS Software.

(b) Confirmation testing and software integration into the ATMS will be paid for under the Integration, Advanced Traffic Management System Software special provision.

3. Acceptance Test Plan (ATP).

A. General Requirements.

(1) Submit a complete ATP to the Engineer at least 14 days prior to any field testing.

(2) The ATP must include individual test cases clearly showing passing criteria for all ITS devices as applicable per project.

(3) The ATP must include local, subsystem, and final system testing for all ITS devices to be integrated on this project.

(4) Failures during testing must be included in a report that documents the defective unit or setting and the corrective action taken. Minor failures may be addressed and retested at the Engineer's discretion. Major failures, which would require additional work to multiple units and sites, may cause the Engineer to stop testing until the issue has been resolved. The Contractor is not to receive any extension of time or additional costs due to delays caused by failed acceptance testing.

(5) The ATP forms as well as any supplemental documentation completed during the testing are to be delivered to the Engineer upon system acceptance. The forms must be signed by the Contractor as well as the Engineer or representative.

B. ITS Local Device Assembly Test (LDAT).

(1) Before ITS Sub-System Tests (SST), the Contractor must conduct stand-alone tests of the equipment installed at each field site as approved by the Engineer. The test must, at a minimum, exercise all stand-alone (non-network) functional operations of the field equipment with all of the equipment installed per the construction plans or as directed by the Engineer.

C. ITS Sub-System Test (SST).

(1) The Contractor must conduct SST to verify a section of the overall ITS system is functioning properly. Sub-system Testing must be conducted at logical nodes or aggregation points to verify both communications and device functionality.

D. ITS Final System Test (FST).

(1) FST is the last step in the ATP and serves as the basis for system acceptance. The Final System Acceptance Test must be performed at the TMC/TOC following completion of the SST.

(2) After the successful completion of the FST, the burn-in period begins.

E. Testing Requirements.

(1) The list of ITS devices and testing requirements identified in Table 1 must be included in the ATP. Test procedures required for Fiber Optic and Licensed Wireless Link Backhaul must be submitted as part of their own special provision requirements.

**Table 1 List of ITS Devices Required for ATP**

ITS Devices	Test Procedures Required
ITS Cabinet	LDAT, SST, FST
Surveillance System Assembly	LDAT, SST, FST
Dynamic Message Sign (DMS)	LDAT, SST, FST
Microwave Vehicle Detection System (MVDS)	LDAT, SST, FST
Managed Field Ethernet Switches (MFES)	LDAT
Digital Video Encoder (DVE)	LDAT
Uninterruptible Power Supply (UPS)	LDAT, SST, FST
Unlicensed Wireless Radios	LDAT,
Cellular Modems	LDAT, FST
Environmental Sensor Station (ESS) Equipment	LDAT, FST
IP Power Distribution Unit	LDAT, FST
Tower Light	LDAT
Infrared Illumination Device	LDAT

(2) Test Case Requirements. For each ITS device type, there must be a test case developed with pass/fail criteria. All functional requirements in the test case must pass during the witness testing to grant final acceptance. The sections below list all functional requirements per device to be included in each test case. During the review of the ATP report, the Engineer has the right to add or remove test case

requirements, as applicable, to the project and within the functional requirements shown in the special provisions.

(a) ITS Cabinet.

(i) LDAT.

1) Visual inspection to check workmanship, confirm equipment has been installed in accordance with approved layout drawings and equipment shop drawings, and verify the cabinet field wiring matches the cabinet wiring diagram and interconnect drawings are stored in the cabinet.

2) Verify proper operation of the Ground Fault Interrupter (GFI) outlet.

3) Verify proper operation of the lights and vent fans.

4) Verify all ITS devices are labeled as required with the device name and IP address.

5) Verify accuracy of the temperature and humidity reported by the cabinet monitoring system.

6) Test door alarms locally.

7) Verify network settings (i.e., IP address, subnet mask, and gateway).

8) Demonstrate the cabinet monitor system can successfully use a Simple Network Management Protocol (SNMP) trap for door opening/closing.

(ii) SST.

1) Verify communications to the SNMP card of the cabinet monitoring system.

(iii) FST.

1) Test Alarm Conditions. Demonstrate the cabinet monitoring system can successfully use SNMP traps to alert a computer at the TMC/TOC about an open door and a high temperature.

2) Verify the ability of users in the TMC/TOC to determine the temperature, humidity, and door status using a web browser.

(b) Surveillance System Assembly.

(i) LDAT. The following local field operational tests must be performed at the camera assembly field site on each Closed-Circuit Television (CCTV)

Camera. Provide a laptop computer testing the video and camera control through software that supports National Transportation Communications for ITS Protocol (NTCIP). After the camera assembly, including the camera hardware, DVE, power supply, and connecting cables, has been installed:

- 1) Verify physical construction has been completed as detailed in the Surveillance System special provisions, on the plans, and in the contract.
  - 2) Inspect the quality and tightness of ground and surge protector connections.
  - 3) Verify the camera control address, as applicable.
  - 4) Verify the presence and quality of the video image with a vector scope and a portable National Television Systems Committee (NTSC) monitor.
  - 5) Observe the video picture from the camera on a portable video device and waveform monitor.
  - 6) Demonstrate camera sensitivity at low light levels meets the specification.
  - 7) Verify titler information is correct.
  - 8) Exercise the pan, tilt, zoom (PTZ), focus – auto and manual, iris opening, and manual iris control selection; and the operation, low-pressure alarm (if present), preset positioning, and power on/off functions.
  - 9) Demonstrate pan/tilt speed and extent of movement meets the specifications.
- (ii) SST.
- 1) Verify communications to the surveillance system or DVE.
- (iii) FST. The following remote operational tests must be conducted at the TMC/TOC using NTCIP software.
- 1) Verify the camera IP address and system name.
  - 2) Verify the presence and quality of the video image.
  - 3) Exercise the PTZ, focus, iris opening, and manual iris control selection; and the operation, low-pressure alarm (if present), preset positioning, and power on/off functions.
- (c) DMS.
- (i) LDAT. DMS LDAT must be conducted at each field location after the DMS has been installed and integrated into the system. The test cases,

at minimum, must include inspection of the sign housing, power supply, and electrical distribution; DMS controller; DMS Auxiliary Control Panel (ACP); Light-Emitting Diode (LED) display modules; temperature and light control; and sign failure conditions.

1) DMS Controller.

a) Verify a “local/remote” switch with an LED indicator that places the controller in local mode such that it can be controlled from the front panel interface instead of via the primary communication channel.

b) Verify the reset switch to quickly restart the controller.

c) LED “Active” indicator blinks when the controller is operating.

d) Verify system status Liquid Crystal Display (LCD) displays time and date.

2) DMS ACP.

a) Verify a “local/remote” switch with an LED indicator that places the controller in local mode such that it can be controlled from the front panel interface instead of via the primary communication channel.

b) Reset switch to quickly restart the controller.

c) LED “Active” indicator blinks when the controller is operating.

d) Verify system status LCD displays time and date.

3) LED Display Module.

a) On command from either a remote computer or local laptop running the central control software, the sign controller must test the operation of all LED pixels and determine whether their functional status is “normal” or “stuck-off.”

- Run a diagnostic test to verify all the LED driver cards, power supply diagnostic cards, temperature sensor cards, fan sensor card, and photo sensor are functioning properly.

- Verify Real-time DMS message posting.

- Verify static test message display.

- Verify flashing test message display.

- Verify a multipage test message display.

- Verify manual blanking of the display.

4) Light Control (DMS Intensity Control).

a) Verify from the DMS controller the option of selecting from a minimum of 100 LED intensity levels. LED intensity levels must be available in a range of 1 percent to 100 percent of the maximum display intensity, and in increments of 1 percent.

b) Not cause any flickering of the LED display matrix.

c) Verify manual and automatic intensity control modes to be user selectable using the DMS control software, although the typical control mode must be "automatic."

d) Verify manual intensity control from both local and remote locations.

5) Sign Failure Conditions.

a) Verify that in the event of communication error between the DMS sign controller and the system control computer; the DMS controller automatically blanks the sign.

b) Verify that in the event of a power failure, the DMS controller automatically blanks the sign.

c) All testing work, activity, and results must be documented and reported with their details to the Engineer.

- SST.

- Verify communications to the DMS controller.

- FST. The DMS FST must be conducted from the TMC/TOC using the ATMS software. In the event the ATMS software is not capable of testing some required functional specifications of the DMS, then the DMS specific manufacturer's software can be used. Test the following requirements remotely:

- LED display module as described in the LDAT.
- DMS intensity control as described in the LDAT.
- Sign failure conditions as described in the LDAT.

(d) MVDS.

(i) LDAT.

1) Verify physical construction has been completed as specified herein, on the plan set, and/or in the contract.

- 2) Verify network settings.
- 3) Inspect the quality and tightness of ground connections.
- 4) Using the manufacturer's software, display lanes and verify lanes match actual field conditions.
- 5) Verify speed, volume, and occupancy are within the requirements of the MVDS special provision. The use of a calibrated Lidar gun is required for the speed test.
- 6) All testing work, activity, and results must be documented and reported with their details to the Engineer.

(ii) SST.

- 1) Verify communications to the MVDS.

(iii) FST.

- 1) Verify network interface device is receiving and transmitting data from the remote site to across the ITS network.
- 2) Conduct FST from the head end ATMS software.

(e) MFES.

(i) LDAT.

- 1) Verify physical connections are performed as specified in contract documents.
- 2) Verify all LED indicators for link, activity, and power are functioning.
- 3) Verify the following configuration settings:
  - a) System name, location, IP address, subnet mask, and default gateway.
- 4) Verify all active ports have been configured per the Project Overview special provision. Check the speed, duplex, and Virtual Local Area Network (VLAN) settings.

(f) DVE.

(i) LDAT.

- 1) Verify physical connections are performed as specified in contract documents.

- 2) Verify the following configuration settings:
    - a) System name, location, IP address, subnet mask, and default gateway.
    - 3) Verify latency of PTZ does not exceed 250 milliseconds.
- (g) UPS.
- (i) LDAT.
    - 1) Verify electrical connections have been completed as detailed in the UPS special provision.
    - 2) Verify network settings.
    - 3) Verify the UPS can run off battery backup. Test utility power loss feature, automatic low-battery, and high temperature shutdown features. Verify the UPS returns to normal operations without a manual reset.
    - 4) Demonstrate the UPS can successfully use a SNMP trap for utility power loss and return to normal operations.
  - (ii) SST.
    - 1) Verify remote communications to the SNMP card of the UPS.
  - (iii) FST.
    - 1) Test Alarm conditions. Demonstrate the UPS can successfully use SNMP traps to alert a computer at the TMC/TOC about a power loss feature, automatic low-battery and high temperature shutdown features.
    - 2) Verify the ability of users in the TMC/TOC to determine the temperature, humidity, and door status using a web browser.
- (h) Unlicensed Wireless Radios.
- (i) LDAT.
    - 1) Verify physical construction has been completed per the contract documents.
    - 2) Inspect the quality and tightness of ground connections.
    - 3) Verify the radio has been configured with the proper site name, IP address, subnet mask, gateway, and VLAN settings.
    - 4) Verify actual throughput meets requirements using two laptops with Iperf, Jperf, or similar approved software.

5) Record the throughput, Signal-to-Noise Ratio (SNR), Received Signal Strength (RSS), and noise level.

(i) Cellular Modem/Cable Modem.

(i) LDAT.

1) Verify physical construction has been completed per the contract documents.

2) Verify cable, connections, and antenna (as applicable) are properly installed.

3) Conduct an upload throughput test using Iperf, Jperf, or similar approved software.

(ii) FST.

1) Verify remote connectivity to the cell/cable modem. The modem must be able to be monitored and configured remotely.

(j) ESS LDAT.

(i) LDAT.

1) After each ESS field location is fully installed and integrated, the following tests must be conducted for all environmental sensors and RPU.

2) Verify physical construction has been completed as detailed in the ESS special provision, on the plans, and in the contract.

3) Verify all cable, connectors, grounding, bonding and lightning protection.

4) Sensor Testing.

a) Conduct all sensor measurements using manufacturer's recommended testing equipment, and compare the recorded data to the functional requirements shown in the Atmospheric sensors, Pavement Condition Sensors, and Sub-Surface Temperature Probe special provisions.

5) RPU Testing.

a) Verify all sensors are connected to the RPU as shown on the plans.

b) Verify accurate data collection and reporting from each sensor.

- c) Verify the RPU displays real-time data for all sensors connected.
  - d) Verify the RPU displays the data for the entire system “at a glance” for analysis.
  - e) Verify a long-term history page is present to show historical data from any sensor connected to the RPU. A log of at least three days should be present.
  - f) Verify the RPU supports local maintenance of all devices physically connected to the RPU using a graphical user interface (GUI).
  - g) Verify the RPU allows remote configuration of any sensor physically connected to the RPU using web interface.
  - h) Verify the presence of eight camera views in the RPU menu.
  - i) Verify the user is able to switch the first eight images with a second set of eight views.
- (ii) FST. After each ESS field location is fully installed and integrated, the following tests must be conducted from the TMC/TOC using ATMS or current residing RWIS central management software:
- 1) Verify remotely from the TMC/TOC that each sensor is reporting accurate data within the ranges shown in the special provisions.
  - 2) Verify each ESS location is represented on the map on the RWIS central management system.
  - 3) Verify the presence of eight camera views on the hosted site during the day and the night. Night images must be easily viewed when an Infrared (IR) Illumination device is present.
  - 4) Verify the IP address and site name corresponds to the ESS site location.
  - 5) Verify remote configuration of the RPU from a web-browser.
  - 6) Verify remote configuration of the IP camera from a web-browser.
- (k) IP Power Distribution Unit (PDU).
- (i) LDAT.
    - 1) Verify the user has the ability to reset the power to all the devices connected to the IP PDU.
    - 2) Verify all devices recover and return to normal operation.

## (ii) FST.

1) Verify the user has the ability to remotely reset the power to all the devices connected to the IP PDU.

2) Verify all devices recover and return to normal operation.

## (l) Tower Light.

## (i) LDAT.

1) Verify physical construction has been completed per the contract documents.

2) Verify the tower light automatically turns on in low light conditions.

## (m) IR Illumination Device.

## (i) LDAT.

1) Verify physical construction has been completed per the contract documents.

2) Verify the camera images/video is clearly viewable at night during low ambient light conditions.

## 4. Post-Construction.

## A. ATP Execution Requirements.

(1) After the ATP has been accepted, the Contractor must submit in writing a detailed ATP schedule to MDOT for witness testing in the field. The schedule must include time and duration for each test case.

(2) The Contractor must conduct their own pre-testing to verify each device is performing according to the passing criteria requirements submitted with each test case, prior to scheduling formal testing with the Engineer and MDOT.

(3) The Contractor must maintain an ATP progress report tracker in a tabulated format and submit to MDOT when required and at the completion of testing.

(4) The Contractor must maintain signed electric and hard copies of the witness testing and submit to MDOT with the as-built documentation.

(5) All test equipment required must be provided by the Contractor. Prior to field testing, all test equipment datasheets and calibration records must be submitted to MDOT for approval.

## B. Burn-in Period Requirements.

(1) Begin the burn-in period at a time after FST acceptance and as approved by the Engineer. All ITS items must be accepted and training requirements met prior to the start of the burn-in-period.

(2) Conduct the burn-in-period for 60 days.

(3) Maintain a failure log that records the date, time, and location of major and minor failures that occur and the corrective actions taken. Record the details of the failure and corrective action in this log. Make documentation available for inspection by the Engineer and provide to the Engineer at the end of the burn-in-period.

(4) Equipment failure reports must be generated by the MDOT Engineer and issued to the Contractor for corrective action.

(5) There may be no major failures during the burn-in-period. If one occurs, restart the 60-day period after the major failure has been corrected to the Engineer's satisfaction. The following are major failures:

(i) Less than 95 percent of entire ITS system for the project is operational at any moment.

(ii) Any failure that requires more than 48 hours to correct after providing notice to the Contractor.

(iii) Frequent occurrence of minor failures indicating a major system flaw, as determined by the Engineer.

(iv) Any failure of routing or core network communications equipment.

(6) A minor failure is any other failure. The 60-day acceptance test period must be stopped when a minor failure occurs and restarted without resetting to zero after the minor failure is corrected to the satisfaction of the Engineer.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay item.

<b>Pay Item</b>	<b>Pay Unit</b>
System Integration and Testing .....	Lump Sum

Partial Payments for **System Integration and Testing** will be made based on Table 2:

Accepted EIP and ATP	50%
FST Acceptance	85%
Burn-in Completion	100%

**Accepted EIP and ATP** will be paid to the Contractor upon approval of the Equipment Installation Plan (EIP) and Acceptance Test Plan (ATP).

**FST Acceptance** will be paid to the Contractor upon acceptance of the Final System Tests (FST). All FST's must be successfully tested and satisfied per the requirements noted above. Any tests that do not pass will prevent the Contractor from receiving partial payment, unless otherwise approved by the Engineer.

**Burn-in Completion** will be paid to the Contractor upon Final System Acceptance and Burn-In is successfully completed. Outstanding punch list items from Burn-In will prevent the Contractor from receiving payment on this item, unless otherwise approved by the Engineer.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**UNINTERRUPTIBLE POWER SUPPLY FOR INTELLIGENT TRANSPORTATION  
SYSTEMS (ITS)**

MET:MRM

1 of 3

ITS:APPR:CLC:DBP:03-14-12

**a. Description.** This work consists of furnishing and installing a rack-mounted, Uninterruptible Power Supply (UPS) in an ITS cabinet or indoor location and connection to the power supply and equipment within the ITS cabinet or rack.

**b. Materials.**

1. Uninterruptible Power Supply.

A. Provide a UPS that meets the following environmental requirements:

(1) Operating temperature range of -29 degrees F to 165 degrees F for ITS cabinets and Environmental Sensor Stations (ESS).

(2) Operating temperature range of 32 degrees F to 104 degrees F for indoor racks.

(3) Non-condensing operating humidity range of 5 percent to 90 percent.

B. Provide a rack-mounted, line-interactive UPS with an input voltage of 120 volts alternating current (AC) and an output voltage of 120 volts AC.

C. Provide a UPS with minimum output power capacity of 1500 volt-ampere (VA).

D. Provide a UPS with an auto-bypass feature and a serial interface port for local management.

E. Provide a UPS with at least eight protected outlets.

F. Provide a UPS with automatic low-battery and high temperature shutdown features. Ensure the UPS will return to normal operations without a manual reset.

G. Provide a UPS capable of remote management over an Ethernet/Internet Protocol (IP) network via Simple Network Management Protocol (SNMP). The UPS will be configurable to report failure of line power, high temperature, failures of the battery system, and overloads.

2. Batteries.

A. Provide batteries capable of discharging and charging over the following temperature ranges:

(1) -29 degrees F to 165 degrees F for ITS cabinets and ESS. The charging temperature range will be at least 0 degrees F to +140 degrees F, using a charger with temperature compensation.

(2) 32 degrees F to 104 degrees F for indoor racks. The charging temperature range will be at least that of the battery operating temperature.

B. Include connectors and cables recommended by the battery manufacturer and compliant with the latest version of the National Electric Code (NEC). The batteries must be capable of being serviced and replaced separately from the main UPS.

(1) Size batteries to be capable of running the full anticipated load for 15 minutes for ITS cabinets and indoor racks.

(2) Size batteries to be capable of running the full anticipated load for 4 hours for ESS sites.

### 3. Battery Heater.

A. Provide a heater and thermostat at each ESS location. Place the heater inside of the ITS Cabinet.

B. Provide a heater that does not consume more than 100 watts (W).

C. Provide only silicone rubber type heaters to provide controlled heat to the UPS batteries.

D. Include a thermostat to automatically adjust the heater temperature to avoid overheating of the equipment.

E. The heater is included in the Uninterruptible Power Supply, ESS pay item and will not be paid for separately.

### c. Construction.

1. Mount the UPS in the cabinet.

2. Connect the UPS to the UPS Breaker inside the ITS cabinet.

3. Provision UPS with IP address and network settings provided by the Engineer. Configure the UPS using settings that were approved at equipment mock up (if required per the Special Provision for Testing and Integration) or as approved by the Engineer.

4. Alarms.

A. Disable the audible alarms of all the devices in the battery cabinet.

B. Ensure that the communication module of the UPS reports alarm conditions to the Management/Operations Center using SNMP over the Ethernet communication system.

5. For the main UPS, provide a manufacturer’s warranty for parts and labor for a period of 3 years after the date of final acceptance. For the batteries, provide a manufacturer’s warranty for parts and labor for a period of 2 years after the date of final acceptance.

**d. Measurement and Payment.** The completed work, as described, will be measured and paid for at the contract unit price using the following pay items:

<b>Pay Item</b>	<b>Pay Unit</b>
<del>Uninterruptible Power Supply, ITS Cabinet.....</del>	<del>Each</del>
<del>Uninterruptible Power Supply, Indoor.....</del>	<del>Each</del>
Uninterruptible Power Supply, Environmental Sensor Stations .....	Each

MICHIGAN  
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION  
FOR  
**REMOTE PROCESSING UNIT**

ITS:JF

1 of 7

C&amp;T:APPR:XXX:YYY:00-00-12

**a. Description.** This work consists of furnishing, installing, integrating, testing, and warranting a Remote Processing Unit (RPU) as a part of an Environmental Sensor Station (ESS) installation as shown on the plans. This work is to be done in accordance with the standard specifications, except as modified herein. The plans must indicate device quantity, location, communications medium, and power for each ESS.

1. General.

A. The Contractor must furnish, install, integrate, calibrate, test, and provide warranty for all equipment and components necessary to provide complete functionality without additional expense to the Department.

B. Use identical and completely interchangeable equipment at each field location.

C. Final equipment selection, procurement, and installation must be approved and coordinated with the MDOT Engineer.

D. Different configurations of sensors and/or equipment may be specified at various ESS sites. Equipment with the same function and range must be identical when used at each site. This is intended to minimize the number of variations of spare parts and software patches necessary to maintain the ESS sites.

2. Requirements of Regulatory Agencies. Comply with the latest edition of the following codes or standards:

A. Environmental Sensor Station (ESS) Interface Standard – V3, National Transportation Communications for ITS Protocol (NTCIP) 1204 V03.

B. Federal Highway Administration (FHWA) Road Weather Information System (RWIS) Environmental Sensor Stations (ESS) Siting Guidelines, including all FHWA mounting heights for all atmospheric mounting locations.

3. Functional and Performance Requirements – Remote Processing Unit (RPU).

A. General.

(1) The RPU must include 10 serial ports, 2 of which are for communications and 8 of which are for sensor interface. Serial ports can be soft-selected for either Recommended Standard (RS)-232 or RS-485 serial line types. The proposed RPU must be expandable with additional circuit boards to support additional sensor inputs, camera types, digital outputs, and serial ports. Digital outputs may optionally be

added to the RPU by adding a relay driver card. The relay card includes four dry contact solid state relays to open or close based on any weather condition parameter sensed by the ESS site.

B. All data communication from the proposed RPU to the Central RWIS Server, using the specified communication medium is to be performed via a V23/Electronic Industries Association (EIA) RS-232C communication interface port that supports standard baud rates up to 115.2 Kilobits per second (Kbps).

(1) The RPU must be Open Protocol (NTCIP level 3) allowing for interoperability and connectivity to multiple vendors' products.

(2) RPU design must maximize the use of solid state components and each sensor outputs/controls must be protected against lightning.

(3) The RPU must have sufficient memory and capability to record and archive automated ESS instrument observations for a period of three days, at minimum. The interval between archived observations is selectable between 1 minute and 20 minutes.

C. Communications and Interfaces.

(1) RPU communication with the server must utilize the most current published Federal Standard NTCIP-ESS protocol. The server must poll the RPU via one of the following communications modes: Ethernet, Point-to-Point (PPP) dial-up over telephone, Point-to-Multipoint (PMPP) leased line, PMPP Very High Frequency/Ultra High Frequency (VHF/UHF) 2-way radio, PMPP spread spectrum radio, or PMPP serial fiber optic. The RPU must incorporate "watch-dog" circuitry, monitor its own operation, and reset itself if the RPU software enters an indeterminate state. The RPU must also have the capability to be reset by a "user administrator" from the server.

D. For maximum reliability, the design must utilize extensive lightning protection for all channels and serial ports, including auto-reset circuit breakers for power, transorbs, and gas discharge tubes. All RPU electronics must provide stable operation over a temperature range of -40 degrees C to 70 degrees C (-40 degrees F to 160 degrees F) and 0 percent to 90 percent Relative Humidity (RH) non-condensing.

E. The RPU must have the capability of being modified to utilize solar power or other power sources in place of conventional commercial electric power. Solar-powered RPU sites must operate a minimum of 72 hours without sunlight or solar charging of the batteries.

F. The RPU must be enclosed inside a NEMA 4 lockable aluminum enclosure that is resistant to damage by weather and vandals. RPU software configuration must be performed by personal computer (PC) with browser connected to the RPU Ethernet port.

G. The RPU software must have a built-in web browser for sensor configuration and routine maintenance. Troubleshooting and complete configuration of the RPU must be accomplished by local on-site access or remote access. Software fixes and upgrades

for the RPU must be accomplished remotely, either by dialing directly into the RPU, or from the existing RWIS server.

H. The RPU must be fully capable of supporting many different types of data communication to the Central Server. The following modes of communication must be supported by either serial or Ethernet ports on the RPU:

- (1) Telephone line using auto dial/answer modems.
- (2) Cellular phone using auto dial/answer modems.
- (3) Two-way radio with terminal node controllers.
- (4) Data radios, including Freewave spread spectrum radios.
- (5) External fiber optic modems.
- (6) Department of Transportation (DOT) Microwave network.
- (7) Ethernet network connection.
- (8) Satellite using a RS-232 or Ethernet interface.
- (9) Digital Subscriber Line (DSL) – digital subscriber line using Ethernet interface.

I. The RPU must support communications of the field data in compliance with the latest version of ESS Interface Standard, NTCIP 1204 (Level 3), "Object Definitions for ESS," previously approved in 1998 and must be field upgradeable for future NTCIP version releases at no additional cost to MDOT. Contractor must provide and install all hardware or software upgrades to any ESS components affected by changes to NTCIP standards which occur prior to the completion of the warranty period.

J. The RPU must, at minimum, be capable of collecting data from the following sensors:

- (1) Relative humidity/air temperature sensor.
- (2) Wind speed and direction, mechanical or ultrasonic sensors.
- (3) Precipitation occurrence sensor.
- (4) Classifying precipitation and visibility sensors combination sensor.
- (5) Snow depth sensor.
- (6) Solar radiation sensor.
- (7) Water level sensor.
- (8) Rain gauge sensor.

- (9) Digital visibility sensors.
- (10) Passive pavement sensor.
- (11) Active pavement sensor.
- (12) Non-invasive pavement temperature sensor.
- (13) Non-invasive laser based pavement sensor.
- (14) Sub-surface temperature probe.
- (15) Temperature Depth Probe sensor.
- (16) Wireless in pavement traffic sensor.
- (17) Side fire traffic radar.
- (18) Fixed color web camera.
- (19) Pan/Tilt/Zoom (PTZ) color web camera.
- (20) External device control – such as spread spectrum radio activation of signs.

K. All of the above sensors and devices must be connected to a RPU within the ESS. Any combination of sensors as shown on the plans must be accommodated by one or more RPU's.

L. The RPU must collect data from the sensors shown on the plans and must, at minimum, support the calculation and presentation of the following items using the NTCIP (Level 3) compliant RPU:

- (1) Atmospheric.
  - (a) Air Temperature - Minimum/Maximum Air Temperature, Relative Humidity, Dew Point.
  - (b) Anemometer (Wind Sensor) - Wind Speed, Direction, Maximum Wind Gust.
  - (c) Precipitation.
    - (i) Precipitation rate, Intensity, Classification, Accumulation, Start/End Time, Time since Last Precipitation, Forecasted Snow Accumulation, Probability of Precipitation.
- (2) Pavement Condition Sensor.

(a) Pavement Temperature, Condition, Chemical concentration, Conductivity, Snow/Ice Warning, Snow/Ice Watch, Wet Below Freezing, Frost, Chemical Wet, Depth of Water Layer.

(3) Sub-surface Temperature Probe.

(a) Temperature reading up to six sub-surface depths.

(4) Camera.

(a) Up to 16 camera images must be stored digitally by the RPU until requested or retrieved at the head-end.

(b) Images must be configurable in the RPU and must display at least eight images at a time.

(5) Vehicle Detection.

(a) Traffic detection per lane up to 10 lanes, including traffic speed, volume, and occupancy.

(6) Maintenance and operation.

(a) RPU must display real-time data for all sensors connected.

(b) A long-term history page must show historical data from any sensor connected to the RPU.

(c) The RPU must support local maintenance of all devices physically connected to the RPU using an integrated web-based data display.

(d) The RPU must have an automated reset system, which in case of power failure or other interruption of normal operation, must allow the system to return to normal operation.

## **b. Materials.**

### **1. General Requirements.**

A. All materials furnished, assembled, fabricated, or installed under this section must be new, corrosion resistant, and in accordance with the details shown on the plans and in the special provisions.

B. All electrical components must operate on 120 volts alternating current (VAC) ( $\pm$  10 percent) 50/60 Hertz (Hz) electricity. The Contractor must provide appropriate direct current (DC) conversion for any equipment requiring DC power. If the site is solar powered, Contractor must be allowed to power the devices using DC equipment. Contractor must provide appropriate DC-to-DC or AC-to-DC conversion equipment as needed.

C. The equipment used must be designed to protect personnel from exposure to high voltage during equipment operation, adjustments, and maintenance.

D. All field equipment must:

(1) Meet the following minimum temperature and environmental requirements:

(a) Operating/Storage temperature range of -40 degrees C to +60 degrees C (-40 degrees F to 140 degrees F).

(b) Non-condensing operating humidity range of 5 percent to 95 percent.

(2) Survive exposure to either direct solar heating or to high temperatures within an enclosure, as stated in storage temperature range noted above.

E. The RPU must incorporate surge suppression protection for each of the devices inside of the ITS Cabinet (to be paid for under the special provision for Grounding, Bonding, Lightning Protection, and Surge Protection for ITS Equipment).

**c. Construction.** All elements included in this specification, including power and communications, must comply with the construction requirements stated in the MDOT standard specifications, these special provisions, and any applicable state and local regulations.

1. Installation.

A. All installation must be done in a neat and professional manner. All cabling must be labeled on both ends, bundled, and stressed.

B. Installation of the RPU must be in conformance with the manufacturer's requirements for the device as specified, as it may be upgraded over its operational life.

C. The installation must meet local and state electrical requirements, including grounding. Grounding must be paid for and covered under the special provision for Grounding, Bonding, Lightning Protection, and Surge Protection for ITS Equipment.

D. Care must be taken not to damage any part or equipment during installation. Damaged parts or equipment must be replaced at no additional cost to the project or the Department. Repair is not an acceptable means of replacement. All equipment must be replaced with new parts.

E. The appropriate surge protector must protect the power, control, and return conductors along with all site equipment as specified by the ESS RPU and sensor manufacturers. Surge protection is to be paid for under the special provision for Grounding, Bonding, Lightning Protection, and Surge Protection for ITS Equipment.

2. Testing:

A. Include the RPU in Acceptance Test Plan (ATP) as detailed in the special provision for System Integration and Testing.

B. The Contractor must furnish test equipment at no additional cost to MDOT. Test procedures and passing criteria must, at minimum, be the requirements of the RPU manufacturer.

C. Provide a complete detailed cut sheet and shop drawing for the RPU and all connectivity, for the Engineer's approval before procurement. All cut sheets must include device manuals, installation and operation guides, and preventative maintenance schedules as described in the special provision for Basic Methods and Materials for ITS Work.

3. Manufacturer Warranty.

A. Any defect in design, materials, or workmanship which may occur during proper and normal use through final system acceptance must be corrected by repair and/or replacement by the Contractor without cost to the Department.

B. The manufacturer warranty on hardware and software is to be supplied for a total of two years after final acceptance. This manufacturer warranty must cover all equipment and parts.

C. Manufacturer warranty coverage must include expedited spare part supply to ensure replacement or repair of warranted equipment within 10 calendar days of the notification of equipment failure.

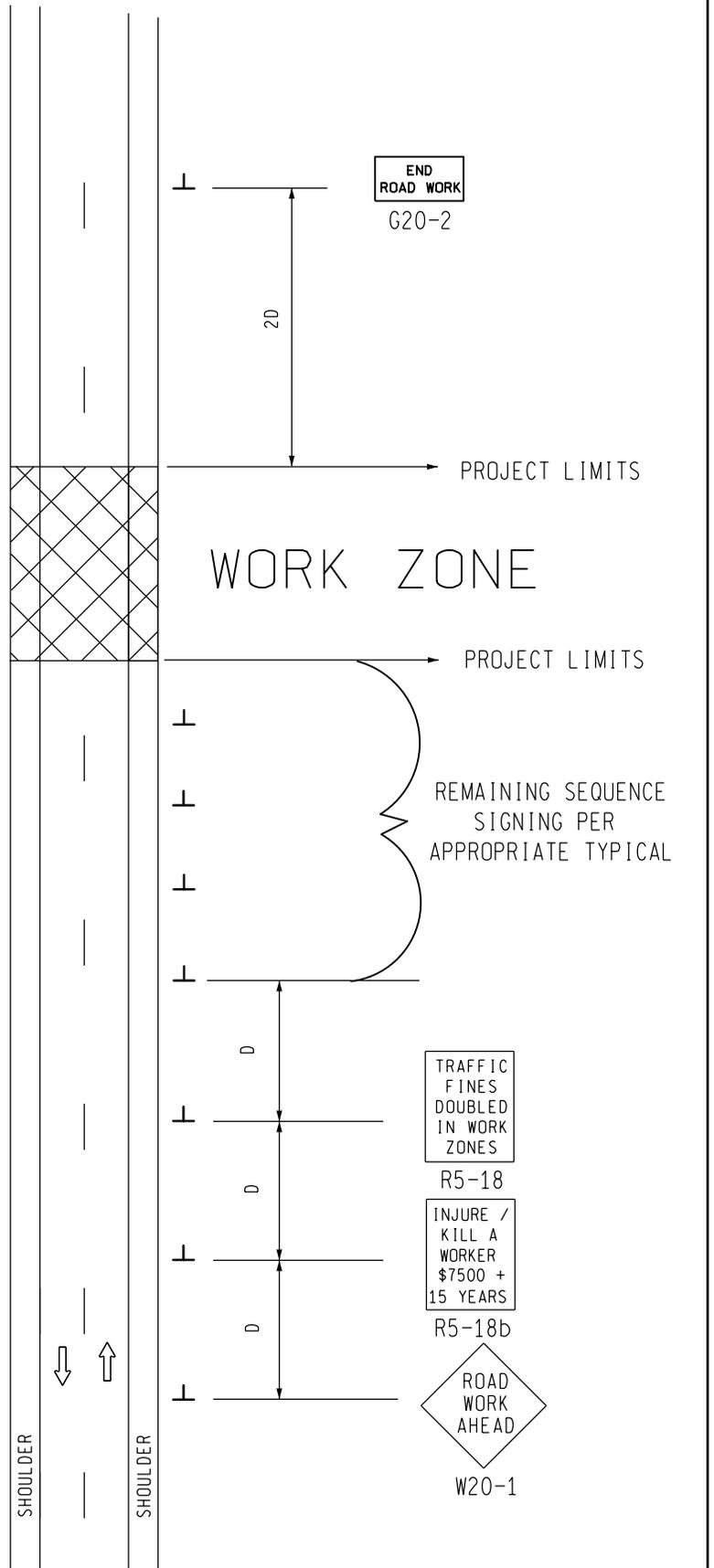
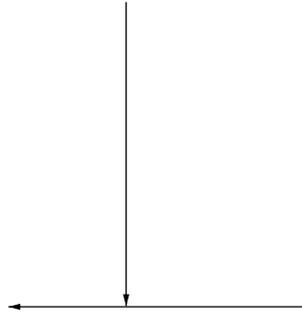
D. All manufacturer warranties must be transferred to MDOT upon written final acceptance of the ESS.

**d. Measurement and Payment.** The completed work as described will be measured and paid for at the contract unit price using the following pay item.

<b>Pay Item</b>	<b>Pay Unit</b>
Remote Processing Unit.....	Each

**Remote Processing Unit** includes the processing unit, cabling, mounting accessories, and power and communications connections for a fully functional unit.

SIGN PLACEMENT  
IS THE SAME FOR  
BOTH DIRECTIONS



SIGN = 48 f+2 - TYPE B  
FOR ONE DIRECTION OF TRAFFIC  
W20-1 QUANTITY INCLUDED WITH  
APPROPRIATE TYPICAL FOR  
SEQUENCE SIGNING

<p>TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL</p>	<p>TYPICAL ADVANCE SIGNING TREATMENT FOR INTERMEDIATE AND SHORT TERM STATIONARY WORK ZONE OPERATIONS WHERE ALL TRAFFIC CONTROL DEVICES ARE REMOVED AT END OF EACH WORK DAY ON AN UNDIVIDED TWO-WAY ROADWAY</p>	
	<p>DRAWN BY: CON:AE:djf CHECKED BY: BMM:CRB</p>	<p>OCTOBER 2011 PLAN DATE:</p>
<p>FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0050a.dgn REV. 10/13/2011</p>		

NOT TO SCALE

## NOTES

30. THE APPROPRIATE ADVANCE SIGNING SEQUENCE(S), (M0030a THROUGH M0080a) SHALL BE USED ON ALL PROJECTS.
35. THESE SIGNS ARE INTENDED TO BE USED WITHIN THE LIMITS OF THE TEMPORARY SEQUENCE SIGNING AS IS SHOWN ON 1 OF 2. THESE SIGNS ARE NOT TO BE INTERMINGLED WITH ANY OTHER TEMPORARY SEQUENCE SIGNING EXCEPT AS SHOWN.

### SIGN SIZES

G20-2	-	48" x 24"
R5-18	-	48" x 60"
R5-18b	-	48" x 60"
W20-1	-	48" x 48"

NOT TO SCALE

 TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL	TYPICAL ADVANCE SIGNING TREATMENT FOR INTERMEDIATE AND SHORT TERM STATIONARY WORK ZONE OPERATIONS WHERE ALL TRAFFIC CONTROL DEVICES ARE REMOVED AT END OF EACH WORK DAY ON AN UNDIVIDED TWO-WAY ROADWAY		
	DRAWN BY: CON:AE:djf	OCTOBER 2011	SHEET
CHECKED BY: BMM:CRB	PLAN DATE:	M0050a	
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0050a.dgn REV. 10/13/2011			2 OF 2

WHERE WORKERS PRESENT  
4 5  
R2-1a

SPEED LIMIT  
X X  
R2-1

WHERE WORKERS PRESENT  
4 5  
R2-1a

SPEED LIMIT  
X X  
R2-1

**KEY**  
 . . . CHANNELIZING DEVICES  
 → TRAFFIC FLOW  
 ■ REQUIRED AFTER ALL ENTRANCE RAMP

\* WHERE WORKERS PRESENT  
4 5  
R2-1a

SPEED LIMIT  
X X  
R2-1

\*SUPPLEMENTAL SET OF SPEED LIMIT SIGNS ARE REQUIRED WHEN ENTRANCE RAMP ARE MORE THAN 2 MILES APART, SUCH THAT NO SET OF THESE SPEED LIMIT SIGNS ARE EVER PLACED MORE THAN 2 MILES APART.

WHERE WORKERS PRESENT  
4 5  
R2-1a

SPEED LIMIT  
X X  
R2-1

SPEED LIMIT  
X X  
R2-1

WHERE WORKERS PRESENT  
4 5  
R2-1a

**MDOT**  
Michigan Department of Transportation  
TRAFFIC AND SAFETY  
MAINTAINING TRAFFIC TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL FOR SUPPLEMENTAL SPEED LIMIT TREATMENT ON LIMITED ACCESS ROADWAYS WHERE WORKERS PRESENT

DRAWN BY: CON:AE:djf  
CHECKED BY: BMM:CRB

OCTOBER 2011  
PLAN DATE:

M0100a

SHEET  
1 OF 2

NOT TO SCALE

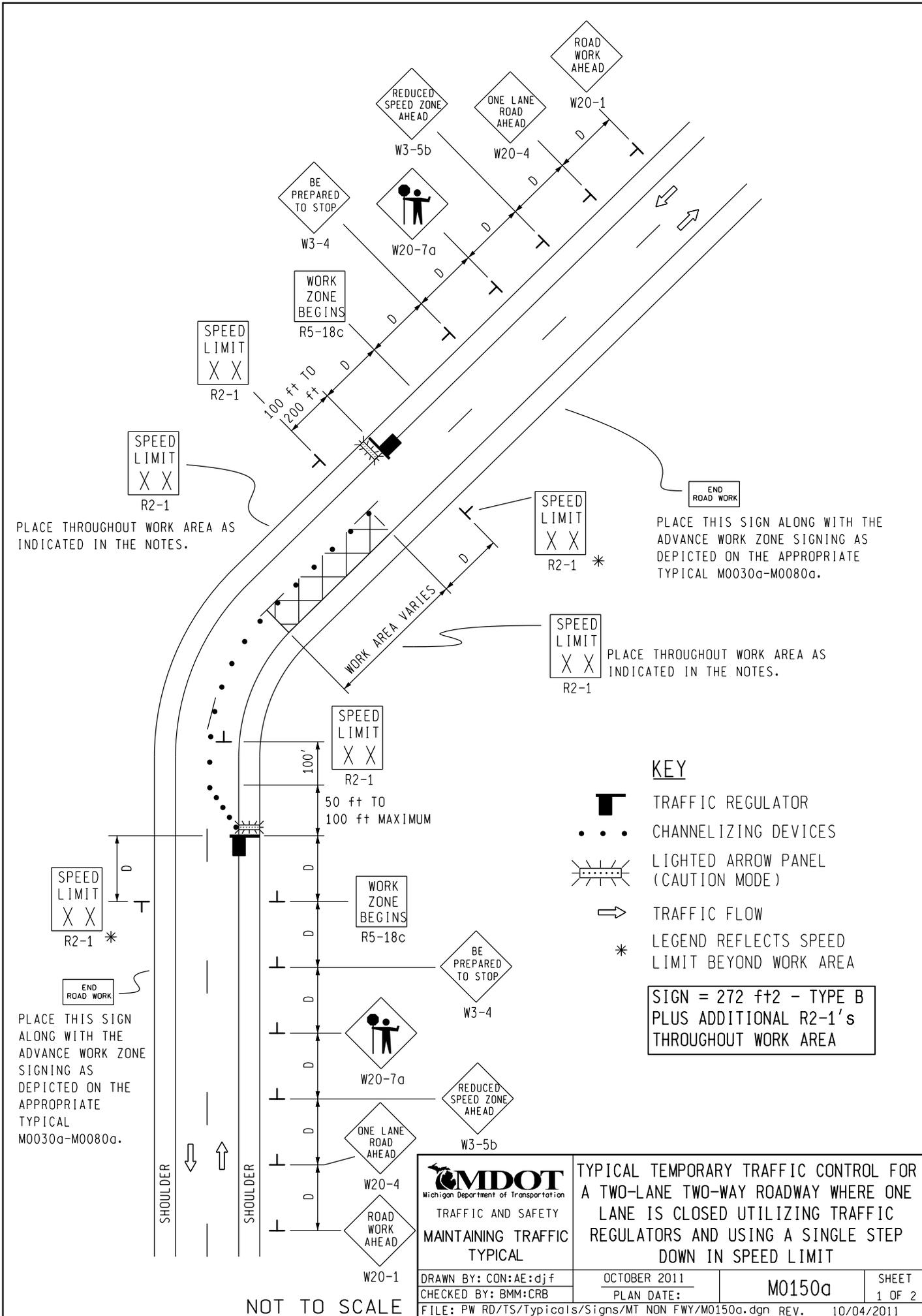
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0100a.dgn REV. 10/04/2011

## NOTES

- 1N. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES  
SEE **M0020a** FOR "D" VALUES
2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
8. WHEN BUFFER AREAS ARE ESTABLISHED, THERE SHALL BE NO EQUIPMENT OR MATERIALS STORED OR WORK CONDUCTED IN THE BUFFER AREA.

 <b>MDOT</b> Michigan Department of Transportation TRAFFIC AND SAFETY MAINTAINING TRAFFIC TYPICAL	TYPICAL TEMPORARY TRAFFIC CONTROL FOR SUPPLEMENTAL SPEED LIMIT TREATMENT ON LIMITED ACCESS ROADWAYS WHERE WORKERS PRESENT	
	DRAWN BY: CON:AE:djf CHECKED BY: BMM:CRB	OCTOBER 2011 PLAN DATE:
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0100a.dgn REV. 10/04/2011		

NOT TO SCALE



PLACE THROUGHOUT WORK AREA AS INDICATED IN THE NOTES.

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

PLACE THROUGHOUT WORK AREA AS INDICATED IN THE NOTES.

**KEY**

-  TRAFFIC REGULATOR
-  CHANNELIZING DEVICES
-  LIGHTED ARROW PANEL (CAUTION MODE)
-  TRAFFIC FLOW
-  \* LEGEND REFLECTS SPEED LIMIT BEYOND WORK AREA

SIGN = 272 ft x 2 - TYPE B PLUS ADDITIONAL R2-1's THROUGHOUT WORK AREA

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

NOT TO SCALE

 Michigan Department of Transportation <b>TRAFFIC AND SAFETY</b> <b>MAINTAINING TRAFFIC</b> <b>TYPICAL</b>		<b>TYPICAL TEMPORARY TRAFFIC CONTROL FOR A TWO-LANE TWO-WAY ROADWAY WHERE ONE LANE IS CLOSED UTILIZING TRAFFIC REGULATORS AND USING A SINGLE STEP DOWN IN SPEED LIMIT</b>	
DRAWN BY: CON:AE:djf CHECKED BY: BMM:CRB FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0150a.dgn REV.	OCTOBER 2011 PLAN DATE:	<b>M0150a</b>	SHEET 1 OF 2

## NOTES

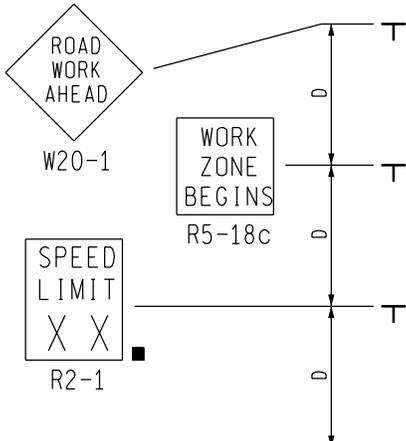
- 1H. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES AND LENGTH OF LONGITUDINAL BUFFERS  
SEE **M0020a** FOR "D" VALUES.
2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- 3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.
- 4A. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES IN THE TAPER AREA(S) SHOULD BE 15 FEET AND SHOULD BE EQUAL IN FEET TO TWICE THE POSTED SPEED IN MILES PER HOUR IN THE PARALLEL AREA(S).
5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.
6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.
7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
9. ALL TRAFFIC REGULATORS SHALL BE PROPERLY TRAINED AND SUPERVISED.
- 9A. IN ANY OPERATION INVOLVING MORE THAN ONE TRAFFIC REGULATOR, ONE PERSON SHOULD BE DESIGNATED AS HEAD TRAFFIC REGULATOR.
10. ALL TRAFFIC REGULATORS' CONDUCT, THEIR EQUIPMENT, AND TRAFFIC REGULATING PROCEDURES SHALL CONFORM TO THE CURRENT EDITION OF THE MICHIGAN MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES (MMUTCD) AND THE CURRENT EDITION OF THE MDOT HANDBOOK ENTITLED "TRAFFIC REGULATORS INSTRUCTION MANUAL."
11. WHEN TRAFFIC REGULATING IS ALLOWED DURING THE HOURS OF DARKNESS, APPROPRIATE LIGHTING SHALL BE PROVIDED TO SUFFICIENTLY ILLUMINATE THE TRAFFIC REGULATOR'S STATIONS.
- 12E. THE MAXIMUM DISTANCE BETWEEN THE TRAFFIC REGULATORS SHALL BE NO MORE THAN 2 MILES IN LENGTH UNLESS RESTRICTED FURTHER IN THE SPECIAL PROVISIONS FOR MAINTAINING TRAFFIC. ALL SEQUENCES OF MORE THAN 2 MILES IN LENGTH WILL REQUIRE WRITTEN PERMISSION FROM THE ENGINEER BEFORE PROCEEDING.
13. WHEN INTERSECTING ROADS OR SIGNIFICANT TRAFFIC GENERATORS (SHOPPING CENTERS, MOBILE HOME PARKS, ETC.) OCCUR WITHIN THE ONE-LANE TWO-WAY OPERATION, INTERMEDIATE TRAFFIC REGULATORS AND APPROPRIATE SIGNING SHALL BE PLACED AT THESE LOCATIONS.
14. ADDITIONAL SIGNING AND/OR ELONGATED SIGNING SEQUENCES SHOULD BE USED WHEN TRAFFIC VOLUMES ARE SIGNIFICANT ENOUGH TO CREATE BACKUPS BEYOND THE W3-4 SIGNS.
15. THE HAND HELD (PADDLE) SIGNS REQUIRED BY THE MMUTCD TO CONTROL TRAFFIC WILL BE PAID FOR AS PART OF FLAG CONTROL.
- 16A. ADDITIONAL SPEED LIMIT SIGNS REFLECTING THE REDUCED SPEED SHALL BE PLACED AFTER EACH MAJOR CROSSROAD THAT INTERSECTS THE WORK AREA WHERE THE REDUCED SPEED IS IN EFFECT, AND AT INTERVALS ALONG THE ROADWAY SUCH THAT NO SPEED LIMIT SIGNS REFLECTING THE REDUCED SPEED ARE MORE THAN TWO MILES APART.
- 16B. WHEN REDUCED SPEED LIMITS ARE UTILIZED IN THE WORK AREA, ADDITIONAL SPEED LIMIT SIGNS RETURNING TRAFFIC TO ITS NORMAL SPEED SHALL BE PLACED BEYOND THE LIMITS OF THE REDUCED SPEED AS INDICATED.
- 16E. WHEN EXISTING SPEED LIMITS ARE REDUCED MORE THAN 10 MPH, THE SPEED LIMIT SHALL BE STEPPED DOWN IN NO MORE THAN 10 MPH INCREMENTS.
- 28E. THE TRAFFIC REGULATORS SHOULD BE POSITIONED AT OR NEAR THE SIDE OF THE ROAD SO THAT THEY ARE SEEN CLEARLY AT A MINIMUM DISTANCE OF 500 FEET. THIS MAY REQUIRE EXTENDING THE BEGINNING OF THE LANE CLOSURE TO OVERCOME VIEWING PROBLEMS CAUSED BY HILLS AND CURVES.

### SIGN SIZES

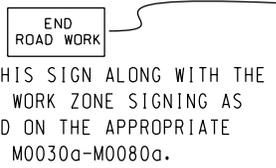
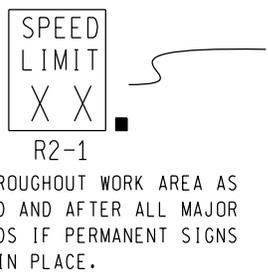
DIAMOND WARNING	- 48" x 48"
RECTANGULAR REGULATORY	- 48" x 60"
R5-18c REGULATORY	- 48" x 48"

NOT TO SCALE

 TRAFFIC AND SAFETY <b>MAINTAINING TRAFFIC TYPICAL</b>	<b>TYPICAL TEMPORARY TRAFFIC CONTROL FOR A TWO-LANE TWO-WAY ROADWAY WHERE ONE LANE IS CLOSED UTILIZING TRAFFIC REGULATORS AND USING A SINGLE STEP DOWN IN SPEED LIMIT</b>	
DRAWN BY: CON:AE:djf	OCTOBER 2011	<b>M0150a</b>
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FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0150a.dgn		SHEET 2 OF 2 REV. 10/04/2011

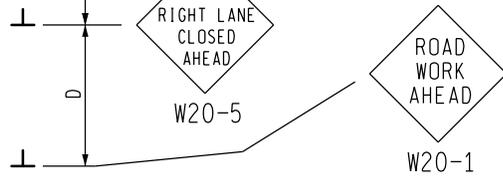
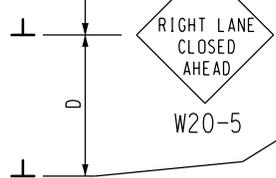
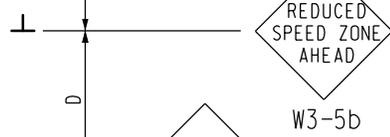
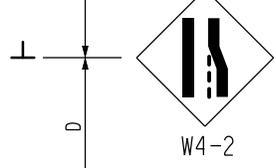
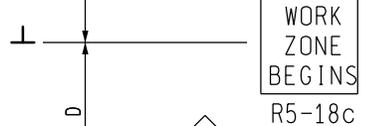
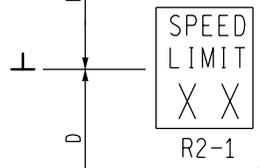
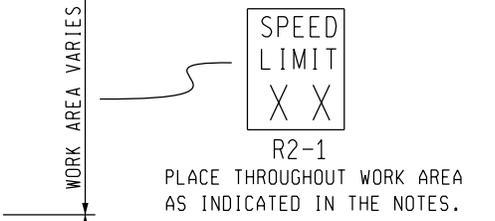
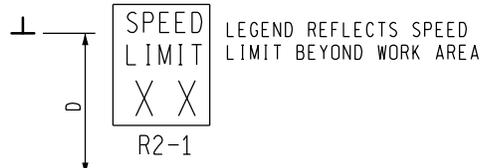
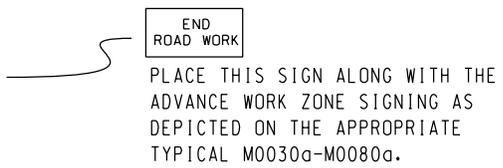
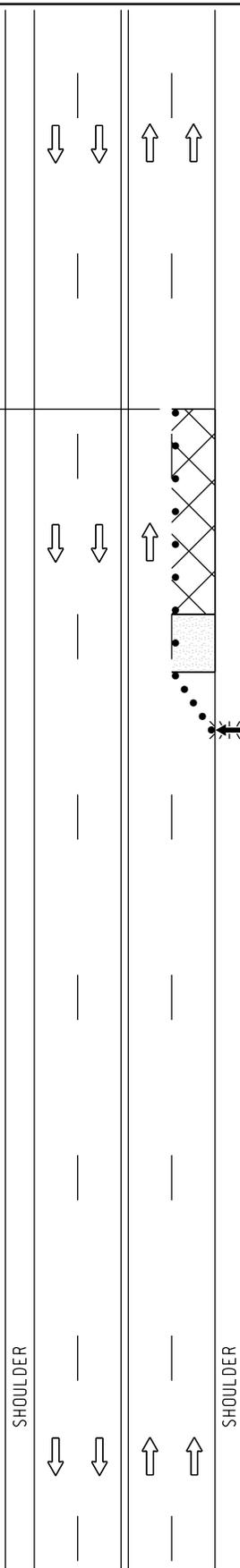


NO SPEED REDUCTION  
THIS DIRECTION



- KEY**
- • • CHANNELIZING DEVICES
  - ← LIGHTED ARROW PANEL
  - TRAFFIC FLOW
  - REFLECTS EXISTING SPEED LIMIT

SIGN = 172 f+2 - TYPE B PLUS ADDITIONAL R2-1'S THROUGHOUT WORK AREA



↑ MAXIMUM 10MPH SPEED REDUCTION THIS DIRECTION

**MDOT**  
Michigan Department of Transportation  
TRAFFIC AND SAFETY  
MAINTAINING TRAFFIC  
TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL FOR A ONE-LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY USING A SINGLE STEP DOWN IN SPEED LIMIT IN ONE DIRECTION ONLY

DRAWN BY: CON:AE:djf  
CHECKED BY: BMM:CRB

OCTOBER 2011  
PLAN DATE:

M0250a

SHEET  
1 OF 2

NOT TO SCALE

## NOTES

- 1B. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES  
L = MINIMUM LENGTH OF TAPER  
B = LENGTH OF LONGITUDINAL BUFFER  
SEE **M0020a** FOR "D," "L," AND "B" VALUES
- 2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
- 3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- 3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.
- 4E. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES SHOULD BE EQUAL IN FEET TO THE POSTED SPEED IN MILES PER HOUR ON TAPER(S) AND TWICE THE POSTED SPEED IN THE PARALLEL AREA(S).
- 5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.
- 6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.
- 7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
- 8. WHEN BUFFER AREAS ARE ESTABLISHED, THERE SHALL BE NO EQUIPMENT OR MATERIALS STORED OR WORK CONDUCTED IN THE BUFFER AREA.
- 16A. ADDITIONAL SPEED LIMIT SIGNS REFLECTING THE REDUCED SPEED SHALL BE PLACED AFTER EACH MAJOR CROSSROAD THAT INTERSECTS THE WORK AREA WHERE THE REDUCED SPEED IS IN EFFECT, AND AT INTERVALS ALONG THE ROADWAY SUCH THAT NO SPEED LIMIT SIGNS REFLECTING THE REDUCED SPEED ARE MORE THAN TWO MILES APART.
- 16B. WHEN REDUCED SPEED LIMITS ARE UTILIZED IN THE WORK AREA, ADDITIONAL SPEED LIMIT SIGNS RETURNING TRAFFIC TO ITS NORMAL SPEED SHALL BE PLACED BEYOND THE LIMITS OF THE REDUCED SPEED AS INDICATED.
- 16E. WHEN EXISTING SPEED LIMITS ARE REDUCED MORE THAN 10 MPH, THE SPEED LIMIT SHALL BE STEPPED DOWN IN NO MORE THAN 10 MPH INCREMENTS.
- 21. ALL EXISTING PAVEMENT MARKINGS WHICH ARE IN CONFLICT WITH EITHER PROPOSED CHANGES IN TRAFFIC PATTERNS OR PROPOSED TEMPORARY TRAFFIC MARKINGS, SHALL BE REMOVED BEFORE ANY CHANGE IS MADE IN THE TRAFFIC PATTERN. EXCEPTION WILL BE MADE FOR DAYTIME-ONLY TRAFFIC PATTERNS THAT ARE ADEQUATELY DELINEATED BY OTHER TRAFFIC CONTROL DEVICES.
- 26. THE LIGHTED ARROW PANEL SHALL BE LOCATED AT THE BEGINNING OF THE TAPER AS SHOWN. WHEN PHYSICAL LIMITATIONS RESTRICT ITS PLACEMENT AS INDICATED, THEN IT SHALL BE PLACED AS CLOSE TO THE BEGINNING OF THE TAPER AS POSSIBLE.

### SIGN SIZES

DIAMOND WARNING           - 48" x 48"  
 RECTANGULAR REGULATORY - 48" x 60"  
 R5-18c REGULATORY       - 48" x 48"

NOT TO SCALE

 TRAFFIC AND SAFETY <b>MAINTAINING TRAFFIC          TYPICAL</b>	<b>TYPICAL TEMPORARY TRAFFIC CONTROL FOR          A ONE-LANE CLOSURE ON AN UNDIVIDED          MULTI-LANE ROADWAY USING A SINGLE          STEP DOWN IN SPEED LIMIT          IN ONE DIRECTION ONLY</b>		
DRAWN BY: CON:AE:djf	OCTOBER 2011	<b>M0250a</b>	SHEET
CHECKED BY: BMM:CRB	PLAN DATE:		2 OF 2
FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0250a.dgn REV. 10/11/2011			

END ROAD WORK

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

END ROAD WORK

PLACE THIS SIGN ALONG WITH THE ADVANCE WORK ZONE SIGNING AS DEPICTED ON THE APPROPRIATE TYPICAL M0030a-M0080a.

SPEED LIMIT  
X X  
R2-1

PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL ENTRANCE RAMP AND ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

SPEED LIMIT  
X X  
R2-1

PLACE THROUGHOUT WORK AREA AS INDICATED AND AFTER ALL ENTRANCE RAMP AND ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

KEY

- • • CHANNELIZING DEVICES
- ⋈ LIGHTED ARROW PANEL (CAUTION MODE)
- ➔ TRAFFIC FLOW
- REFLECTS EXISTING SPEED LIMIT
- \* USE THE "NEXT -- MILES" SIGN WHEN SHOULDER CLOSURE EXCEEDS 1 MILE IN LENGTH

SPEED LIMIT  
X X  
R2-1

WORK ZONE BEGINS  
R5-18c

SPEED LIMIT  
X X  
R2-1

WORK ZONE BEGINS  
R5-18c

SIGN = 148 ft2 - TYPE B PLUS ADDITIONAL R2-1's THROUGHOUT WORK AREA

ROAD WORK AHEAD  
W20-1

SHOULDER

SHOULDER

RIGHT SHOULDER CLOSED  
W21-5a

RIGHT SHOULDER CLOSED AHEAD  
W21-5b

NEXT -- MILES \*  
W20-1a

ROAD WORK AHEAD  
W20-1

**MDOT**  
Michigan Department of Transportation  
TRAFFIC AND SAFETY  
MAINTAINING TRAFFIC  
TYPICAL

TYPICAL TEMPORARY TRAFFIC CONTROL FOR A SHOULDER CLOSURE ON A DIVIDED ROADWAY OR FREEWAY NO SPEED REDUCTION

DRAWN BY: CON:AE:djf  
CHECKED BY: BMM:CRB

OCTOBER 2011  
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M0880a

SHEET  
1 OF 2

NOT TO SCALE

FILE: PW RD/TS/Typicals/Signs/MT NON FWY/M0880a.dgn REV. 10/26/2011

## NOTES

1. D = DISTANCE BETWEEN TRAFFIC CONTROL DEVICES  
 $1/3 L$  = MINIMUM LENGTH OF TAPER  
 B = LENGTH OF LONGITUDINAL BUFFER  
 SEE **M0020a** FOR "D," "L," AND "B" VALUES
2. ALL NON-APPLICABLE SIGNING WITHIN THE CIA SHALL BE MODIFIED TO FIT CONDITIONS, COVERED OR REMOVED.
3. DISTANCES BETWEEN SIGNS, THE VALUES FOR WHICH ARE SHOWN IN TABLE D, ARE APPROXIMATE AND MAY NEED ADJUSTING AS DIRECTED BY THE ENGINEER.
- 3A. THE "WORK ZONE BEGINS" (R5-18c) SIGN SHALL BE USED ONLY IN THE INITIAL SIGNING SEQUENCE IN THE WORK ZONE. SUBSEQUENT SEQUENCES IN THE SAME WORK ZONE SHALL OMIT THIS SIGN AND THE QUANTITIES SHALL BE ADJUSTED APPROPRIATELY.
- 4E. THE MAXIMUM RECOMMENDED DISTANCE(S) BETWEEN CHANNELIZING DEVICES SHOULD BE EQUAL IN FEET TO THE POSTED SPEED IN MILES PER HOUR ON TAPER(S) AND TWICE THE POSTED SPEED IN THE PARALLEL AREA(S).
5. FOR OVERNIGHT CLOSURES, TYPE III BARRICADES SHALL BE LIGHTED.
6. WHEN CALLED FOR IN THE FHWA ACCEPTANCE LETTER FOR THE SIGN SYSTEM SELECTED, THE TYPE A WARNING FLASHER, SHOWN ON THE WARNING SIGNS, SHALL BE POSITIONED ON THE SIDE OF THE SIGN NEAREST THE ROADWAY.
7. ALL TEMPORARY SIGNS, TYPE III BARRICADES, THEIR SUPPORT SYSTEMS AND LIGHTING REQUIREMENTS SHALL MEET NCHRP 350 CRASHWORTHLY REQUIREMENTS STIPULATED IN THE CURRENT EDITION OF THE MICHIGAN MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, THE CURRENT EDITION OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION, THE STANDARD PLANS AND APPLICABLE SPECIAL PROVISIONS. ONLY DESIGNS AND MATERIALS APPROVED BY MDOT WILL BE ALLOWED.
8. WHEN BUFFER AREAS ARE ESTABLISHED, THERE SHALL BE NO EQUIPMENT OR MATERIALS STORED OR WORK CONDUCTED IN THE BUFFER AREA.
- 29A. THE TYPE OF REFLECTIVE SHEETING USED FOR THE W20-1a PLAQUE SHALL BE THE SAME AS THE TYPE USED FOR THE PARENT SIGN.

### SIGN SIZES

DIAMOND WARNING	- 48" x 48"
W20-1a PLAQUE	- 48" x 36"
R2-1 REGULATORY	- 48" x 60"
R5-18c REGULATORY	- 48" x 48"

NOT TO SCALE

 <b>MDOT</b> Michigan Department of Transportation TRAFFIC AND SAFETY <b>MAINTAINING TRAFFIC</b> TYPICAL	<b>TYPICAL TEMPORARY TRAFFIC CONTROL</b> <b>FOR A SHOULDER CLOSURE ON A</b> <b>DIVIDED ROADWAY OR FREEWAY</b> <b>NO SPEED REDUCTION</b>		
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