Section II – Part I Preliminary Plans and Engineering Report

VILLAGE AT AMSTERDAM

60 LOT SUBDIVISION

IN SECTION 14, T1S, R3E, P.M., M.
GALLATIN COUNTY, MT 59741

NORTH REF

GALLATIN COUNTY MAP
NOT TO SCALE

SHEET INDEX

NORTH REF

VICINITY MAP
NOT TO SCALE

411 EAST MAIN STREET
SUITE 101
BOZEMAN, MONTANA 59715
PHONE (406) 556-7100
FAX (406) 585-3031

100% DESIGN SUBMITTAL
DECEMBER, 2014

CIVIL

NAME: ERIK GARBERG
DATE: DECEMBER, 2014

CADD FILE: AMTECCVR
DIR: H:\AMS\ILLITE\CIVIL

GENERAL NOTES:

ALL WORK AND MATERIALS SHALL BE IN COMPLETE ACCORDANCE WITH THE MONTANA PUBLIC WORKS STANDARD SPECIFICATIONS (MPWSS), DEQ 8 MONTANA STANDARDS FOR SUBDIVISION STORM DRAINAGE, PROJECT SPECIFIC SPECIFICATIONS, AND ALL OTHER GOVERNING AGENCY'S STANDARDS.

ALL MATERIAL GENERATED FROM DEMOLITION ACTIVITIES SHALL LEGALLY BE DISPOSED OF AT THE CONTRACTORS EXPENSE. AN APPROPRIATE DUMP SITE SHALL BE NOMINATED PRIOR TO THE START OF CONSTRUCTION.

THE CONTRACTOR SHALL PROTECT ADJACENT PROPERTIES, PUBLIC AND PRIVATE, AT ALL TIMES DURING CONSTRUCTION.

THE CONTRACTOR SHALL CONTROL DUST IN ACCORDANCE WITH REGULATIONS OF LOCAL AIR POLLUTION CONTROL AUTHORITY.

TRAFFIC, BOTH VEHICULAR AND PEDESTRIAN SHALL BE PROTECTED BY EFFECTIVE BARRICADES AND SIGNS IN ACCORDANCE WITH MUTCD GUIDANCE. EFFECTIVE LIGHTING OF OBSTRUCTIONS SHALL BE PROVIDED AT NIGHT.

IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO APPLY AND SECURE ALL NECESSARY PERMITS REQUIRED FOR THE COMPLETION OF THE PROJECT.

UPON COMPLETION OF CONSTRUCTION, THE CONTRACTOR SHALL SUBMIT A CLEAN SET OF FIELD DRAWINGS CONTAINING ALL AS BUILT INFORMATION TO THE ENGINEER.

CONTRACTOR SHALL PERFORM ALL WORK NECESSARY TO COMPLETE THE PROJECT IN ACCORDANCE WITH THE APPROVED CONSTRUCTION DRAWINGS INCLUDING INCIDENTALS THAT MAY BE REQUIRED TO PROVIDE A COMPLETE PROJECT.

CONTRACTOR SHALL BE RESPONSIBLE FOR STORM WATER QUALITY DURING CONSTRUCTION. CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM (MPDES), INCLUDING THE PREPARATION AND MAINTENANCE OF A STORM WATER POLLUTION AND PREVENTION PLAN (SWPPP) THROUGHOUT THE DURATION OF THIS PROJECT.

EXISTING UTILITIES:

THE LOCATION AND DESCRIPTION OF ALL SHOWN UTILITIES ARE COMPILED FROM AVAILABLE RECORDS AND FIELD SURVEYS. THE ENGINEER DOES NOT GUARANTEE THE ACCURACY NOR COMPLETENESS OF THESE UTILITIES.

ATTENTION:

THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR LOCATING ALL EXISTING UTILITY INSTALLATIONS ABOVE AND BELOW GROUND IN ADVANCE OF THE PROJECT BY CONTACTING THEIR RESPECTIVE OWNERS. ALL COSTS RELATED TO CROSSING EXISTING UTILITIES, EXPLORATORY EXCAVATION AND OTHER METHODS OF LOCATING EXISTING UTILITIES ARE INCIDENTAL AND SHALL NOT BE PAID SEPARATELY, BUT SHALL BE MERGED WITH APPLICABLE BID ITEMS. NOT ALL UTILITIES ARE IDENTIFIED ON THE PLANS.

811 Know what's below. Call before you dig.

CALL AT LEAST 2 WORKING DAYS
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811 OR 1-800-424-5555

A FEDERAL LAW NOW IN EFFECT STATES THAT ANY PERSON WHO ENGAGES IN EXCAVATION ACTIVITIES WITHOUT FIRST USING AN AVAILABLE ONE-CALL NOTIFICATION SYSTEM TO DETERMINE LOCATIONS OF UNDERGROUND FACILITIES; OR WITHOUT HEEDING LOCATION INFORMATION OR MARKINGS AND SUBSEQUENT DAMAGES A PIPELINE FACILITY SHALL BE SUBJECT TO A FINE, IMPRISONMENT, OR BOTH. THE LAW ALSO STATES THAT OSHA MAY BE NOTIFIED OF ANY ACCIDENT CAUSED BY AN EXCAVATOR.

CONSTRUCTION NOTES:

VERIFY EXISTING CONDITIONS AND LOCATE ALL EXISTING UTILITIES. THE CONTRACTOR SHALL FIELD VERIFY LINE AND GRADE OF EXISTING AND PROPOSED CONNECTIONS WELL IN ADVANCE OF MAKING THE CONNECTION. NOTIFY ENGINEER OF ANY UNFORESEEN CONDITIONS.

CONTRACTOR TO PROTECT ALL EXISTING UTILITIES, SIGNS, AND EXISTING STRUCTURES. REPAIR BACK TO ORIGINAL CONDITION IF DAMAGE HAS OCCURRED DURING CONSTRUCTION.

DO NOT SCALE FROM THE DRAWINGS. VERIFY ALL DIMENSIONS IN THE FIELD. CONTACT THE ENGINEER FOR FURTHER INFORMATION IF DIMENSION NOT PROVIDED.

UNLESS OTHERWISE INDICATED, ALL CONSTRUCTION LAYOUT AND STAKING SHALL BE PERFORMED UNDER THE RESPONSIBLE CHARGE OF A MONTANA LICENSED LAND SURVEYOR.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPORTING AND/OR EXPORTING ALL MATERIAL AS REQUIRED TO PROPERLY GRADE THIS SITE TO THE FINISHED ELEVATIONS SHOWN HEREON IN ACCORDANCE WITH THE APPROVED PLANS AND SPECIFICATIONS.

ALL TRENCHING AND EXCAVATION SHALL BE BACKFILLED AND COMPACTED BACK TO THE ORIGINAL GRADE. BACKFILL OUTSIDE THE BUILDING FOOTPRINT SHALL BE COMPACTED TO 95% OF THE PROCTOR DENSITY. COMPACT LANDSCAPE TO 85%.

PROVIDE POSITIVE DRAINAGE AWAY FROM ALL STRUCTURES.

MEET THE CURRENT DEPARTMENT OF JUSTICE ADA STANDARDS FOR ACCESSIBLE DESIGN.

ALL DIMENSIONS SHOWN ARE TO TOP BACK OF CURB UNLESS OTHERWISE NOTED.

AN ELECTRONIC FILE CONTAINING NORTHINGS, EASTINGS, AND ELEVATIONS WILL BE PROVIDED FOR CONSTRUCTION STAKING.

GRADING & DRAINAGE:

PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL FIELD VERIFY EXISTING ROAD AND TOP BACK OF CURB OF CURB ELEVATIONS TO ENSURE THAT THEY MATCH PROPOSED GRADES.

CLEAR AND GRUB ALL SURFACE VEGETATION, TREES, STUMPS, BRUSH, ETC. REMOVE ALL ORGANIC MATERIAL THAT CANNOT BE COMPACTED INTO A STABLE MASS. ALL BRUSH AND DEBRIS ASSOCIATED WITH CLEARING, STRIPPING OR GRADING SHALL BE REMOVED AND DISPOSED OF OFF SITE.

UNLESS OTHERWISE INDICATED, GRADES SHOWN REPRESENT FINISHED ELEVATIONS.

UNLESS OTHERWISE INDICATED, ALL MANHOLES, VALVES, AND GRATES SHALL BE ADJUSTED TO FINISHED GRADES.

REMOVE TOPSOIL WITHIN LIMITS OF CONSTRUCTION. STOCKPILE SUFFICIENT TOPSOIL TO SPREAD THROUGHOUT DISTURBED AREAS.

IN AREAS WHERE NEW FILL IS TO BE PLACED ON SLOPING GROUND, BENCHING THE SURFACE SHALL BE COMPLETED PRIOR TO PLACING THE FILL. BENCHING SHALL BE COMPLETED WHERE SLOPES ARE STEEPER THAN 4:1 (HORIZONTAL-VERTICAL).

CUT SLOPE GRADES WITHIN THE PROJECT AREA SHALL NOT EXCEED 3 HORIZONTAL TO 1 VERTICAL. FILL SLOPE GRADES SHALL NOT EXCEED 4 HORIZONTAL TO 1 VERTICAL UNLESS OTHERWISE NOTED.

PROVIDE POSITIVE DRAINAGE AT ALL TIMES WITHIN THE CONSTRUCTION AREA. DO NOT ALLOW WATER TO POND IN EXCAVATION AREAS AND MAINTAIN ALL EXISTING DRAINAGE PATTERNS.

THE CONTRACTOR SHALL BE RESPONSIBLE TO COMPLY WITH ALL OSHA REGULATIONS FOR WORK UNDER THIS CONTRACT.

CURB AND GUTTER:

CURB SHALL BE PLACED AT LOCATIONS INDICATED. FINAL GRADES SHALL BE ADJUSTED TO BEST MATCH EXISTING STREET GRADES, UPON APPROVAL FROM ENGINEER.

SUBGRADE AND BASE COURSE MATERIAL AND COMPACTION SHALL CONFORM TO PROVISIONS PROVIDED IN THE GEOTECHNICAL REPORT.

CONTRACTION JOINTS SHALL BE PLACED AT 10' INTERVALS AND HAVE A MINIMUM DEPTH OF ¾" AND A MINIMUM WIDTH OF 1/8".

½" EXPANSION JOINT MATERIAL SHALL BE PLACED AT ALL PC'S, PT'S, CURB RETURN AND AT NO MORE THAN A 100' INTERVAL. EXPANSIONS MATERIAL SHALL EXTEND THROUGH THE FULL DEPTH OF THE CURB.

STREET SIGNAGE AND STRIPING:

ALL SIGNS SHALL BE FURNISHED NEW PER THE CURRENT MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, AND ERECTED PER MONTANA PUBLIC WORK STANDARDS, 6TH EDITION, AT THE LOCATIONS SPECIFIED. SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL FOR ALL SIGNS PRIOR TO PURCHASE AND INSTALLATION.

ALL PAVEMENT MARKINGS SHALL BE PER THE APPROVED PROJECT SPECIFICATIONS.

SHOP AND FABRICATION DRAWINGS:

THE CONTRACTOR SHALL PREPARE AND SUBMIT FABRICATION DRAWINGS, DESIGN MIX INFORMATION, MATERIAL TESTING COMPLIANCE DATA, AND ANY OTHER PERTINENT DATA TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO PLACEMENT OF MATERIALS. FOLLOWING REVIEW THE CONTRACTOR SHALL RESUBMIT COPIES OF ANY DRAWINGS WHICH REQUIRE REVISION OR CORRECTIONS.

ANY REVIEW BY THE ENGINEER WILL NOT RELIEVE THE CONTRACTOR FOR RESPONSIBILITY FOR ERRORS OR OMISSIONS, INADEQUATE DESIGN PERFORMANCE REQUIREMENTS, SCHEDULE REQUIREMENTS. THE CONTRACTOR SHALL REMAIN SOLELY RESPONSIBLE FOR FULL AND COMPLETE PERFORMANCE IN ACCORDANCE WITH THE TERMS, CONDITIONS, PROVISIONS, DRAWINGS, AND SPECIFICATIONS.

INSPECTION AND TESTING:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ENSURING THAT ALL REQUIRED AND NECESSARY INSPECTIONS ARE PERFORMED BY AN INDEPENDENT AND AUTHORIZED INSPECTION AGENCY PRIOR TO PROCEEDING WITH SUBSEQUENT WORK WHICH COVERS OR IS DIRECTLY DEPENDENT ON THE WORK TO BE INSPECTED. FAILURE TO OBTAIN NECESSARY INSPECTION AND RELATED TESTING SHALL RESULT IN THE CONTRACTOR BEING FULLY RESPONSIBLE FOR PROBLEMS FROM UN-INSPECTED WORK. ALL INSPECTION REQUIREMENTS SHALL FOLLOW MPWSS GUIDELINES AND THE CURRENT UTILITY SOLUTIONS.

WATER:

NOTIFY THE CITY OF AMSTERDAM AND THE ENGINEER & GALLATIN COUNTY A MINIMUM OF 2 BUSINESS DAYS PRIOR TO CONSTRUCTION.

THE CONTRACTOR SHALL VERIFY LOCATIONS AND MATERIAL TYPES OF ALL UTILITIES PRIOR TO THE START OF CONSTRUCTION.

THE CONTRACTOR SHALL SUPPLY ALL NECESSARY FITTINGS, COUPLING, AND SPOOL PIECES FOR CONNECTING NEW UTILITIES TO EXISTING UTILITIES. THESE PLANS MAY NOT SHOW ALL REQUIRED COMPONENTS FOR MAKING THE CONNECTIONS.

THE MINIMUM DEPTH OF BURY TO THE TOP OF PIPE FOR WATER LINES IS 6.5 FT.

ANY EXISTING OR NEW VALVES THAT CONTROL THE CITY OF AMSTERDAM WATER SUPPLY SHALL BE OPERATED BY CITY STAFF PERSONNEL ONLY.

PRESSURE TEST AND DISINFECT ALL WATER LINES IN ACCORDANCE WITH MPWSS SPECIFICATIONS AND PROJECT SPECIFICATIONS.

SANITARY SEWER:

UNLESS OTHERWISE SPECIFIED, SANITARY SEWER PIPE SHALL BE PVC IN CONFORMANCE WITH ASTM D-3034, SDR 35.

THE CONTRACTOR SHALL VERIFY LOCATIONS AND MATERIAL TYPES OF ALL UTILITIES PRIOR TO THE START OF CONSTRUCTION.

ALL SERVICES AND CONNECTIONS SHALL CONFORM TO THE CURRENT GALLATIN COUNTY & MPWSS.

ALL PIPES SHALL BE BEDDED PER CURRENT CITY OF AMSTERDAM & MPWSS.

NO UTILITY TRENCHES SHALL BE LEFT OPEN OVERNIGHT. ALL SUCH TRENCHES SHALL BE CLOSED BEFORE THE END OF THE WORKDAY OR FENCED OFF IN A SECURE MANNER.

CONTRACTOR SHALL SUPPLY ALL MATERIALS, EQUIPMENT AND FACILITIES REQUIRED FOR TESTING ALL UTILITY PIPES IN ACCORDANCE WITH THE CURRENT CITY OF AMSTERDAM & MPWSS.

EROSION CONTROL NOTES:

CONTRACTOR SHALL OBTAIN ALL NECESSARY MPDES PERMITS AND SHALL MAINTAIN SAID PERMITS AS REQUIRED BY THE REGULATORY AGENCY. ANY HAUL/BORROW SITE SHALL BE INCLUDED IN THE MPDES PERMIT. NATIVE RE-SEEDING AT ALL DISTURBED AREAS.

CONTRACTOR SHALL BE RESPONSIBLE FOR ALL FEES, NOTIFICATION, MAINTENANCE, MONITORING AND RECORD KEEPING REQUIRED BY THE MPDES GENERAL PERMIT.

CONTRACTOR SHALL MAINTAIN AN INSPECTION AND MAINTENANCE PROGRAM FOR ALL EROSION CONTROL MEASURES. THE INSPECTIONS SHALL BE COMPLETED AT LEAST EVERY SEVEN (7) DAYS AND WITHIN 24 HOURS AFTER A STORM EVENT OF 0.5 INCHES OR MORE. THE MAINTENANCE PROGRAM SHALL REPAIR AND RESTORE ALL EROSION CONTROL MEASURE DEFICIENCIES. DOCUMENTATION OF THE INSPECTIONS, THE FINDINGS, AND CORRECTIVE ACTIONS SHALL BE MAINTAINED AT THE JOB SITE.

ESTABLISH EROSION CONTROL MEASURES AT THE BEGINNING OF CONSTRUCTION AND MAINTAIN DURING THE ENTIRE LENGTH OF CONSTRUCTION. AREAS WHICH ARE SUBJECT TO SEVERE EROSION AND OFF-SITE AREAS WHICH ARE ESPECIALLY VULNERABLE TO DAMAGE FROM EROSION AND/OR SEDIMENTATION ARE TO BE IDENTIFIED AND RECEIVE ADDITIONAL EROSION CONTROL MEASURES.

COORDINATE ALL LAND DISTURBING ACTIVITIES AND CONDUCT SO AS TO MINIMIZE THE SIZE OF THE AREA TO BE EXPOSED AT ANY ONE TIME AND MINIMIZE THE TIME OF EXPOSURE. COORDINATE ALL LAND DISTURBING ACTIVITIES SO AS TO MINIMIZE OFF-SITE SEDIMENTATION DAMAGE. MASS CLEARING AND GRADING OF THE ENTIRE SITE SHALL BE AVOIDED. RESTABILIZE DISTURBED AREAS AS SOON AS POSSIBLE AFTER CONSTRUCTION IS COMPLETED.

KEEP THE EROSION AND SEDIMENTATION PLAN AND ALL DISCHARGE MONITORING REPORTS ON-SITE FOR THE DURATION OF CONSTRUCTION AND ONE YEAR AFTER CONSTRUCTION COMPLETION.

NOTE TO CONTRACTOR -
CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS
-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA®

NOTES

SHEET
C002

TEMPORARY EROSION CONTROL

THIS STORMWATER POLLUTION PREVENTION PLAN IS PROVIDED IN ACCORDANCE WITH THE TERMS OF THE MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM (MPDES) PERMIT FOR CONSTRUCTION ACTIVITIES FOR THIS PROJECT. THE CONTRACTOR IS ADVISED THAT THE PROJECT AREA DRAINS TO WETLANDS AND/OR STATE WATERS AND THAT THE CONTRACTOR IS RESPONSIBLE TO PROTECT THE RECEIVING WATERS FROM DELETERIOUS EFFECTS OF CONSTRUCTION.

THE CONTRACTOR IS REQUIRED TO HAVE A COPY OF THE NPDES PERMIT(IF PROJECT DISTURBANCE IS GREATER THAN 1 ACRE) AS WELL AS THE SWPPP ON SITE AT ALL TIMES.

THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE EROSION CONTROL MEASURES SHOWN OR DESCRIBED IN THE CONTRACT DOCUMENTS AND ANY ADDITIONAL MEASURES THAT MAY BE REQUIRED BY THE CONTRACTORS MEANS AND METHODS OF CONSTRUCTION AS NEEDED TO CONTROL EROSION AND SEDIMENT AT THE CONSTRUCTION SITE AND TO PREVENT VIOLATION OF SURFACE WATER QUALITY, GROUND WATER QUALITY, OR SEDIMENT MANAGEMENT STANDARDS. EROSION CONTROL MEASURES SHALL BE MAINTAINED THROUGHOUT THE COURSE OF CONSTRUCTION AND UNTIL ALL DISTURBED EARTH IS STABILIZED IN FINISH GRADES.

THE FOLLOWING ITEMS ARE BEST MANAGEMENT PRACTICES (BMPS) WHICH MAY BE APPLIED TO COMPLY WITH THE SWPPP. REFER TO THESE PLANS FOR DRAWINGS OF THE PROJECT, SITE MAP, CONVEYANCE SYSTEMS, EROSION AND SEDIMENT CONTROL MEASURES, AND EROSION AND SEDIMENT CONTROL DETAILS.

PRESERVE VEGETATION/MARK CLEARING LIMITS
1. PRIOR TO BEGINNING LAND DISTURBING ACTIVITIES, INCLUDING CLEARING AND GRADING, CLEARLY MARK ALL CLEARING LIMITS AND TREES THAT ARE TO BE PRESERVED WITHIN THE CONSTRUCTION AREA AS SHOWN ON THE DRAWINGS.
2. SILT FENCE, GEOTEXTILE ENCASED BARRIERS, CONSTRUCTION FENCE, ORANGE PLASTIC FENCE, OR OTHER APPROVED MEASURES MAY BE USED TO MARK THE CLEARING LIMITS.
3. THE DUFF LAYER, NATIVE TOPSOIL, AND NATURAL VEGETATION SHALL BE RETAINED IN AN UNDISTURBED STATE TO THE MAXIMUM DEGREE PRACTICABLE.

ESTABLISH CONSTRUCTION ACCESS
1. WHEN POSSIBLE, LIMIT CONSTRUCTION VEHICLE ACCESS AND EXIT TO ONE ROUTE.
2. ALL ACCESS/EXIT POINTS SHALL BE STABILIZED WITH QUARRY SPALLS, CRUSHED ROCK OR OTHER EQUIVALENT BMP, TO MINIMIZE THE TRACKING OF SEDIMENT ONTO PUBLIC ROADS.
3. WHEEL WASH OR TIRE BATHS SHALL BE LOCATED ON SITE, IF THE STABILIZED CONSTRUCTION ENTRANCE IS NOT EFFECTIVE IN PREVENTING SEDIMENT FROM BEING TRACKED ONTO PUBLIC ROADS.
4. IF SEDIMENT IS TRACKED OFF SITE, PUBLIC ROADS SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY, OR MORE FREQUENTLY DURING WET WEATHER. SEDIMENT SHALL BE REMOVED FROM ROADS BY SHOVELING OR PICKUP SWEEPING AND SHALL BE TRANSPORTED TO A CONTROLLED SEDIMENT DISPOSAL AREA.
5. STREET WASHING IS ALLOWED ONLY AFTER SEDIMENT IS REMOVED AS DESCRIBED ABOVE. STREET WASH WASTEWATER SHALL BE CONTROLLED BY PUMPING BACK ON SITE OR OTHERWISE BE PREVENTED FROM FROM DISCHARGING INTO SYSTEMS TRIBUTARY TO WATERS OF THE STATE.

CONTROL FLOW RATES
1. PROPERTIES AND WATERWAYS DOWNSTREAM FROM DEVELOPMENT SITES SHALL BE PROTECTED FROM EROSION DUE TO INCREASES IN THE VELOCITY AND PEAK VOLUMETRIC FLOW RATE OF STORMWATER RUNOFF FROM THE PROJECT SITE, AS REQUIRED BY LOCAL PLAN APPROVAL AUTHORITY.
2. WHERE NECESSARY TO COMPLY WITH #1, STORMWATER RETENTION OR DETENTION FACILITIES SHALL BE CONSTRUCTED AS ONE OF THE FIRST STEPS IN GRADING. DETENTION FACILITIES SHALL BE FUNCTIONAL PRIOR TO CONSTRUCTION OF SITE IMPROVEMENTS (e.g. IMPERVIOUS SURFACES).
3. IF PERMANENT INFILTRATION PONDS ARE USED FOR FLOW CONTROL DURING CONSTRUCTION, THESE FACILITIES SHALL BE PROTECTED FROM SILTATION DURING THE CONSTRUCTION PHASE.

INSTALL SEDIMENT CONTROLS
1. STORMWATER RUNOFF FROM DISTURBED AREAS SHALL PASS THROUGH A SEDIMENT POND OR OTHER APPROPRIATE SEDIMENT REMOVAL BMP, PRIOR TO LEAVING THE CONSTRUCTION SITE OR PRIOR TO DISCHARGE TO AN INFILTRATION FACILITY. RUNOFF FROM FULLY STABILIZED AREAS MAY BE DISCHARGED WITHOUT A SEDIMENT REMOVAL BMP, BUT SHALL MEET FLOW CONTROL PERFORMANCE AS STATED IN THE CONTROL FLOW RATES SECTION. THE PONDS SHALL BE MAINTAINED AT A LEVEL THAT PREVENTS TURBID RUNOFF FROM LEAVING THE SITE AT ALL TIMES. IN THE EVENT THE PONDS APPROACH CAPACITY THE TURBID RUNOFF MAY BE DISPERSED ON SITE (TO A PREDETERMINED AND DESIGNATED LOCATION). IF DISPERSION IS NOT PRACTICAL DUE TO SITE CONDITIONS, THE TURBID RUNOFF SHALL BE PUMPED AND TRUCKED OFF SITE TO A PREDETERMINED AND DESIGNATED LOCATION.
2. SEDIMENT CONTROL BMPs (SEDIMENT PONDS, TRAPS, FILTERS, ETC.) SHALL BE CONSTRUCTED AS ONE OF THE FIRST STEPS IN GRADING. THESE BMPs SHALL BE FUNCTIONAL BEFORE OTHER LAND DISTURBING ACTIVITIES TAKE PLACE.

STABILIZE SOILS
1. EXPOSED AND UNWORKED SOILS SHALL BE STABILIZED BY APPLICATION OF EFFECTIVE BMPs THAT PREVENT EROSION. APPLICABLE BMPs INCLUDE, BUT ARE NOT LIMITED TO: TEMPORARY AND PERMANENT SEEDING, SODDING, MULCHING, PLASTIC COVERING, EROSION CONTROL FABRICS AND MATTING, SOIL APPLICATION OF POLYACRYLAMIDE (PAM), THE EARLY APPLICATION OF GRAVEL BASE ON AREAS TO BE PAVED AND DUST CONTROL.
2. NO SOILS SHALL REMAIN EXPOSED AND UNWORKED FOR MORE THAN THE TIME PERIODS SET FORTH BELOW TO PREVENT EROSION:
   DURING THE WET SEASON (OCTOBER 1 - APRIL 30): 2 DAYS
   DURING THE DRY SEASON (MAY 1 - SEPT. 30): 7 DAYS
3. SOILS SHALL BE STABILIZED AT THE END OF THE SHIFT BEFORE A HOLIDAY OR WEEKEND IF NEEDED BASED ON THE WEATHER FORECAST.
4. SOIL STOCKPILES SHALL BE STABILIZED FROM EROSION, PROTECTED WITH SEDIMENT TRAPPING MEASURES, AND WHERE POSSIBLE, BE LOCATED AWAY FROM STORM DRAIN INLETS, WATERWAYS, AND DRAINAGE CHANNELS.
5. HYDROSEED AS SOON AS PRACTICAL ALL DISTURBED AREAS NOT INDICATED IN THE CONTRACT DOCUMENTS FOR OTHER PERMANENT STABILIZATION MEASURES.
6. REMOVE ALL TEMPORARY EROSION SEDIMENT CONTROL (TESC) MEASURES AS SOON AS PRACTICAL AFTER ESTABLISHMENT OF UNIFORM GRASS GROWTH OR INSTALLATION OF OTHER PERMANENT STABILIZATION MEASURES. REPAIR ANY DAMAGE TO STABILIZED SURFACES AFTER REMOVAL OF TESC MEASURES.

PROTECT SLOPES
1. DESIGN, CONSTRUCT, AND PHASE CUT AND FILL SLOPES IN A MANNER THAT WILL MINIMIZE EROSION. APPLICABLE PRACTICES INCLUDE, BUT ARE NOT LIMITED TO, REDUCING CONTINUOUS LENGTH OF SLOPE WITH TERRACING AND DIVERSIONS, REDUCING SLOPE STEEPNESS, AND ROUGHENING SLOPE SURFACES (e.g., TRACK WALKING).
2. OFF-SITE STORMWATER (RUN-ON) OR GROUNDWATER SHALL BE DIVERTED AWAY FROM SLOPES AND DISTURBED AREAS WITH INTERCEPTOR DIKES, PIPES, AND/OR SWALES. OFF-SITE STORMWATER SHOULD BE MANAGED SEPARATELY FROM STORMWATER GENERATED ON THE SITE.
3. DO NOT CLEAR AND GRUB SLOPES GREATER THAN 4(HORIZONTAL):1(VERTICAL) UNLESS FURTHER WORK RESULTING IN STABILIZATION OF THE SLOPES TO BE CLEARED AND GRUBBED IS SCHEDULED FOR LESS THAN ONE WEEK FROM COMPLETION OF CLEARING AND GRUBBING OR OTHER TEMPORARY STABILIZATION MEASURES ARE PUT IN PLACE.
4. EXCAVATED MATERIAL SHALL BE PLACED ON THE UPHILL SIDE OF TRENCHES, CONSISTENT WITH SAFETY AND SPACE CONSIDERATIONS.
5. CHECK DAMS SHALL BE PLACED AT REGULAR INTERVALS WITHIN CONSTRUCTED CHANNELS THAT ARE CUT DOWN A SLOPE.

PROTECT DRAIN INLETS
1. ALL STORM DRAIN INLETS MADE OPERABLE DURING CONSTRUCTION AND ALL INLETS WITHIN 200' DOWNSTREAM OF THE PROJECT SITE SHALL BE PROTECTED WITH CATCH BASIN FILTERS SO THAT STORMWATER RUNOFF DOES NOT ENTER THE CONVEYANCE SYSTEM WITHOUT FIRST BEING FILTERED OR TREATED TO REMOVE SEDIMENT. CATCH BASIN FILTERS IN THE ROADWAY WILL BE OIL/SEDIMENT FILTERS AND CATCH BASIN FILTERS OUTSIDE OF THE ROADWAY WILL BE SEDIMENT FILTERS.
2. APPROACH ROADS SHALL BE KEPT CLEAN. SEDIMENT AND STREET WASH WATER SHALL NOT BE ALLOWED TO ENTER STORM DRAINS WITHOUT PRIOR AND ADEQUATE TREATMENT.
3. INLET PROTECTION DEVICES SHOULD BE CLEANED OR REMOVED AND REPLACED WHEN SEDIMENT HAS FILLED ONE-THIRD OF THE AVAILABLE STORAGE.

STABILIZE CHANNELS AND OUTLETS
1. TEMPORARY ON-SITE CONVEYANCE CHANNELS REQUIRED BY THE CONTRACTOR'S MEANS AND METHODS SHALL BE DESIGNED, CONSTRUCTED, AND STABILIZED TO HANDLE THE PEAK 10 MINUTE VELOCITY OF FLOW FROM A 10-YEAR, 24-HOUR FREQUENCY STORM FOR THE DEVELOPED CONDITION. IN LIEU OF DESIGN, THE CONTRACTOR MAY ELECT TO LINE TEMPORARY CHANNELS WITH EROSION CONTROL MAT AT CONTRACTOR'S EXPENSE.
2. STABILIZATION, INCLUDING ARMORING MATERIAL, ADEQUATE TO PREVENT EROSION OF OUTLETS, ADJACENT STREAM BANKS, SLOPES, AND DOWNSTREAM REACHES SHALL BE PROVIDED AT THE OUTLETS OF ALL CONVEYANCE SYSTEMS.

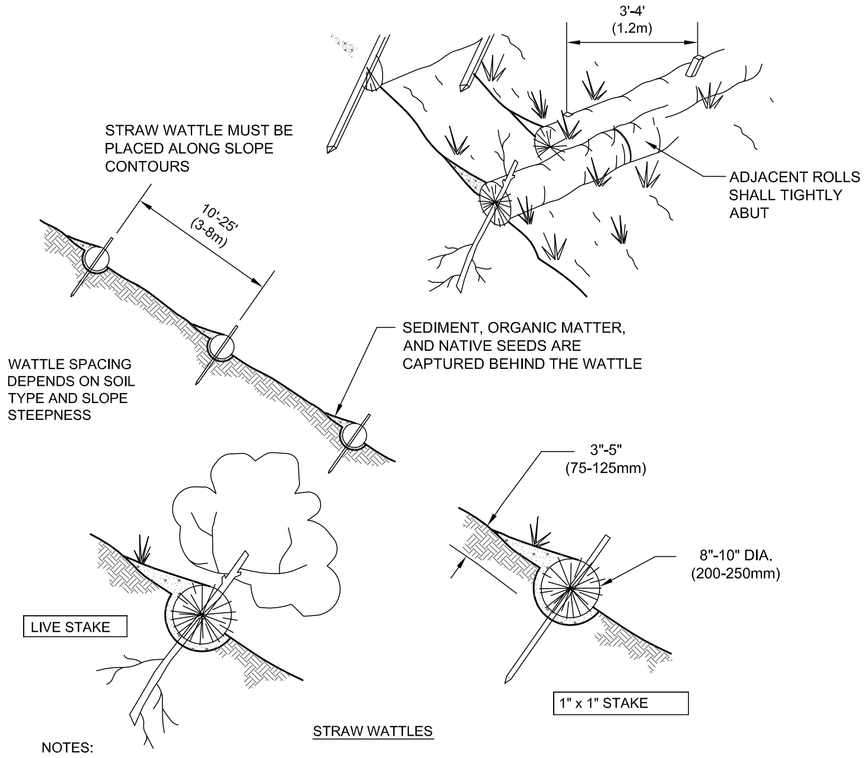
CONTROL POLLUTANTS
1. ALL POLLUTANTS, INCLUDING WASTE MATERIALS AND DEMOLITION DEBRIS, THAT OCCUR ONSET SHALL BE HANDLED AND DISPOSED OF IN A MANNER THAT DOES NOT CAUSE CONTAMINATION OF STORMWATER.
2. COVER, CONTAINMENT, AND PROTECTION FROM VANDALISM SHALL BE PROVIDED FOR ALL CHEMICALS, LIQUID PRODUCTS, PETROLEUM PRODUCTS, AND OTHER MATERIALS THAT HAVE THE POTENTIAL TO POSE A THREAT TO HUMAN HEALTH OR THE ENVIRONMENT. ON-SITE FUELING TANKS SHALL INCLUDE SECONDARY CONTAINMENT.
3. MAINTENANCE, FUELING, AND REPAIR OF HEAVY EQUIPMENT AND VEHICLES SHALL BE CONDUCTED USING SPILL PREVENTION AND CONTROL MEASURES. CONTAMINATED SURFACES SHALL BE CLEANED IMMEDIATELY FOLLOWING ANY SPILL INCIDENT.
4. WHEEL WASH OR TIRE BATH WASTEWATER SHALL BE DISCHARGED TO A SEPARATE ON-SITE TREATMENT SYSTEM OR TO THE SANITARY SEWER WITH LOCAL SEWER DISTRICT APPROVAL.
5. APPLICATION OF FERTILIZERS AND PESTICIDES, SHALL BE CONDUCTED IN A MANNER AND AT APPLICATION RATES THAT WILL NOT RESULT IN LOSS OF CHEMICAL TO STORMWATER RUNOFF. MANUFACTURERS' LABEL REQUIREMENTS FOR APPLICATION RATES AND PROCEDURES SHALL BE FOLLOWED.
6. BMPs SHALL BE USED TO PREVENT OR TREAT CONTAMINATION OF STORMWATER RUNOFF BY pH MODIFYING SOURCES. THESE SOURCES INCLUDE, BUT ARE NOT LIMITED TO: BULK CEMENT, CEMENT KILN DUST, FLY ASH, NEW CONCRETE WASHING AND CURING WATERS, WASTE STREAMS GENERATED FROM CONCRETE GRINDING AND SAWING, EXPOSED AGGREGATE PROCESSES, DENATURING CONCRETE VAULTS, CONCRETE PUMPING AND MIXER WASHOUT WATERS. PERMITTEES SHALL ADJUST THE pH OF STORMWATER IF NECESSARY TO PREVENT VIOLATIONS OF WATER QUALITY STANDARDS.
7. PERMITTEES SHALL OBTAIN WRITTEN APPROVAL FROM ECOLOGY PRIOR TO USING CHEMICAL TREATMENT, OTHER THAN CARBON DIOXIDE OR DRY ICE TO ADJUST pH.

CONTROL DEWATERING
1. FOUNDATION, VAULT, AND TRENCH DE-WATERING WATER, WHICH HAVE SIMILAR CHARACTERISTICS TO STORMWATER RUNOFF AT THE SITE, SHALL BE DISCHARGED INTO A CONTROLLED CONVEYANCE SYSTEM PRIOR TO DISCHARGE TO A SEDIMENT TRAP OR SEDIMENT POND.
2. CLEAN, NON-TURBID DE-WATERING WATER, SUCH AS WELL-POINT GROUND WATER, CAN BE DISCHARGED TO SYSTEMS TRIBUTARY TO, OR DIRECTLY INTO SURFACE WATERS OF THE STATE, AS SPECIFIED IN THE STABILIZE CHANNELS AND OUTLETS SECTION, PROVIDED THE DE-WATERING FLOW DOES NOT CAUSE EROSION OR FLOODING OF RECEIVING WATERS. CLEAN DE-WATERING WATER SHOULD NOT BE ROUTED THROUGH STORMWATER SEDIMENT PONDS.
3. OTHER DE-WATERING DISPOSAL OPTIONS MAY INCLUDE:
   a) INFILTRATION.
   b) USE OF A SEDIMENTATION BAG (DIRTBAG OR APPROVED EQUAL) WITH OUTFALL TO A DITCH OR SWALE FOR SMALL VOLUMES OF LOCALIZED DE-WATERING.
   c) TRANSPORT OFF SITE IN A VEHICLE, SUCH AS A VACUUM FLUSH TRUCK, FOR LEGAL DISPOSAL IN A MANNER THAT DOES NOT POLLUTE STATE WATERS.
   d) ECOLOGY APPROVED ON-SITE CHEMICAL TREATMENT OR OTHER SUITABLE TREATMENT TECHNOLOGIES.
   e) SANITARY SEWER DISCHARGE WITH LOCAL SEWER DISTRICT APPROVAL, IF THERE IS NO OTHER OPTION.
4. CHECK PROJECT SPECIFICATIONS AND GEOTECHNICAL REPORT FOR ADDITIONAL REQUIREMENTS.

MAINTAIN BMPs
1. INSPECT EROSION CONTROL DEVICES ON A WEEKLY BASIS AND AFTER EACH RUNOFF EVENT. MAKE NECESSARY REPAIRS AND MAINTENANCE TO ENSURE CONTINUED PERFORMANCE OF EROSION AND SEDIMENT CONTROLS.
2. WHEN SEDIMENT ACCUMULATION IN SEDIMENTATION STRUCTURES, OTHER THAN INLET PROTECTION DEVICES, HAS REACHED A POINT ONE-THIRD DEPTH OF SEDIMENT STRUCTURE OR DEVICE, OR IF FLOW THROUGH THE DEVICE IS REDUCED BY MORE THAN ONE-THIRD CAPACITY, THE CONTRACTOR SHALL REMOVE AND REPLACE DISPOSABLE DEVICES OR CLEAN AND DISPOSE OF SEDIMENT.
3. TEMPORARY EROSION AND SEDIMENT CONTROL BMPs SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY BMPs ARE NO LONGER NEEDED. TRAPPED SEDIMENT SHALL BE REMOVED OR STABILIZED ON SITE. DISTURBED SOILS SHALL BE PERMANENTLY STABILIZED.

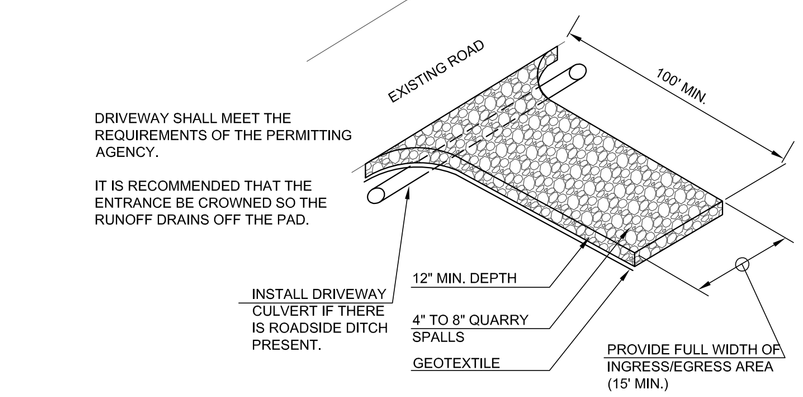
MANAGE THE PROJECT
1. PHASING OF CONSTRUCTION
   a) MINIMIZE DISTURBANCE AND COMPACTION OF NATIVE SOILS EXCEPT AS NECESSARY FOR THE CURRENT PHASE OF WORK.
   b) STABILIZE AREAS IMMEDIATELY AFTER WORK HAS BEEN FINISHED FOR THAT PHASE.
2. COORDINATE WITH OTHER CONTRACTORS.
3. INSPECTION AND MONITORING:
   a) A CERTIFIED PROFESSIONAL IN EROSION AND SEDIMENT CONTROL (AS REQUIRED BY THE NPDES) SHALL BE IDENTIFIED AT THE PRE- CONSTRUCTION MEETING AND SHALL BE ON-SITE OR ON-CALL AT ALL TIMES. EMERGENCY CONTACT INFORMATION SHALL BE KEPT ON-SITE. CERTIFICATION MAY BE THROUGH ANY EQUIVALENT LOCAL OR NATIONAL CERTIFICATION AND/OR TRAINING PROGRAM.
   b) IF INSPECTION AND/OR WATER MONITORING OF SITE RUNOFF REVEALS THAT THE BMPs IDENTIFIED IN THE CONSTRUCTION SWPPP ARE INADEQUATE, THE CONTRACTOR SHALL IMMEDIATELY ADD BMPs TO THE SWPPP AS NECESSARY.
4. THE CONSTRUCTION SWPPP SHALL BE RETAINED ON-SITE. THE CONTRACTOR'S TESC RECORD OF RAINFALL, TESC MEASURES, AND INSPECTION SHALL BECOME PART OF THE SWPPP. THE CONSTRUCTION SWPPP SHALL BE MODIFIED BY THE CONTRACTOR'S TESC RECORD WHENEVER THERE IS A SIGNIFICANT CHANGE IN THE DESIGN, CONSTRUCTION, OPERATION, OR MAINTENANCE OF ANY BMP.

NOTE: COVERAGE UNDER THE GENERAL PERMIT IS REQUIRED FOR PROJECTS DISTURBING ONE OR MORE ACRES. THE DISTURBANCE FOR THIS PROJECT EQUALS 30,000 SF ±, WHICH IS LESS THAN THE 43,560 SF MINIMUM.

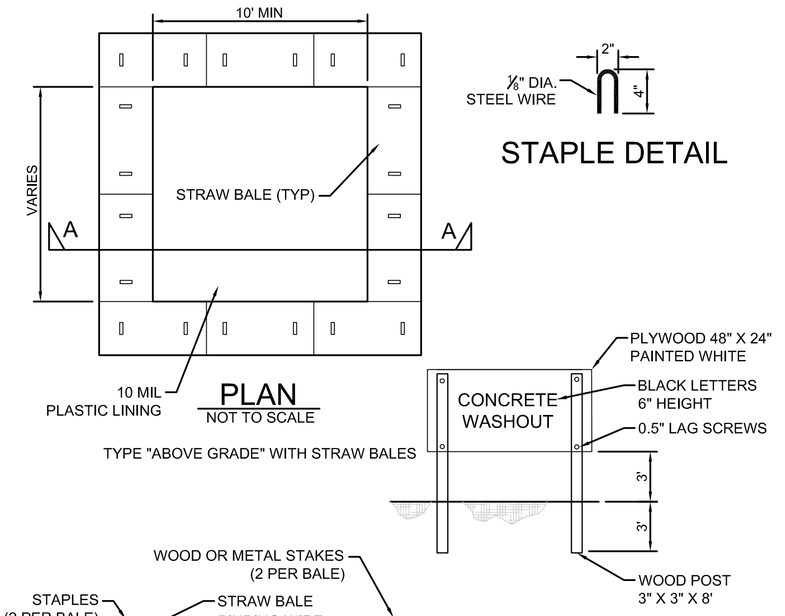


NOTES:
1. STRAW WATTLE INSTALLATION REQUIRES THE PLACEMENT AND SECURE STAKING OF THE ROLL IN A TRENCH, 3" x 5" (75-125mm) DEEP, DUG ON CONTOUR. RUNOFF MUST NOT BE ALLOWED TO RUN UNDER OR AROUND ROLL.

1 / C004 — FIBER ROLL INSTALLATION — NOT TO SCALE

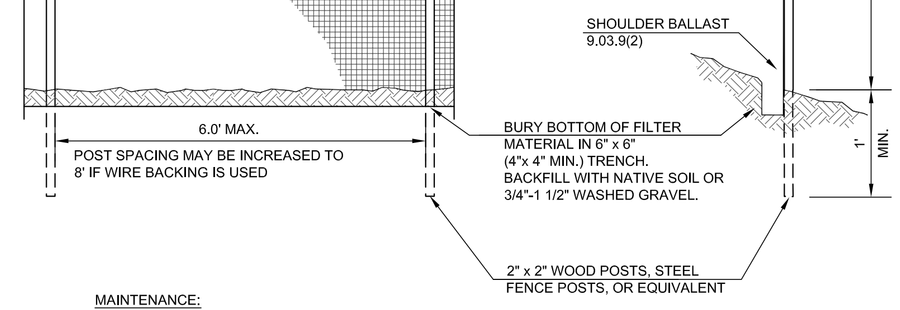


3 / C004 — STABILIZED CONSTRUCTION ENTRANCE — NOT TO SCALE



NOTES
1. ACTUAL LAYOUT DETERMINED IN FIELD
2. THE CONCRETE WASHOUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

2 / C004 — CONCRETE WASHOUT — NOT TO SCALE



MAINTENANCE:

INSPECT IMMEDIATELY AFTER EACH RAINFALL, AND AT LEAST DAILY DURING PROLONGED RAINFALL SEDIMENT MUST BE REMOVED WHEN IT REACHES APPROXIMATELY ONE THIRD THE HEIGHT OF THE FENCE. ANY SEDIMENT DEPOSITS REMAINING IN PLACE AFTER THE FILTER FENCE IS NO LONGER REQUIRED SHALL BE DRESSED TO CONFORM WITH THE EXISTING GRADE, PREPARED AND SEEDED.

4 / C004 — SILT FENCE — NOT TO SCALE

NOTE: THIS STORMWATER POLLUTION PREVENT PLAN IS A DOCUMENT WHICH MUST BE CONTINUALLY UPDATED AND REVISED TO ADDRESS THE CHANGING SITE CONDITIONS AND AS REQUIRED BY THE MPDES.

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

REVISIONS

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

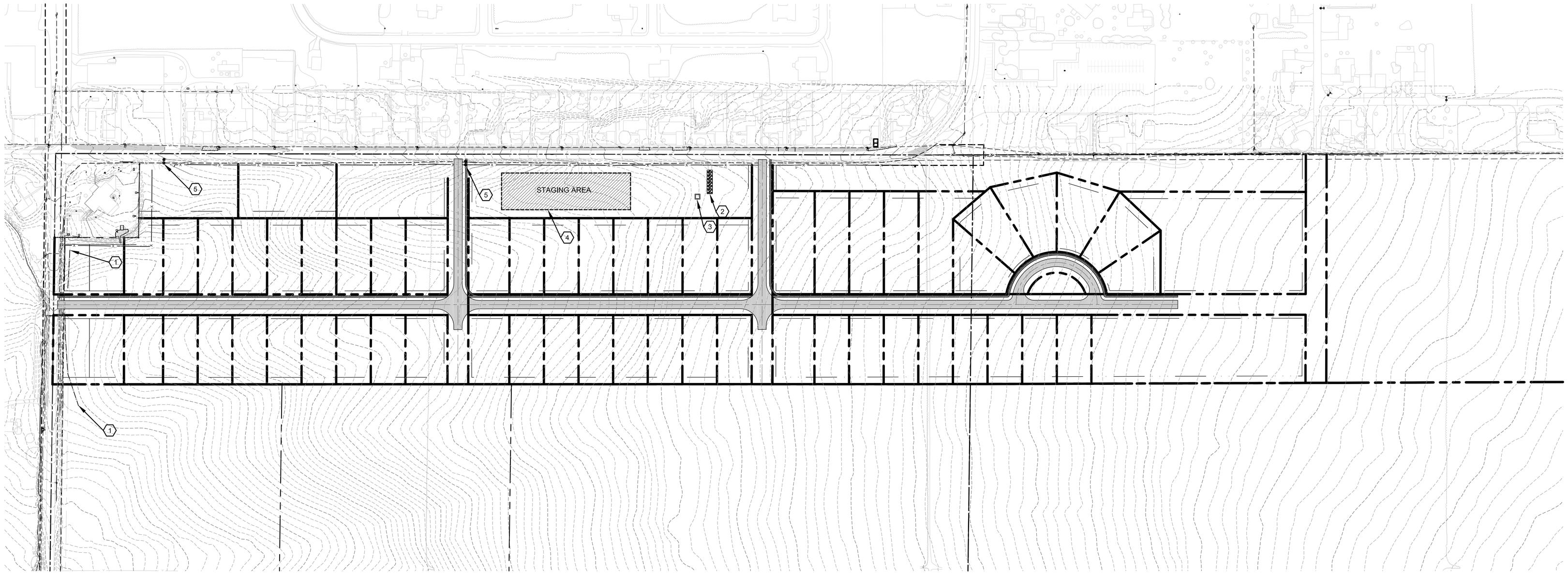
CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

TEMPORARY EROSION CONTROL NOTES & DETAILS

SHEET
C004

celines 12/01/14 8:17am — H:\AMSVILLITE\Civil\AMTEC004.dwg



NORTH

1 / C005 TEMPORARY EROSION CONTROL PLAN

SCALE: 1" = 150'

0 75' 150' 300'

LEGEND:

SF SF SILT FENCE

FIBER ROLL

KEY NOTES:

1. INSTALL SILT FENCE. SEE DETAIL 4/C004.
2. INSTALL TEMPORARY CONSTRUCTION ENTRANCE. SEE DETAIL 3/C004.
3. INSTALL CONCRETE WASHOUT. SEE DETAIL 2/C004.
4. CONSTRUCT STAGING AREA.
5. INSTALL 6" FIBER ROLL. SEE DETAIL 1/C004.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

CONSTRUCTION DOCUMENTS

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION

GALLATIN COUNTY, MONTANA

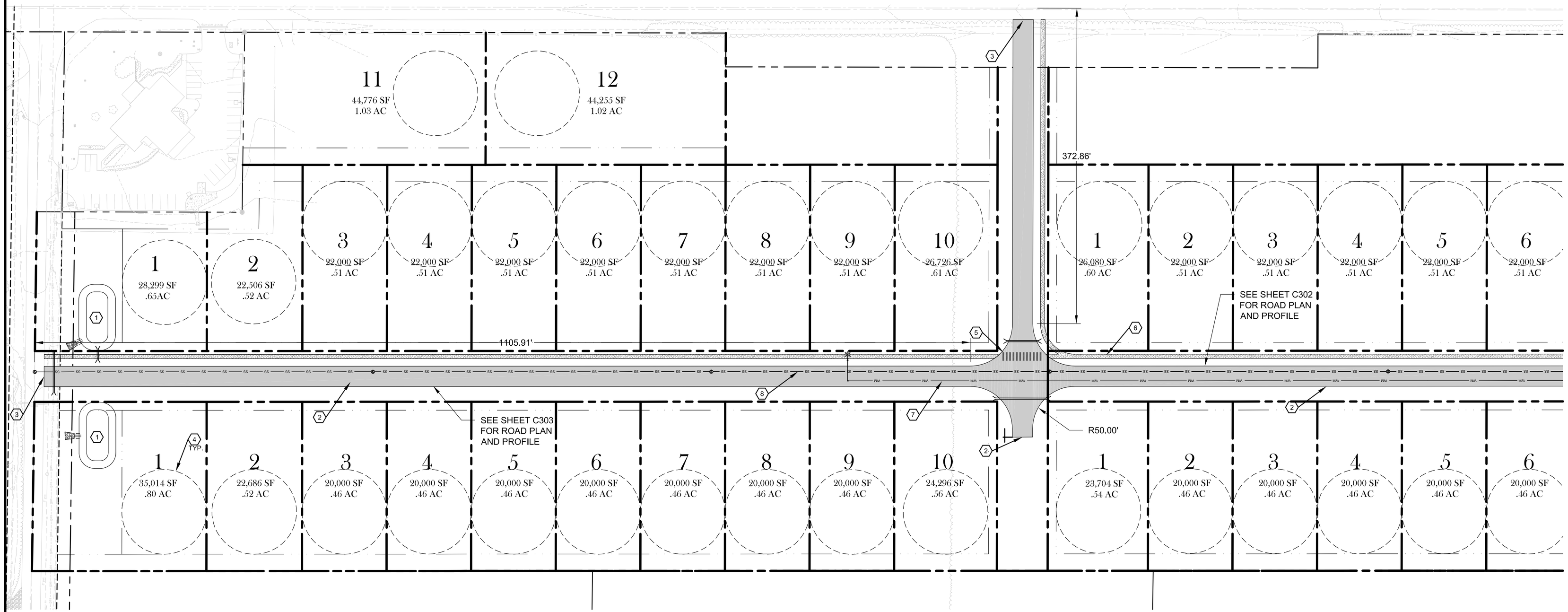
DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

TEMPORARY EROSION CONTROL PLAN

NOTE TO CONTRACTOR -
CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

SHEET
C005

celines 12/02/14 9:41am – H:\AMSVILLITE\Civil\AMTEC005.dwg



NORTH

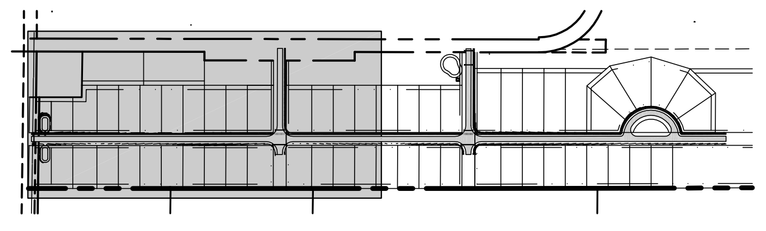
1 / C100 SITE PLAN

SCALE: 1" = 60'

0 30' 60' 120'

KEY NOTES:

1. NEW STORM DETENTION PONDS. SEE SHEET 200
2. NEW 24' WIDE ASPHALT ROAD AND HAMMERHEAD TURNAROUND. SEE DETAIL 3/C401 FOR ROAD CROSS SECTION.
3. CONNECT TO EXISTING ROADWAY, TYPICAL PER GALLATIN COUNTY STANDARDS.
4. NEW WELL 100' DIAMETER COVERAGE AREA, SEE 2/C401..
5. NEW CROSS WALK STRIPING.
6. NEW 5' GRAVEL PATH, SEE DETAIL 4/C401.
7. NEW 6" AWWA C900 PVC WATER LINE.
8. NEW 8" PVC SANITARY SEWER LINE.



KEY MAP

NOTE TO CONTRACTOR -
CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION

GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA®

SITE PLAN

SHEET
C100

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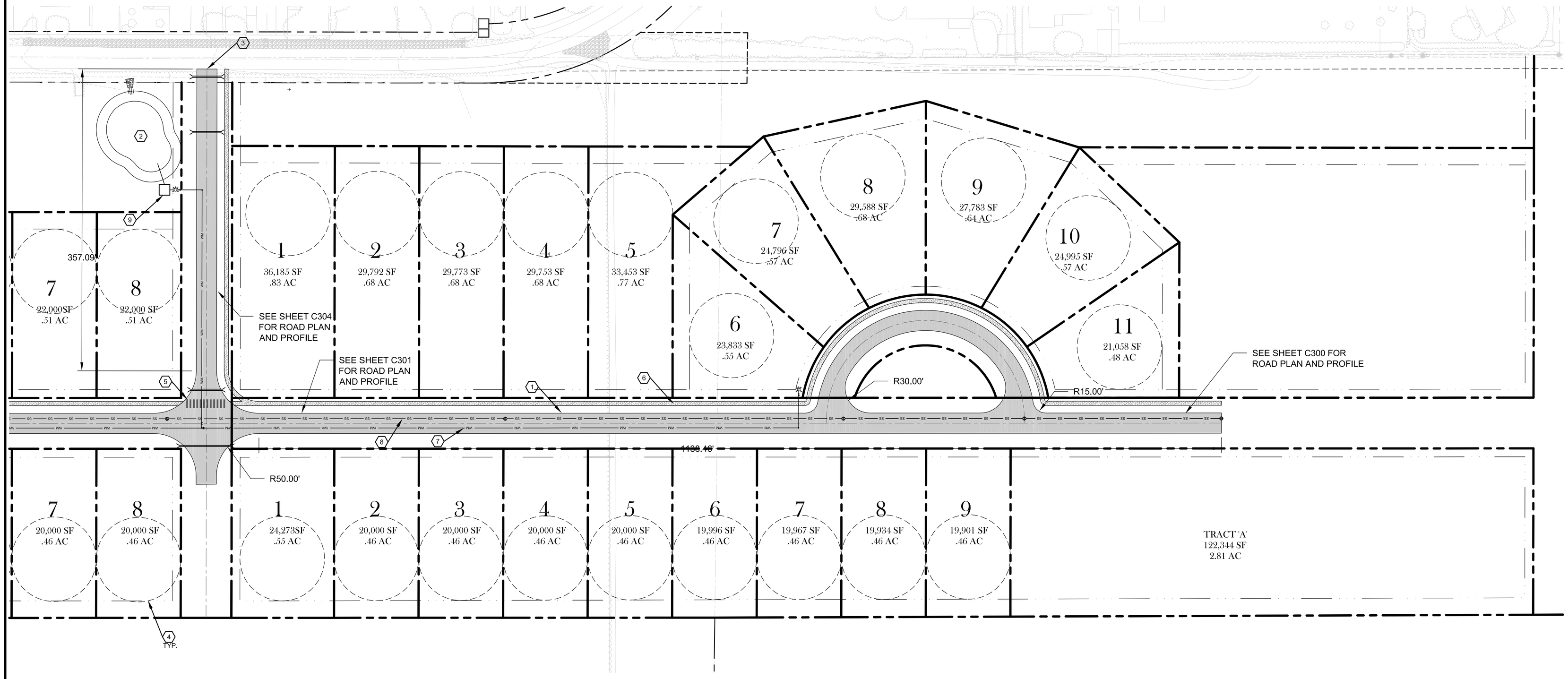


NORTH

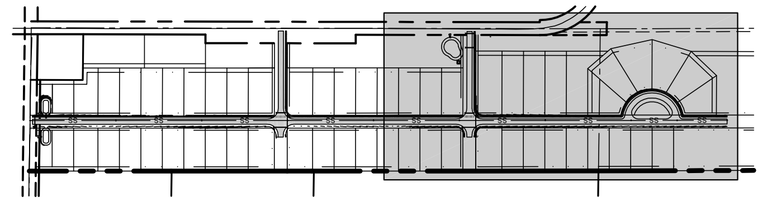
1 / C101 SITE PLAN

SCALE: 1" = 200'

0 100' 200' 400'

KEY NOTES:

1. NEW 24' WIDE ASPHALT ROAD AND HAMMERHEAD TURNAROUND. SEE DETAIL 3/C401 FOR ROAD CROSS SECTION.
2. NEW FIRE POND. SEE SHEET 201 AND DETAIL 1/C401.
3. CONNECT TO EXISTING ROADWAY, TYPICAL PER GALLATIN COUNTY.
4. NEW WELL 100' DIAMETER COVERAGE AREA, SEE 2/C401.
5. NEW CROSS WALK STRIPING.
6. NEW 5' GRAVEL PATH, SEE 4/C401.
7. NEW 6" AWWA C900 PVC WATER LINE.
8. NEW 8" PVC SANITARY SEWER LINE.
9. NEW FIRE POND PUMP AND PUMP HOUSE, SEE 1/C401.



KEY MAP

NOTE TO CONTRACTOR -
CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS
-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA

SITE PLAN

SHEET
C101

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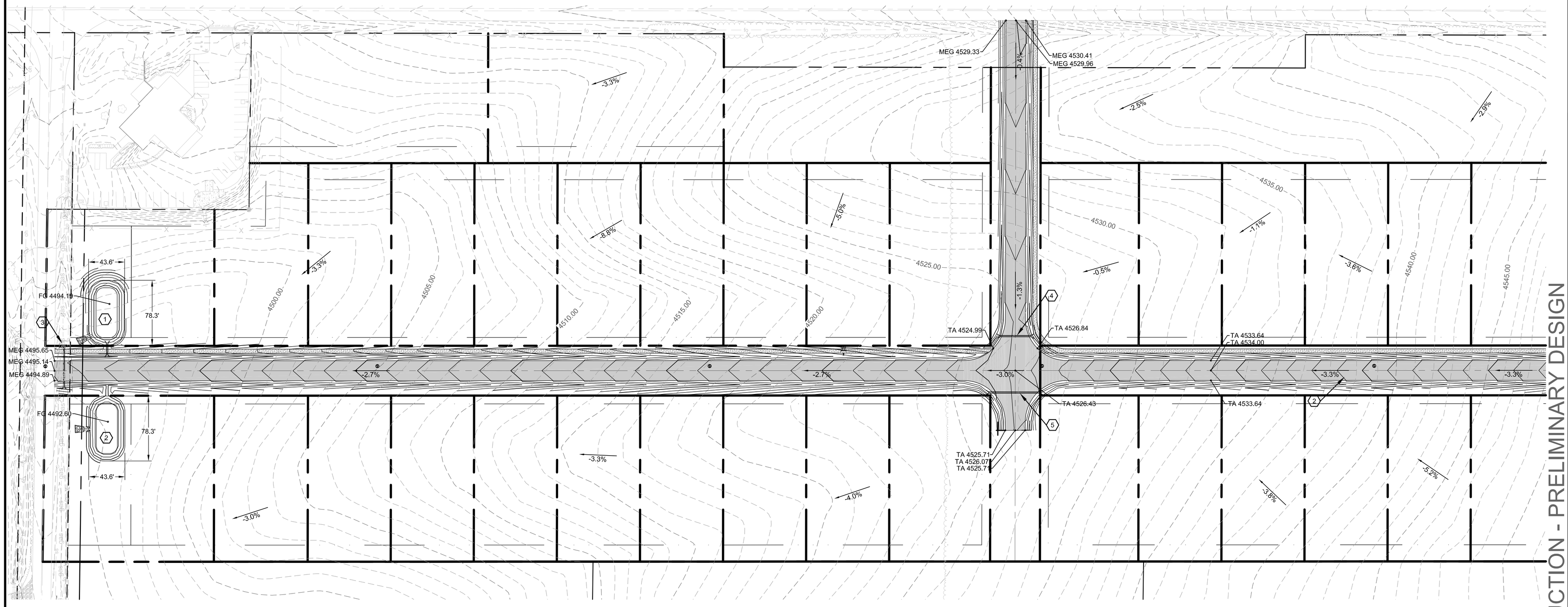


KEY NOTES

1. CONSTRUCT DETENTION POND WITH 3:1 SIDE SLOPES. POND DEPTH = 3'. POND VOLUME = 6,690 CUBIC FT. BOTTOM OF POND: 4494.19'. SEE DETAIL 2/C200.
2. CONSTRUCT DETENTION POND WITH 3:1 SIDE SLOPES. POND DEPTH = 3'. POND VOLUME = 6,690 CUBIC FT. BOTTOM OF POND: 4492.60'. SEE DETAIL 3/C200.
3. NEW 54LF 18" CULVERT AT 3.3% SLOPE. INVERT IN: 4494.64', INVERT OUT: 4492.88'.
4. NEW 44LF 18" CULVERT AT 2.7% SLOPE. INVERT IN: 4524.6', INVERT OUT: 4523.4".
5. NEW 68LF 18" CULVERT AT 3.1% SLOPE. INVERT IN: 4525.35', INVERT OUT: 4523.21".
6. NEW 21.5 LF 18" CULVERT AT 1.5% SLOPE. INVERT IN: 4494.66', INVERT OUT: 4494.34'.

DRAINAGE AND GRADING LEGEND

TC 100	PROPOSED 'TOP OF CONCRETE' ELEV.
TBC 100	PROPOSED 'TOP BACK OF CURB' ELEV.
FL 100	PROPOSED 'FLOW LINE' ELEV.
TA 100	PROPOSED 'ASPHALT' ELEV.
FG 100	PROPOSED 'FINISHED GRADE' ELEV.
MEG 100	PROPOSED 'MATCH EXISTING GRADE' ELEV.
-0.3%	PROPOSED SLOPE
	PROPOSED CONTOUR
	EXISTING CONTOUR

GRADING NOTES:

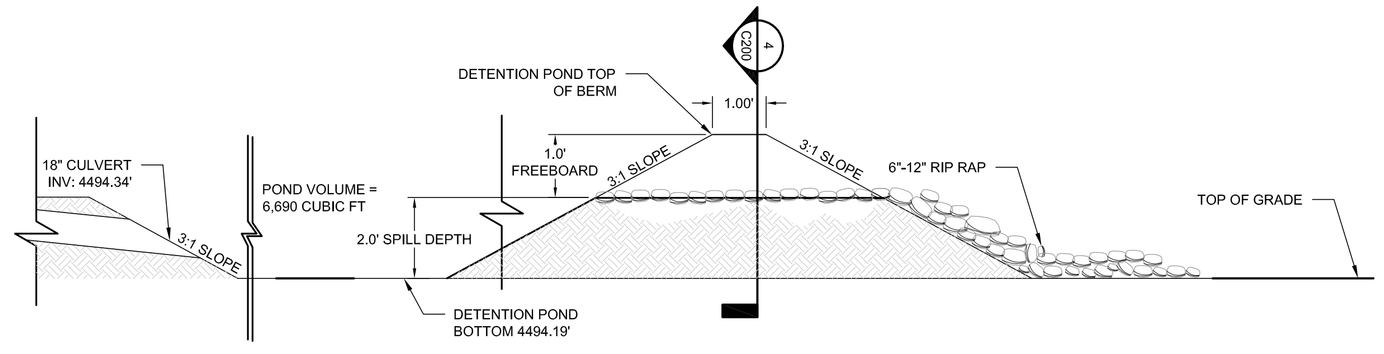
1. EXISTING AND PROPOSED CONTOURS ARE FOR REFERENCE ONLY.
2. FINISHED GRADES SHOULD BE ESTABLISHED THROUGH SPOT GRADES.

NORTH

1 / C200 GRADING AND DRAINAGE PLAN

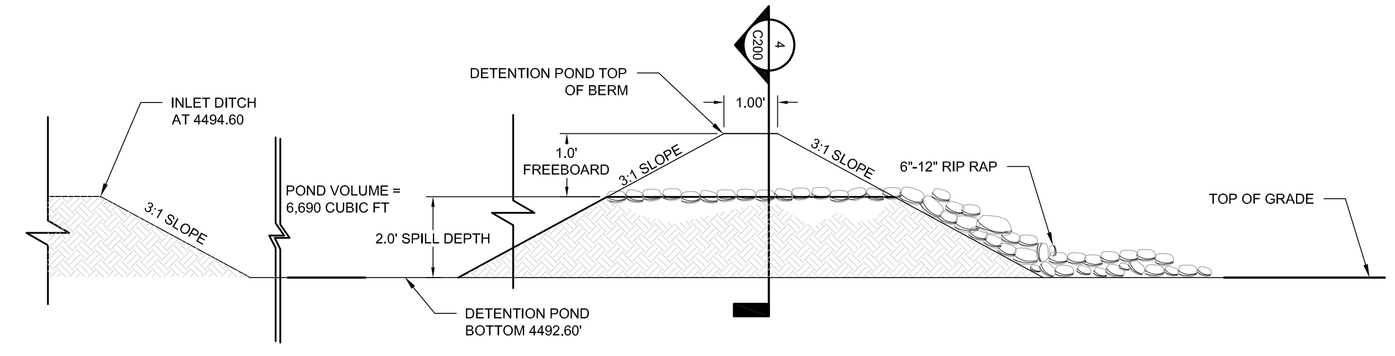
SCALE: 1" = 60'

0 30' 60' 120'



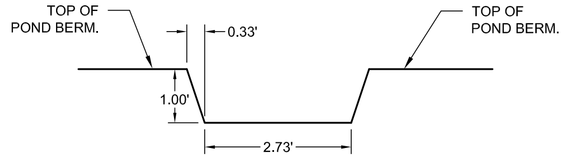
2 / C200 3' DEEP DETENTION POND

NOT TO SCALE



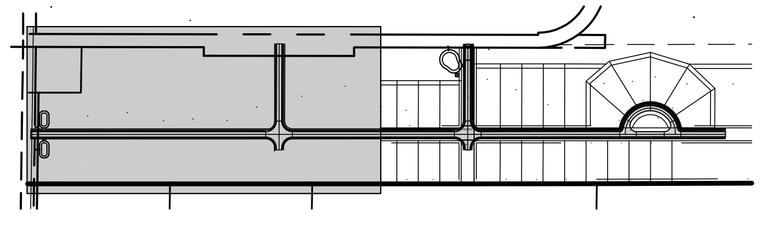
3 / C200 3' DEEP DETENTION POND

NOT TO SCALE



4 / C200 WEIR CUT-OUT

SCALE: 1" = 2'



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION

GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

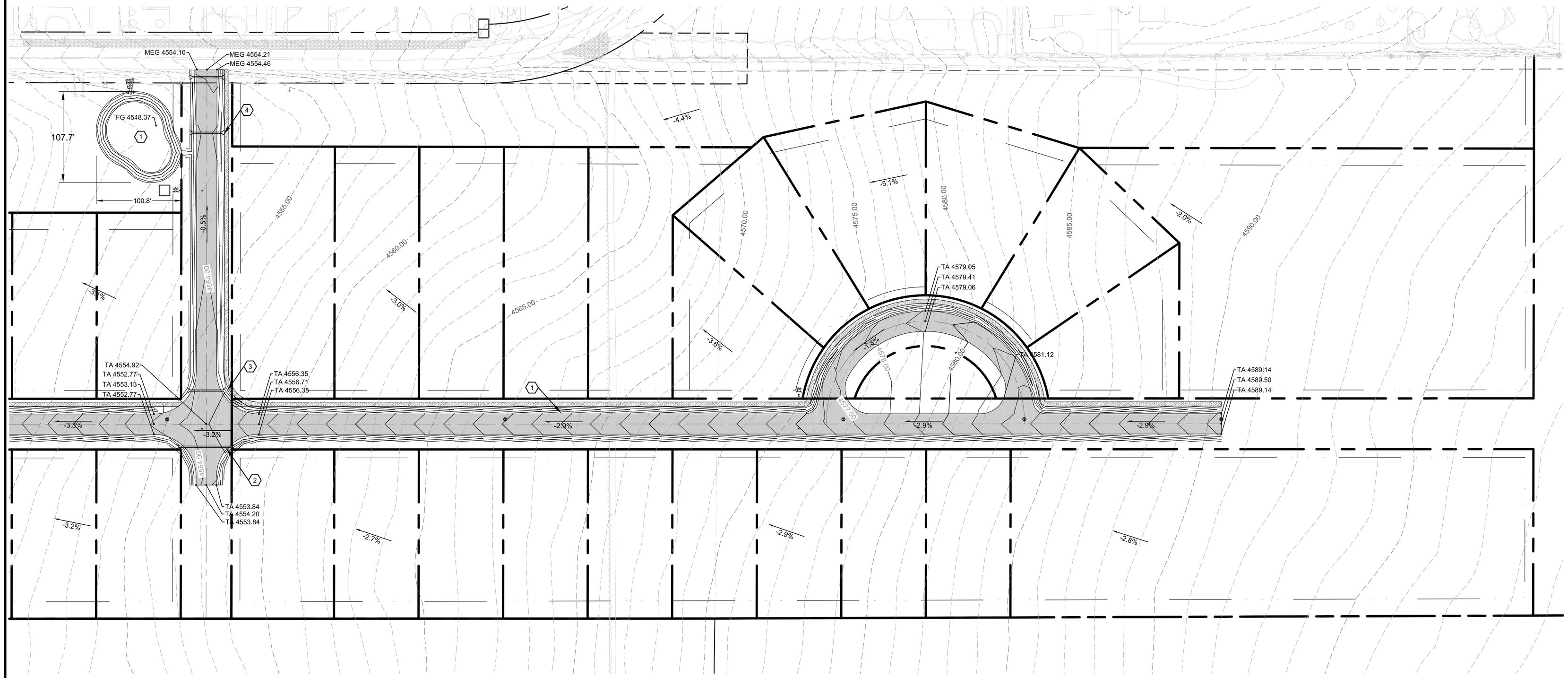
DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA

GRADING AND DRAINAGE PLAN

SHEET
C200

celines 12/01/14 11:02am – H:\AMSVILLITE\Civil\AMTEC200.dwg



NORTH

1 C201 GRADING AND DRAINAGE PLAN

SCALE: 1" = 60'

0 30' 60' 120'

KEY NOTES

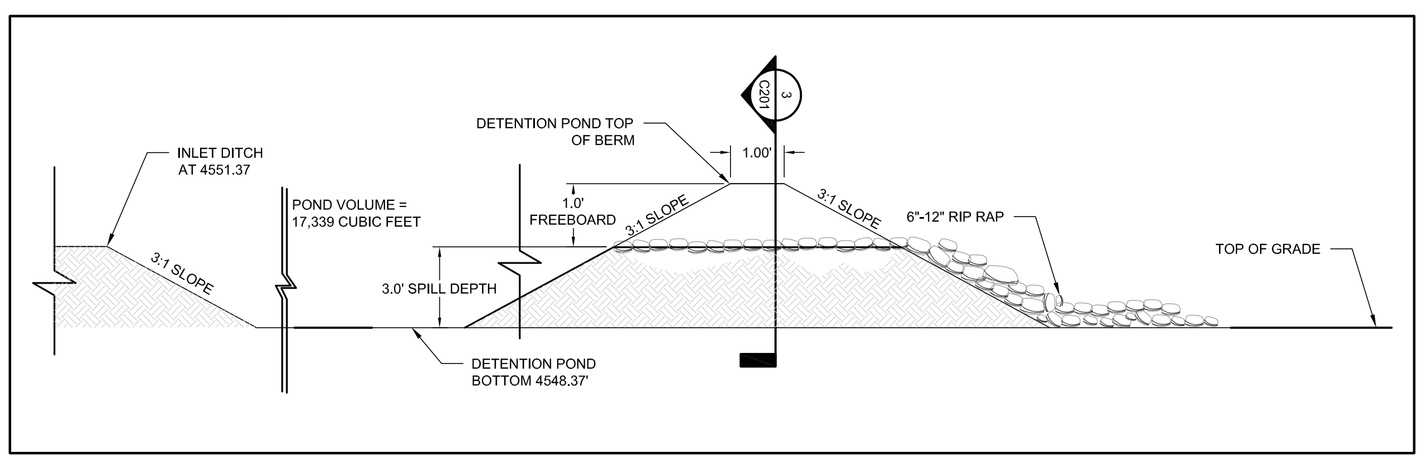
1. CONSTRUCT FIRE POND WITH 3:1 SIDE SLOPES. POND DEPTH = 4' (INCLUDING 1' OF FREEBOARD). POND CAPACITY: 17,339 CUBIC FT. BOTTOM OF POND: 4548.37'. SEE DETAIL 2/C201.
2. NEW 68LF 8" CULVERT AT 3.2% SLOPE. INVERT IN: 4553.85', INVERT OUT: 4551.65'.
3. NEW 46LF 8" CULVERT AT 2.4% SLOPE. INVERT IN: 4553.28', INVERT OUT: 4552.74'.
4. NEW 34LF 8" CULVERT AT 0.5% SLOPE. INVERT IN: 4551.78', INVERT OUT: 4551.60'.
5. NEW 34LF 8" CULVERT AT 1% SLOPE. INVERT IN: 4552.38', INVERT OUT: 4552.04'.

DRAINAGE AND GRADING LEGEND

TC 100	PROPOSED 'TOP OF CONCRETE' ELEV.
TBC 100	PROPOSED 'TOP BACK OF CURB' ELEV.
FL 100	PROPOSED 'FLOW LINE' ELEV.
TA 100	PROPOSED 'ASPHALT' ELEV.
FG 100	PROPOSED 'FINISHED GRADE' ELEV.
MEG 100	PROPOSED 'MATCH EXISTING GRADE' ELEV.
-0.3%	PROPOSED SLOPE
— — —	PROPOSED CONTOUR
- - - - -	EXISTING CONTOUR

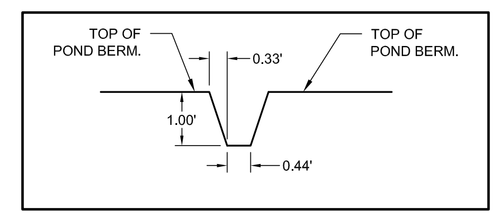
GRADING NOTES:

1. EXISTING AND PROPOSED CONTOURS ARE FOR REFERENCE ONLY.
2. FINISHED GRADES SHOULD BE ESTABLISHED THROUGH SPOT GRADES.



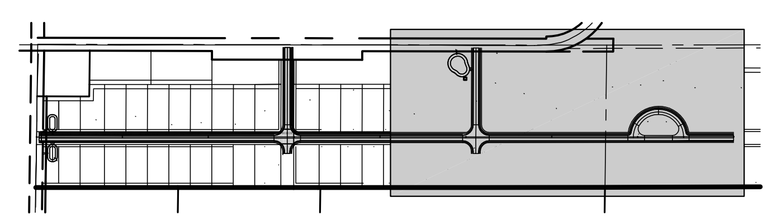
2 C201 4' DEEP FIRE POND

NOT TO SCALE



3 C201 WEIR CUT-OUT

SCALE: 1" = 2'



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA

SITE GRADING AND DRAINAGE PLAN

SHEET
C201

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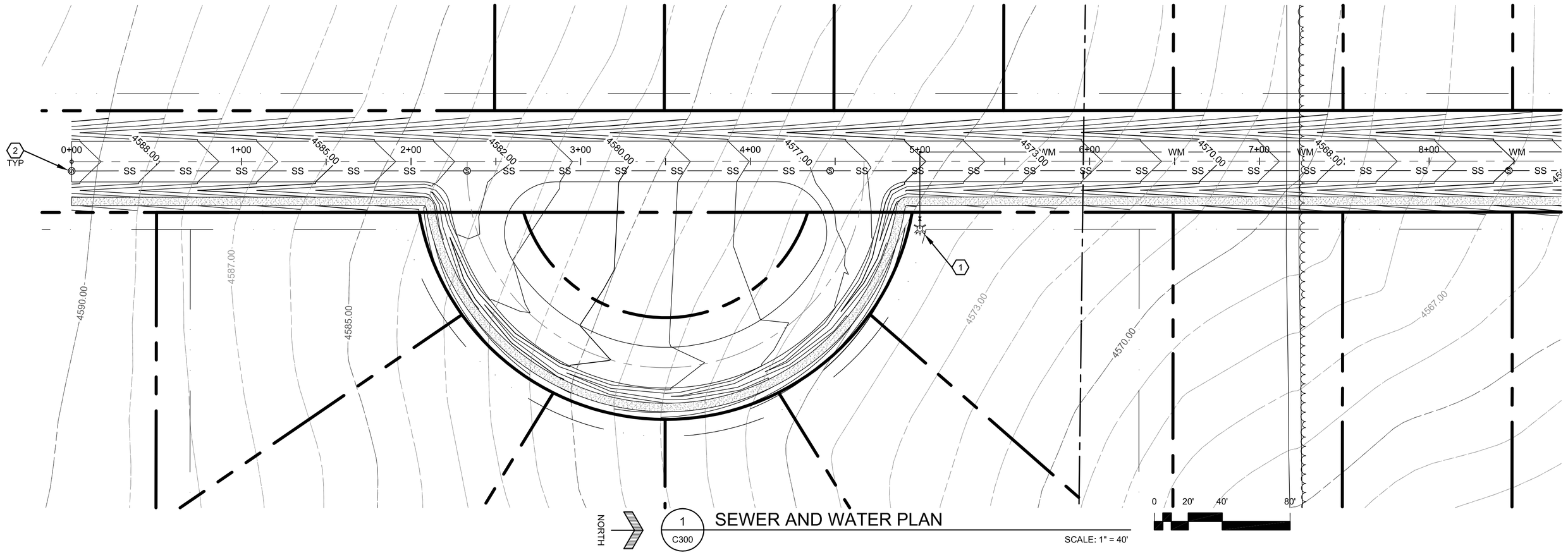
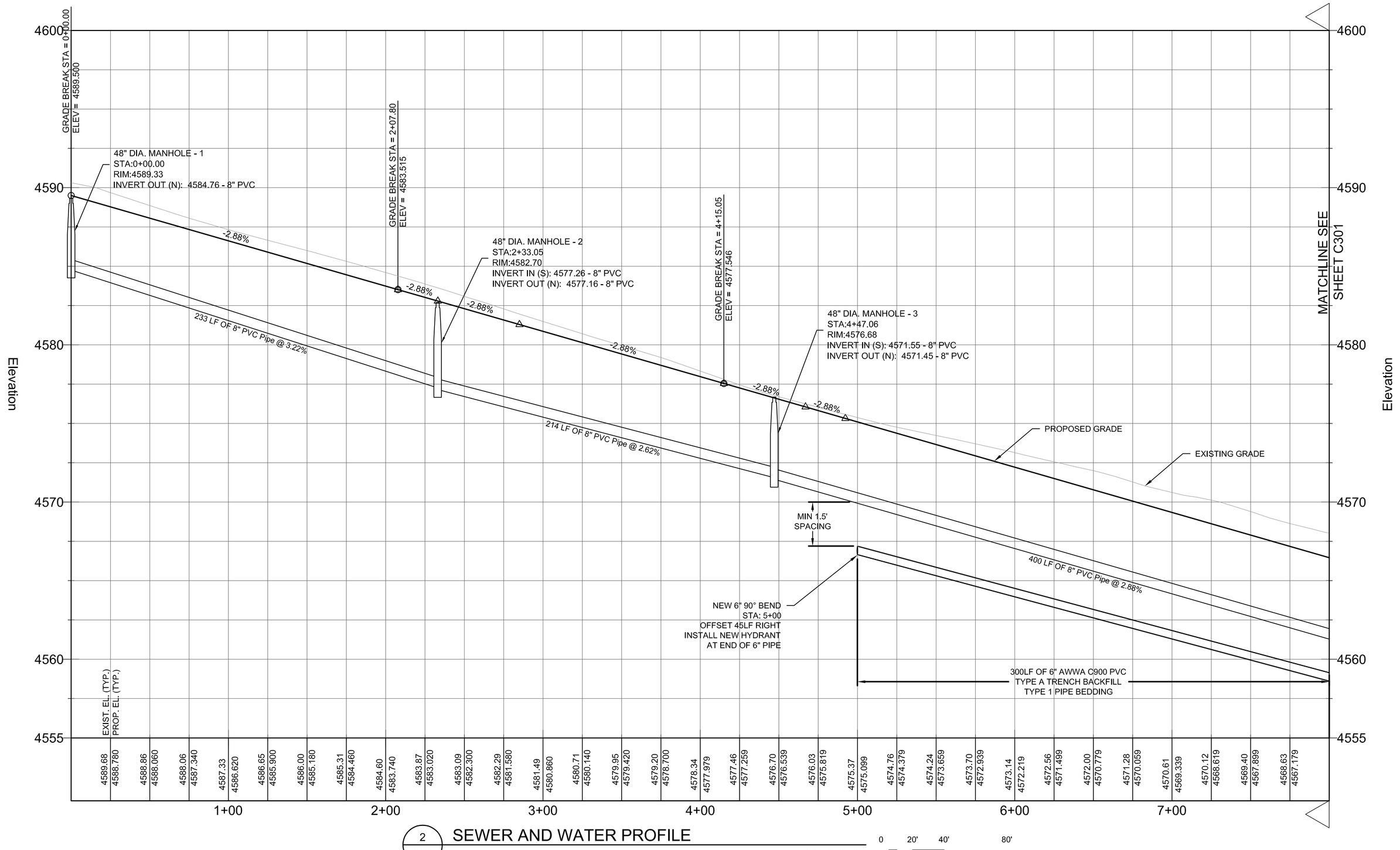


1 C300 SEWER AND WATER PLAN

SCALE: 1" = 40'



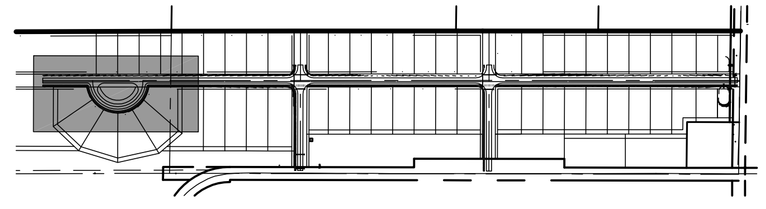
2 C300 SEWER AND WATER PROFILE

SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

0 20' 40' 80'

KEY NOTES:

1. NEW FIRE HYDRANT SEE 7/C400.
2. NEW SANITARY SEWER MANHOLE. SEE 6/C400.



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

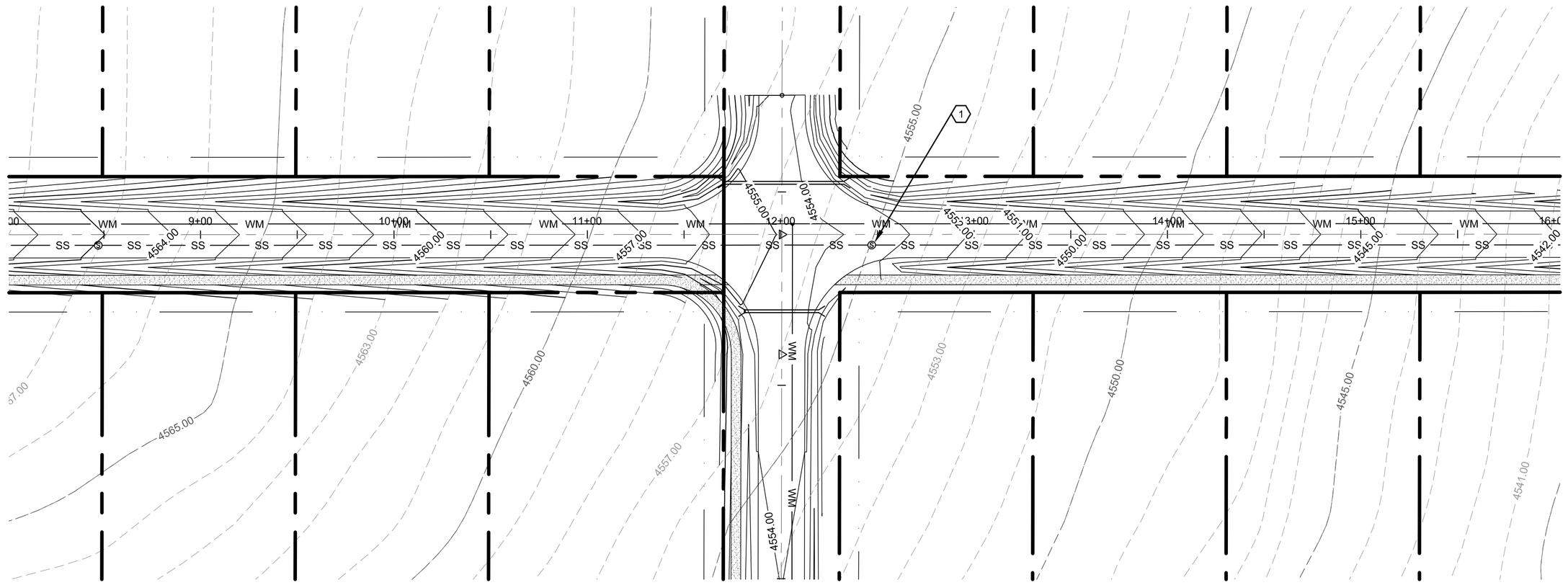
DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA

ROAD, SANITARY SEWER AND WATER PLAN AND PROFILE

SHEET
C300

celines 12/01/14 11:04am – H:\AMSVILLITE\Civil\AMTEC300.dwg



NORTH

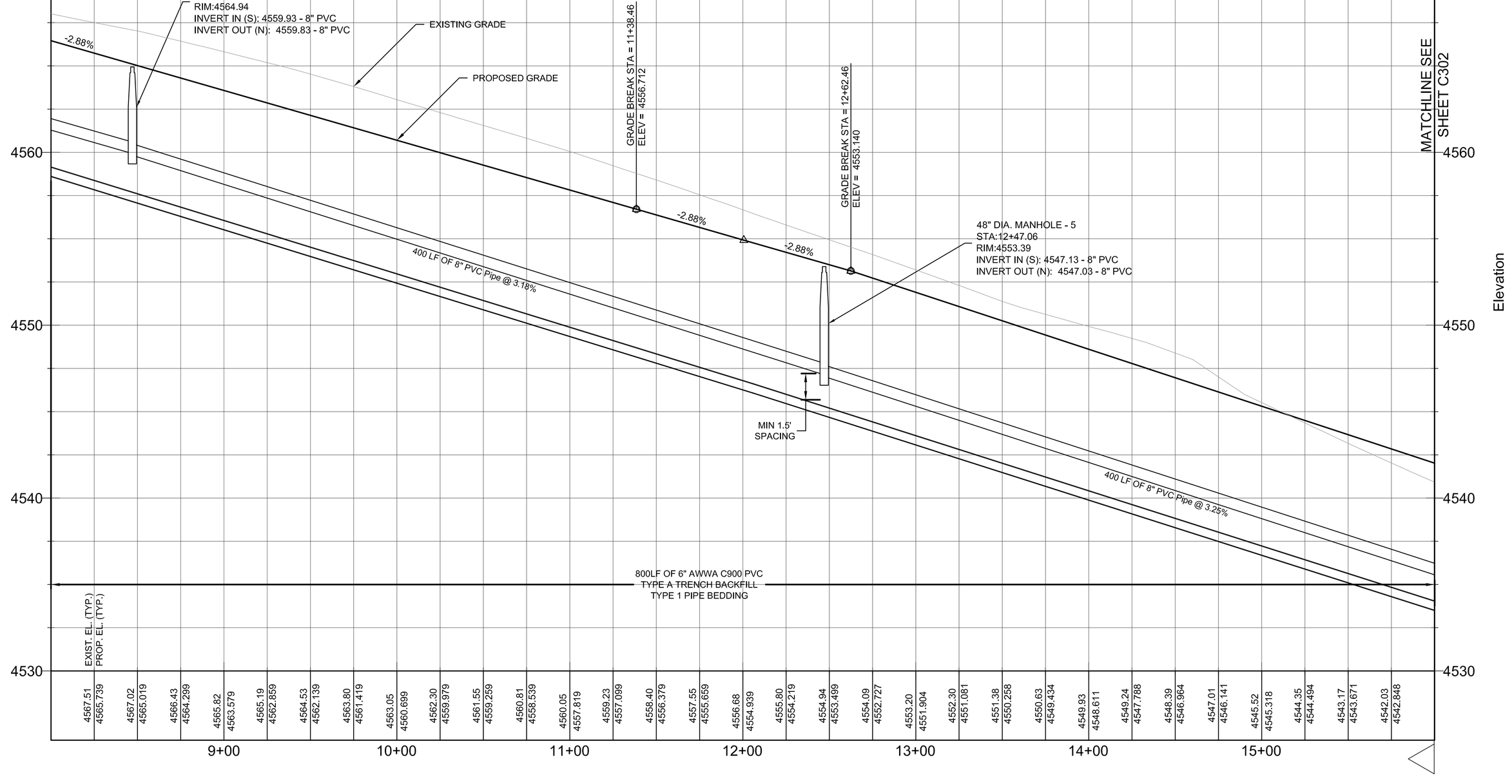
1 / C301 SEWER AND WATER PLAN

SCALE: 1" = 40'

0 20' 40' 80'

KEY NOTES:

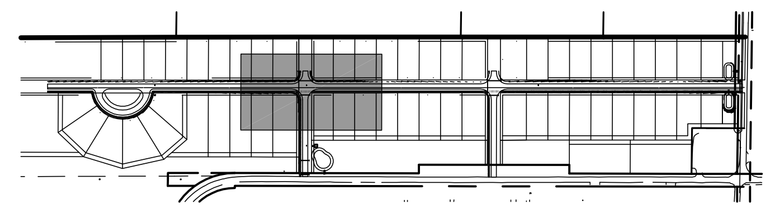
1. NEW SANITARY SEWER MANHOLE. SEE 4/C400.



2 / C301 SEWER AND WATER PROFILE

SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

0 20' 40' 80'



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

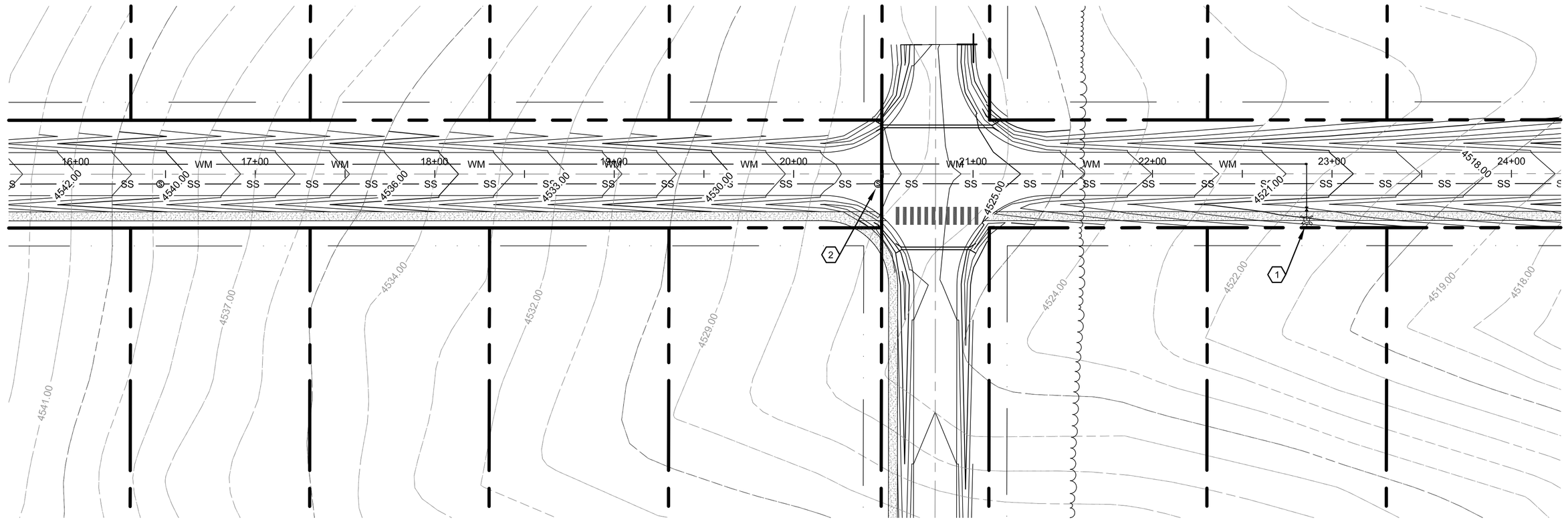
DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA®

ROAD, SANITARY SEWER AND WATER PLAN AND PROFILE

SHEET
C301

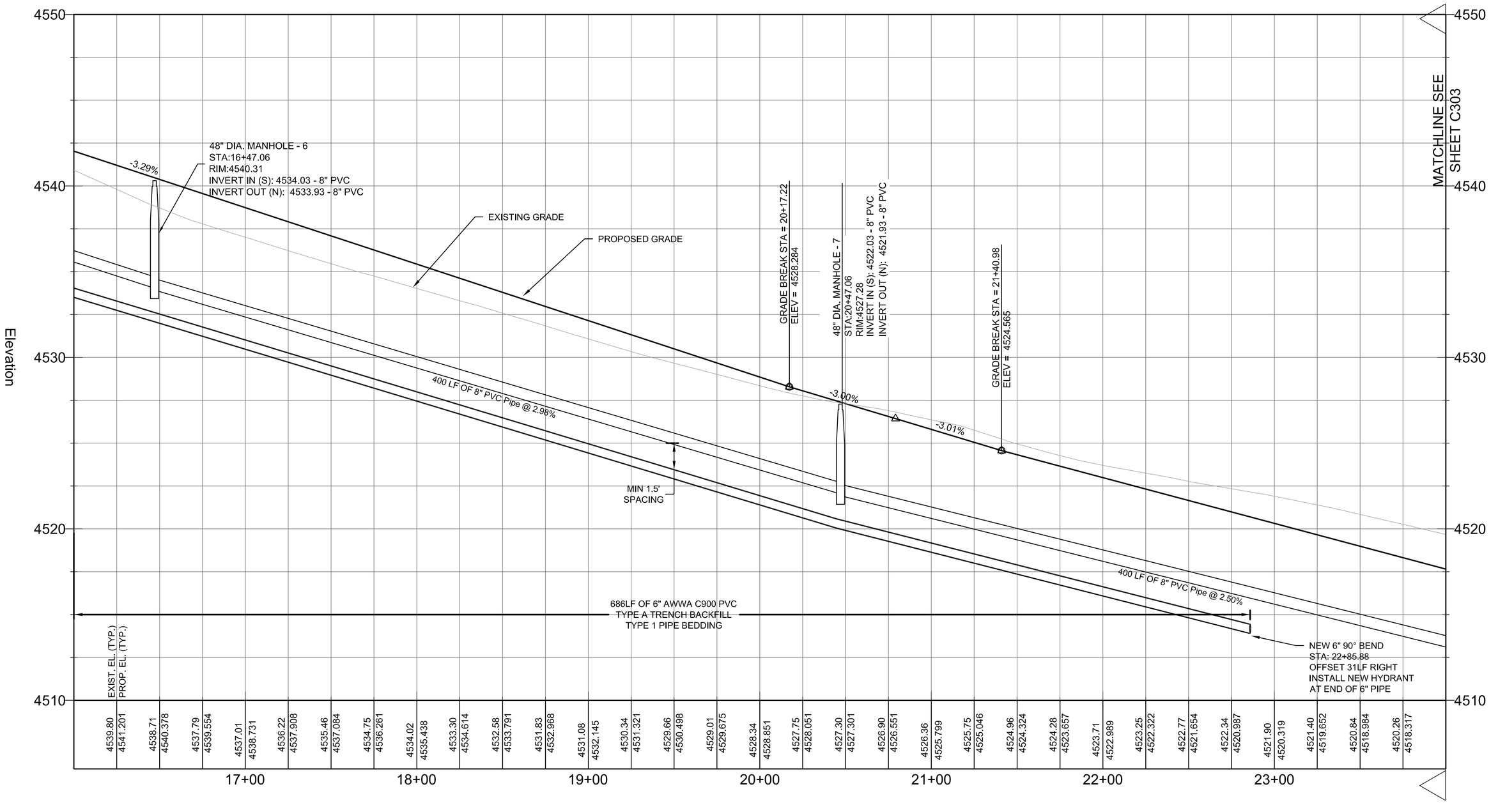
celines 12/01/14 11:08am – H:\AMSVILLITE\Civil\AMTEC300.dwg



1 C302 SEWER AND WATER PLAN

SCALE: 1" = 40'

0 20' 40' 80'



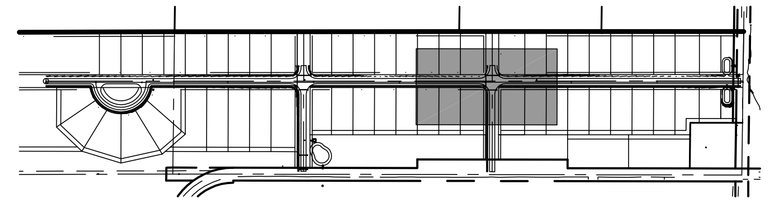
2 C302 SEWER AND WATER PROFILE

SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

0 20' 40' 80'

KEY NOTES:

1. NEW FIRE HYDRANT PER CITY SEE 7/C400.
2. NEW SANITARY SEWER MANHOLE. SEE 4/C400.



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS

-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION

GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

CTA

ROAD, SANITARY SEWER AND WATER PLAN AND PROFILE

SHEET
C302

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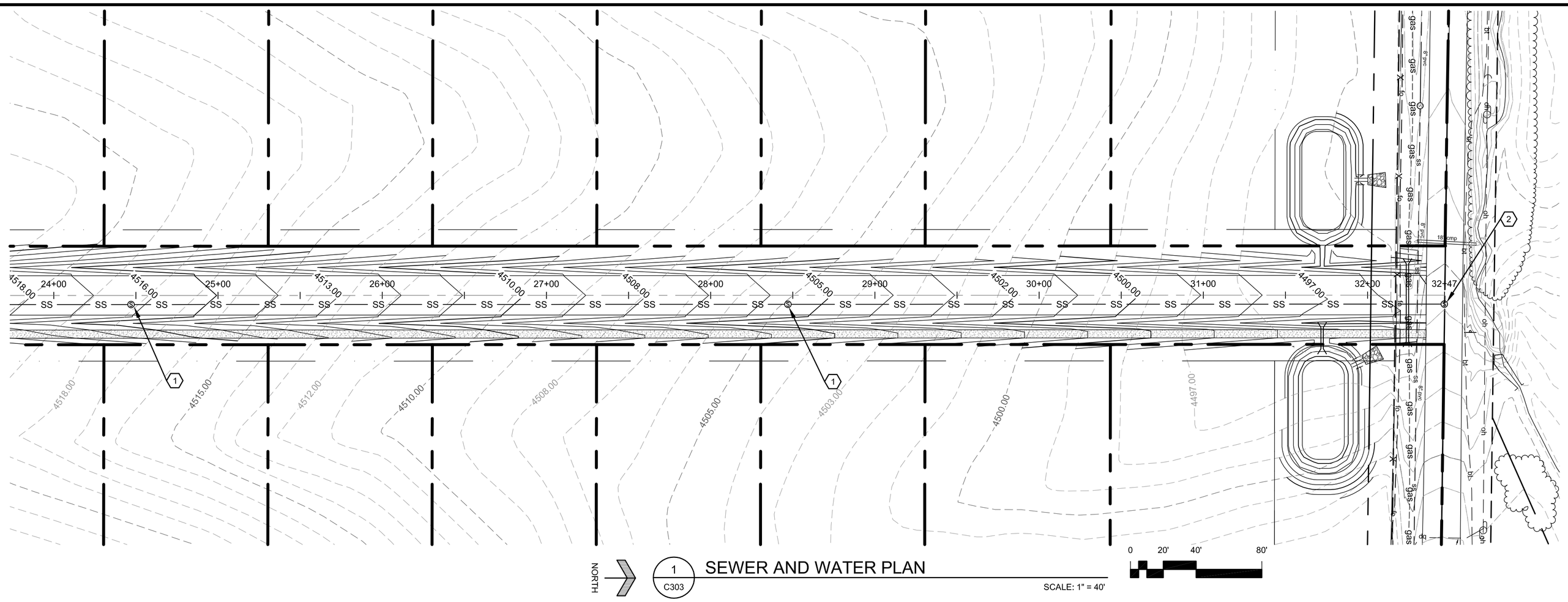
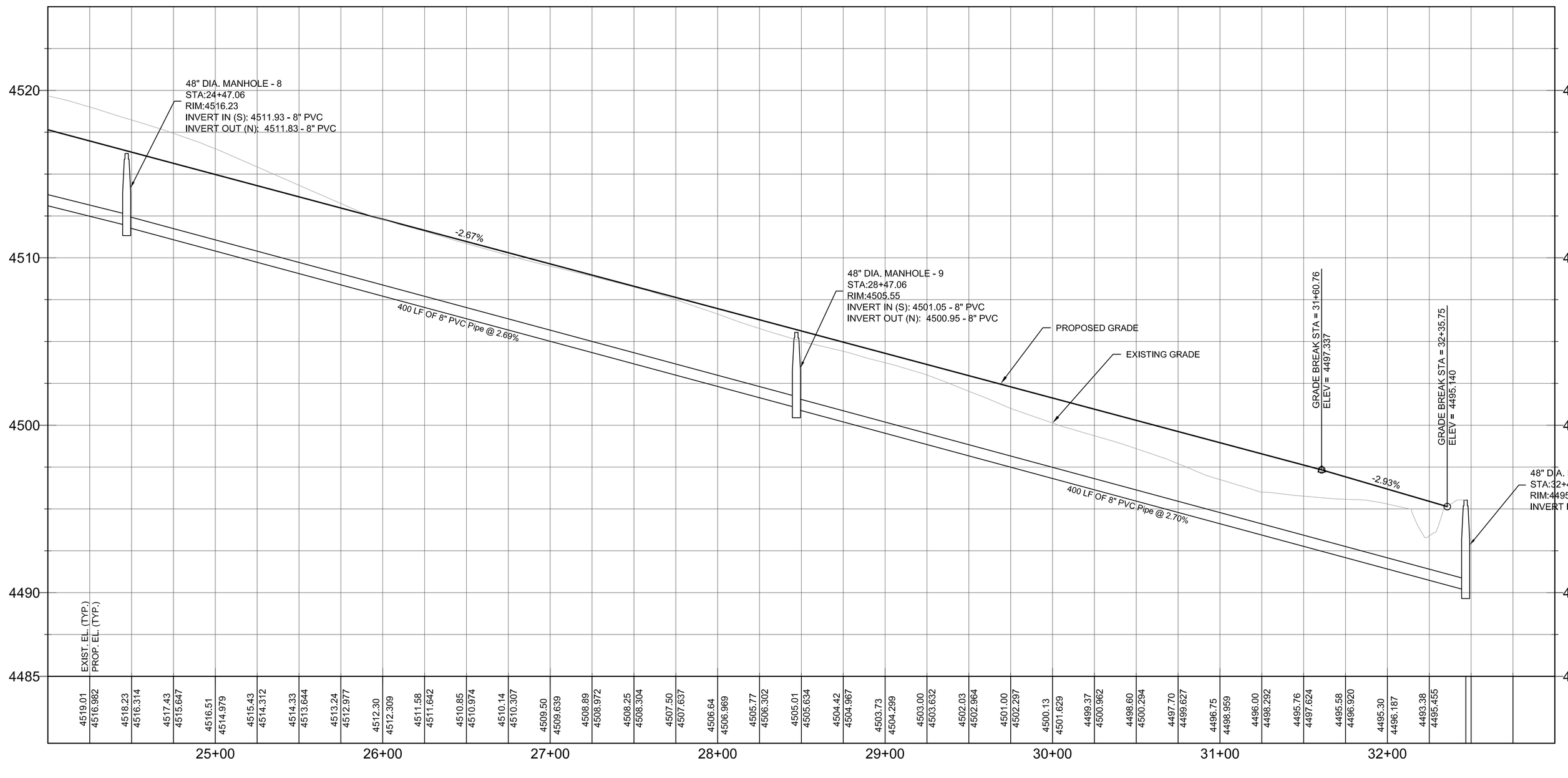


NORTH

1 / C303 SEWER AND WATER PLAN

SCALE: 1" = 40'

0 20' 40' 80'



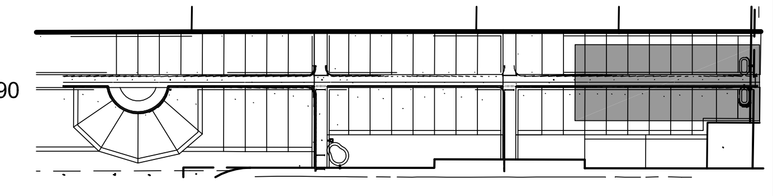
2 / C303 SEWER AND WATER PROFILE

SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

0 20' 40' 80'

KEY NOTES:

1. NEW SANITARY SEWER MANHOLE. SEE 6/C400.
2. NEW 48" SANITARY SEWER DOGHOUSE MANHOLE. FIELD VERIFY SANITARY SEWER ELEVATIONS.



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS
-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

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ROAD, SANITARY SEWER AND WATER PLAN AND PROFILE

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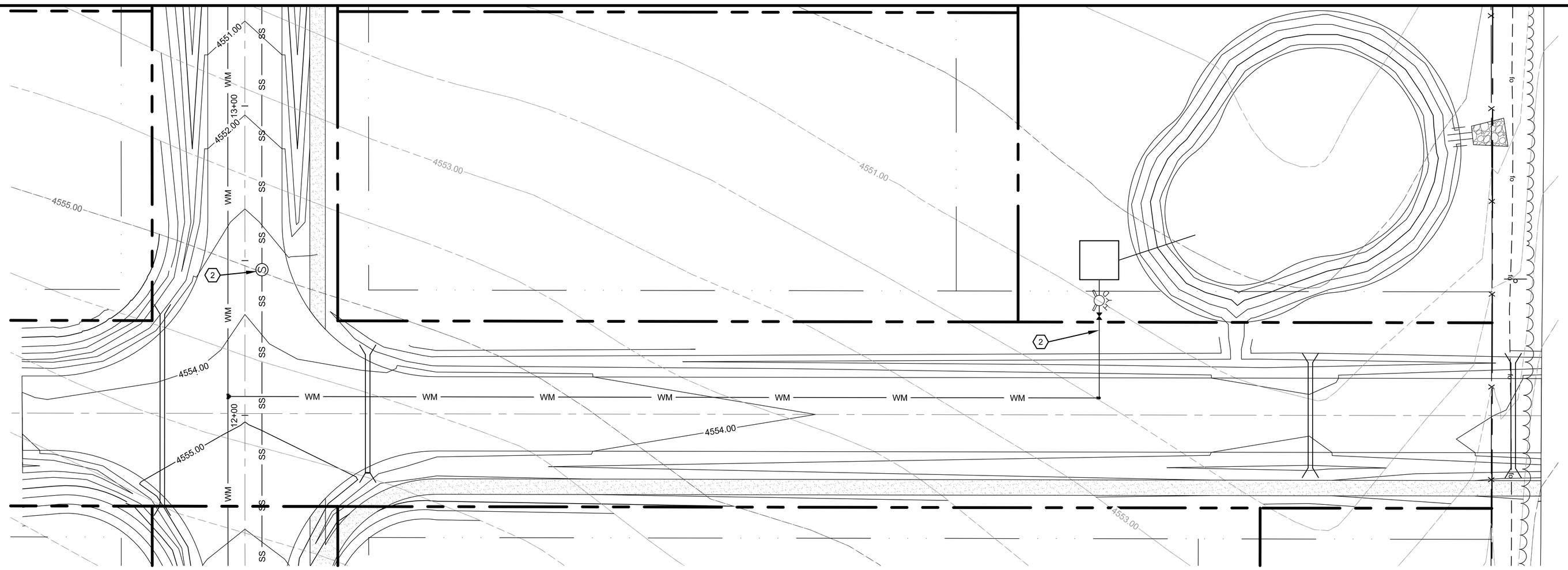
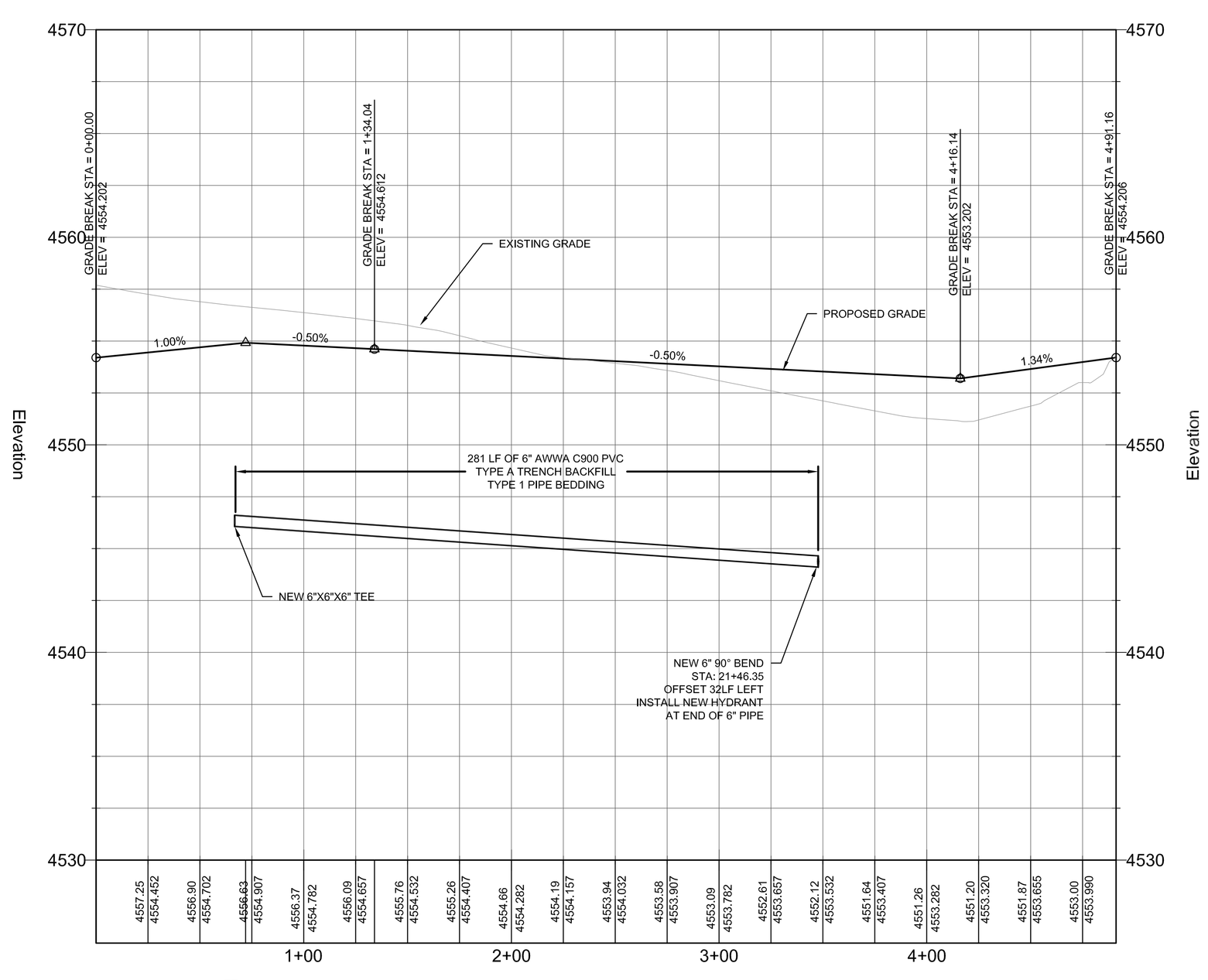


1 C304 SEWER AND WATER PLAN

SCALE: 1" = 20'



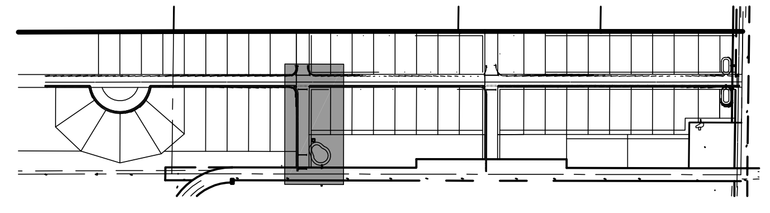
2 C304 SEWER AND WATER PROFILE

SCALE: 1" = 40'
VERTICAL SCALE: 1" = 4'

0 20' 40' 80'

KEY NOTES:

1. NEW SANITARY SEWER MANHOLE. SEE 6/C400.
2. NEW 32LF OF 6" WATER STUB



KEY MAP

NOTE TO CONTRACTOR - CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS
-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
CHECKED BY: EG
DATE: 11-28-2014
CTA # AMSVILLITE

ROAD, SANITARY SEWER AND WATER PLAN AND PROFILE

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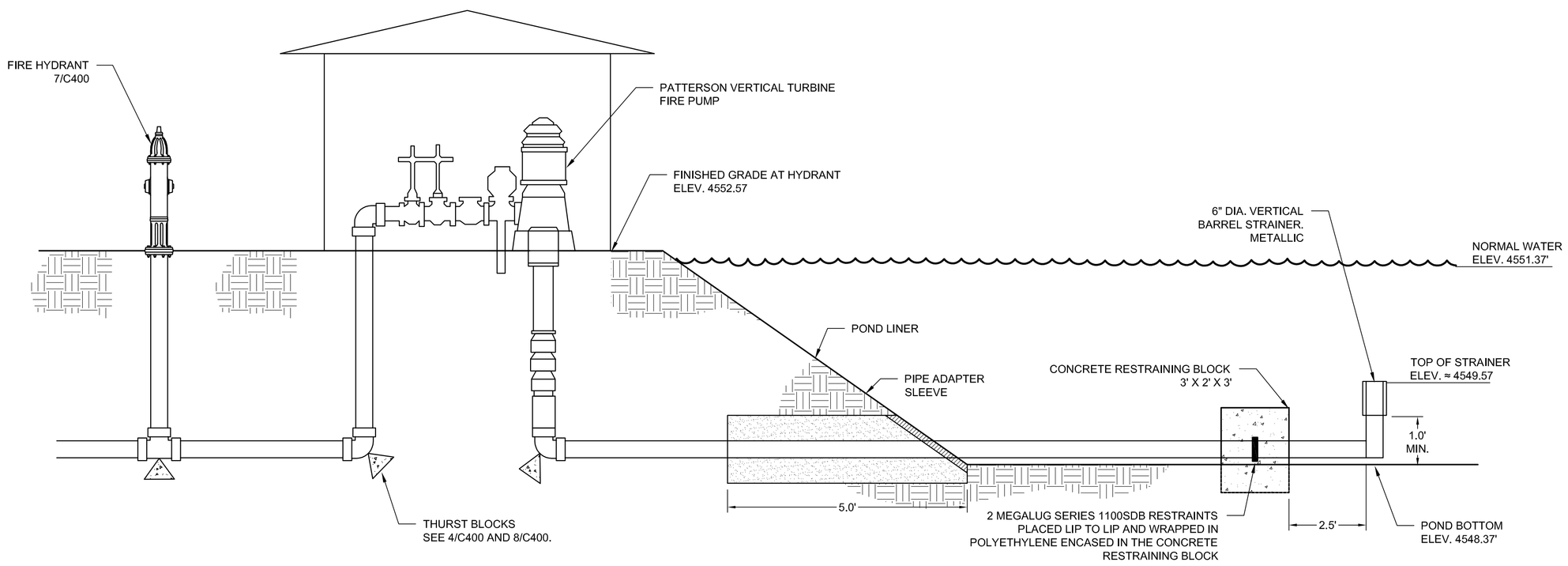
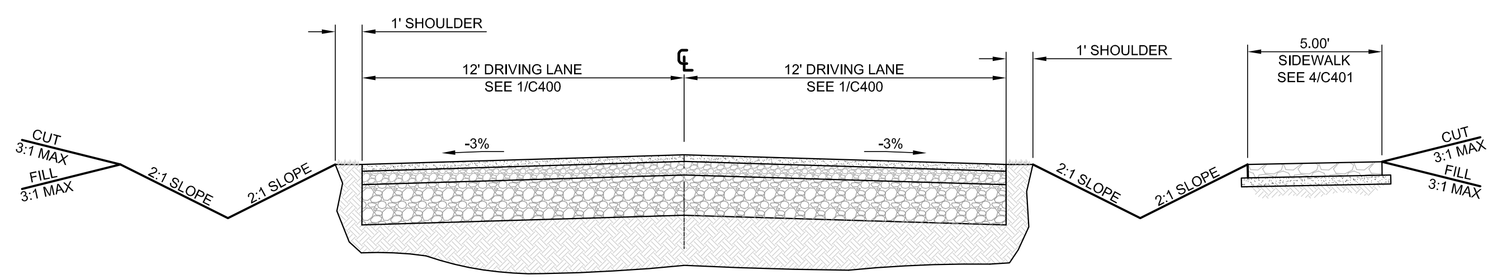


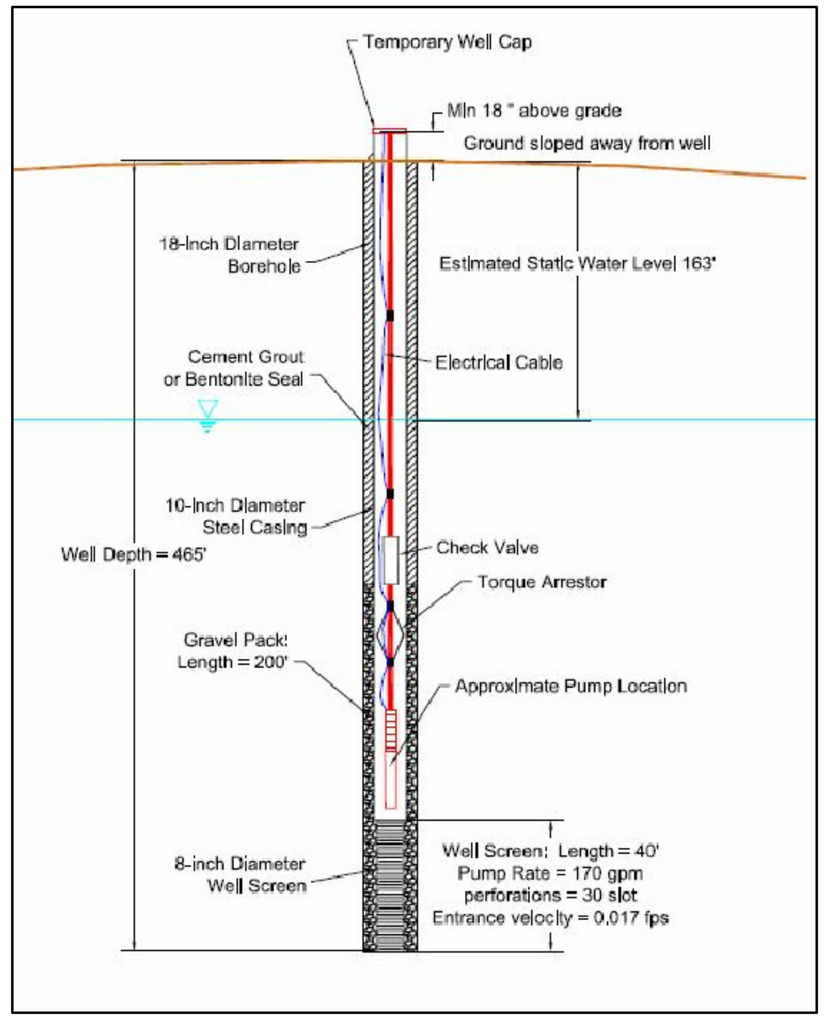
CONSTRUCTION NOTES:

1. 6" DUCTILE IRON MANIFOLD AND CONNECTION PIPE FITTINGS SHALL BE MECHANICAL JOINT RESTRAINED WITH MEGALUGS OR APPROVED EQUAL AND BACKED BY APPROPRIATE CONCRETE THRUST BLOCKING.
2. ALL DRY HYDRANT CONSTRUCTION AND INSTALLATION, INCLUDING HYDROSTATIC TESTING, SHALL CONFORM TO THE CURRENT EDITON OF NFPA 24 & NFPA 1142.

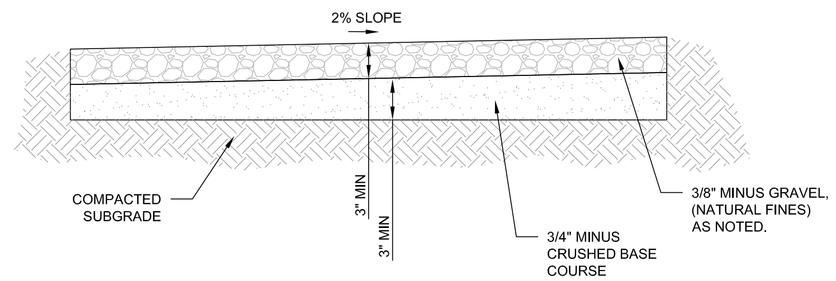
1 / C401 FIRE POND HYDRANT
POND SECTION SCALE: NONE



3 / C401 TYPICAL ROAD CROSS-SECTION
DETAIL SCALE: NONE



2 / C401 PUBLIC WATER SUPPLY WELL
DETAIL SCALE: NONE



NOTE:

1. NATURAL FINES SHALL CONSIST OF 80% SAND, 10% SILT, AND 10% CLAY
2. A SOIL STERILANT SHALL BE APPLIED TO THE SUBGRADE PRIOR TO PLACEMENT OF THE GRAVEL BASE.

4 / C401 GRAVEL SIDEWALK
DETAIL SCALE: NONE

NOTE TO CONTRACTOR -
CALL 1-800-424-5555 TWO WORKING DAYS PRIOR TO ANY EXCAVATION TO HAVE ALL EXISTING UTILITIES LOCATED.

NOT FOR CONSTRUCTION - PRELIMINARY DESIGN

REVISIONS
-

VILLAGE AT AMSTERDAM
58 LOT SUBDIVISION
GALLATIN COUNTY, MONTANA

CONSTRUCTION DOCUMENTS

DRAWN BY: CS
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DATE: 11-28-2014
CTA # AMSVILLITE

FIRE POND DETAILS

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AMSTERDAM VILLAGE SUBDIVISION
AMSTERDAM, MT

PRELIMINARY PLAT - ENGINEERING REPORT

DECEMBER 2015

CTA Project No.: AMSVILLITE

CTA, Inc.
411 East Main Street, Suite 101
Bozeman, Montana 59715
(406) 556-7100

TABLE OF CONTENTS

APPENDICES

INTRODUCTION AND PURPOSE

The Amsterdam Village Subdivision contains 77 acres of undeveloped land. The proposed project site is located southwest of the intersection of Amsterdam Road and Churchill Road. More specifically, the project is located in the East One-Half (E ½) of the East One-Half (E ½) of the East One-Half (E ½) of Section 14, Township One South (T1S), Range Three East (R3E) Gallatin County, Montana. The project proposes to split the property into 58 residential lots and 2 commercial lots being completed in 3 phases.

The subdivision will be serviced by individual water wells located on each lot and a sanitary sewer main that runs south to north connecting to an existing line on Amsterdam Road. Storm water will be managed by two on-site storm sewer detention ponds. One of these ponds will also function as a fire pond with the ability to service the entire site.

Figure 1: Vicinity Map

Not to Scale

SANITARY SEWER COLLECTION SYSTEM

The preferred sanitary system option to service the Amsterdam Village Subdivision is a gravity flow network built to accommodate future flows of a fully developed subdivision. The *DEQ Circular – 2 Standards for Wastewater Facilities* outlines the regulatory requirements and criteria that the design for the sewer systems must meet. The proposed sewer main line will be installed that flows from south to the north connecting to an existing sewer main along Amsterdam Road.

Communication with the District's Engineer indicated that the property is within the revised sewer district boundary. This district has a treatment capacity of 75,000gpd at Manhattan's treatment facility. The subdivision's sewer contribution must be evaluated in conjunction with the existing flows to determine if the district will need to purchase additional capacity.

DEQ-2, Chapter 30 "Design of Sewers"

31 SEPARATION OF CLEAR WATER

The sewer is designed for conveying sewage from the Amsterdam Village Subdivision to the Amsterdam City mains.

32 DESIGN CAPACITIES AND DESIGN FLOW

The sewage from the Amsterdam Village Subdivision will be conveyed to the city main via a sewer line that runs south to north through the middle of the subdivision. This proposed sewer main connects to the 8" main that flows east to west main along Amsterdam Road. The proposed mains within the subdivision will be 8-inch in diameter and are sized to flow at no more than 75% of capacity for peak hour conditions. The peaking factor for the design area is determined by calculating the equivalent population and inserting the population into the Harmon Formula.

Residential Lots
The city residential average of 2.34 persons per household is used to calculate the equivalent population for the residential lots. Montana DEQ 4 specifies a 4 bedroom residential dwelling unit as having a flow of 350gpd.

Population: (2.34persons/d.u.) (58d.u.) = 135.72 persons

Flow Rate = (58d.u.) (350gpd/d.u.) = 20,300gpd

Commercial Lot - Convenience Store
To estimate the commercial population for a convenience store, a flow rate based on square footage (data from Brunswick County NC) was selected and multiplied by the area of a typical convenience store (the corner of 19th and Baxter in Bozeman). This flow is then

divided by a representative Montana DEQ4 flow per employee, yielding a population estimate.

Population = (5,000ft^2) (60gpd/100ft^2) / (13gpd/person) = 231 person

Flow Rate = (5,000ft^2) (60gpd/100ft^2) = 3,000gpd

Commercial Lot - Office
Montana DEQ 4 specifies an office as having a flow of 13gpd/employee. Approximately 30 employees will be utilizing the office facilities.

Flow Rate: (13gpd/employee) (30 employees) = 390gpd

Infiltration Rate

Assumed Infiltration Rate: (150 gal/acre/day) (55 acres) = 8,250gpd = 0.013cfs

Peak Flow
The peak flow rate is calculated by multiplying the total flow rate by the peaking factor and adding the infiltration rate:

Harmon Formula: Peaking factor = $(18+P^{1/2}) / (4+P^{1/2})$
Where: P = Population in thousands = 0.392
Peaking factor = $(18+0.392^{1/2}) / (4+0.392^{1/2})$
Peaking factor = 4.03

Average Daily Flow: 20,300gpd + 3,000gpd + 390gpd = 23,690gpd

Peak Flow Rate: 4.03*(23,690) = 95,470.7gpd = 0.148cfs

Peak Flow Rate (including infiltration): 0.161cfs

Sanitary Sewer Hydraulic Analysis

The capacity of an 8-inch main is checked using Manning's Equation:

$Q = (1.486/n)AR^{2/3}S^{1/2}$

For an 8-inch PVC sewer main:

Manning's n	= 0.013 for PVC
Minimum Slope	= 0.004 ft/ft
A = area = (3.14/4) d^2	= (3.14/4)(8/12)^2 = 0.324907ft^2
P = perimeter = 2(3.14) r	=2(3.14/4)(4/12) = 2.0944ft

R = hydraulic radius = A/P = 0.341/2.094 = 0.1667ft
$R^{2/3}$ = 0.301ft
S = 0.004 ft/ft
$S^{1/2}$ = 0.0632 ft/ft

Q_{full} = (1.486/0.013) (0.34907ft^2) (0.30105ft) (0.0632ft/ft) = 0.7592 cfs

$Q_{0.75}$ = (0.75) (0.7592cfs) = 0.5694cfs > Q_{peak} = 0.161cfs

Based on these calculations, an 8-inch sewer main is more than adequate to carry the design flows for the subdivision. Additionally Appendix A shows the peak flow in the 8-inch sewer main.

33 DETAILS OF DESIGN AND CONSTRUCTION

33.1 Minimum Size

The gravity sewer main is to be 8 inches in diameter.

33.2 Depth

The minimum depth of the new sanitary services is 4 feet to the top of pipe. In locations where cover is less than 4 feet over top of pipe, the pipe will be insulated with polystyrene or equivalent to prevent freezing.

33.3 Buoyancy

Buoyancy of sewers is considered and flotation of the pipe will be prevented with appropriate construction where high groundwater conditions are anticipated.

33.4 Slope

33.41 Recommended Minimum Slopes

The 8” gravity main is to be constructed at various grades equal to or higher than the required standard minimum of 0.40%. A potential 6” gravity service must be considered at various grades higher than the required minimum of 0.60%.

33.42 Minimum Flow Depths

The 8” gravity main will meet or exceed minimum slopes published in DEQ Table 33.41.

33.43 Minimum Flow Deposition

The size and slope of the proposed main will minimize solids deposition.

33.44 Slope Between Manholes

All sewers are designed to have uniform slope between manholes.

33.45 High Velocity Protection

Velocities will be less than 15 feet per second.

33.46 Steep Slope Protection

Design slopes are less than 20%

33.5 Alignment

The gravity sewers will be laid in straight alignments between manholes and will be checked per MPWSS prior to acceptance

33.6 Changes in Pipe Size

Any changes in pipe size will only be made at manholes for this project.

33.7 Materials

The new gravity sewer main will be constructed from SDR 35 PVC in accordance with MPWSS Section 02730.

33.8 Installation

33.81 Standards

The new sewer services will be constructed in accordance with MPWSS Section 02730.

33.82 Trenching

The new gravity will be constructed in accordance with MPWSS Section 02730. Trenching and backfill will be in accordance with MPWSS Standard Drawing No. 02221-1.

33.83 Pipe Bedding Materials and Placement

The new sewer will be constructed in accordance with MPWSS Section 02730. Bedding and backfill will be in accordance with MPWSS Standard Drawing No. 02221-1 and contract documents.

33.84 Final Backfill

The new sewer will be constructed in accordance with MPWSS Section 02730. Final backfill will be in accordance with MPWSS Standard Drawing No. 0221-1 and contract documents.

33.85 Deflection Test

Deflection testing for sewer will be at a minimum per MPWSS Section 02730 or per the procedure described in Circular DEQ-2 Section 33.85.

33.9 Joints and Infiltration

33.91 Joints

Gravity sewer joints shall be gasketed in accordance with MPWSS Section 02730 Part 2.2.

33.92 Leakage Test
Leakage testing will be conducted per MPWSS Section 0273 3.4 Tests.

33.93 Water (Hydrostatic) Test
Hydrostatic testing will be conducted per MPWSS Section 02730 3.4 Tests.

33.94 Air Test
Air testing will be conducted per MPWSS Section 02730 3.4 Tests.

33.95 Service Connections
Service connections shall be constructed in accordance with MPWSS Section 02730 and Standard Detail 02730-2 and the contract documents.

34 MANHOLES

34.1 Location
Manhole locations meet the minimum requirements for 8" gravity sewer and are no more than 400 feet apart.

34.2 Drop Type
No drop manholes are included in the design.

34.3 Diameter
The manholes shall be 4' diameter precast concrete in accordance with MPWSS Section 02730 and Standard Drawing 02720-3.

34.4 Flow Channel
A flow channel with a 0.10' drop across the manhole will be included in accordance with MPWSS Standard Drawings 02720-3 and 02720-7.

34.5 Bench
A bench will be included in accordance with MPWSS Standard Drawing 02720-3.

34.6 Watertightness
The manholes shall be precast concrete in accordance with MPWSS Section 02730. Inlet and outlet pipes shall be joined to the manhole with flexible gaskets.

34.7 Inspection and Testing
Manhole testing shall be in accordance with MPWSS Section 02730 Part 3.4.

34.8 Corrosion Protection for Manholes
Corrosive conditions are not anticipated for this installation.

34.9 Electrical

No electrical connections are necessary for this installation.

35 INVERTED SIPHONS

There are no inverted siphons on this project

36 SEWERS IN RELATION TO STREAMS

There are no stream crossings proposed for sanitary sewers.

37 AERIAL CROSSINGS

There are no proposed aerial crossings in this project.

38 PROTETION OF WATER SUPPLIES

38.1 Cross Connections Prohibited

There will be no physical connection between the proposed sewer and any domestic water facility.

38.2 Relation to Water Works Structures

Known public water mains and service connections are shown on the plans

38.3 Relation to Water Mains

38.31 Horizontal Separation

Sewers will be laid a minimum of 10', measured edge to edge, from any existing or proposed water main.

38.32 Crossings

All new sewer mains will provide for the maximum allowable separation between water services that the existing water mains can provide and include a minimum vertical separation of 18" where possible. Refer to 8.8.4 for any exceptions.

39 SEWER SERVICES AND PLUMBING

39.1. Plumbing

No plumbing connections to domestic and fire lines are proposed for this project

STORMWATER DRAINAGE PLAN

This Stormwater Drainage Plan satisfies the DEQ 8 Montana Standards for Subdivision Storm Drainage requirement for the development for the Amsterdam Village Subdivision in Amsterdam, Montana. This plan addresses the proposed improvements by examining the pre- and post-development stormwater runoff characteristics of the site. Additionally it provides mitigating measures to compensate for potential impacts resulting from the development.

Design Criteria
Pre and post-development runoff calculations are performed using the methodology found in the DEQ 8 Montana Standards for Subdivision Storm Drainage, 2002 edition.

Design Assumptions
An original topographic survey for the Amsterdam Subdivision was performed in 2006 by Alpine Survey. Additionally, a recent supplemental survey information was done by CTA Surveying. Both these surveys are for the storm water analysis. Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2014 is the modeling program used to size the proposed storm water detention ponds and culverts.

Soil Information
A geotechnical report will be completed for the development analyzing: groundwater conditions, existing soils, acceptable use of native materials and compaction requirements. The geotechnical report will also include recommend asphalt and concrete sections.

Design Assumptions
In general, the topography of the site slopes north toward Amsterdam Road and has an average slope of 4%. The natural topography in addition to the property's eastern swale conveys runoff from the south to the north. Once the runoff reaches the northern drainage area it flows into the Amsterdam roadway ditch runs which flows from east to the west.

In analyzing pre-development conditions, the property is delineated into two basins: onsite Basin A having 64.5 acres and off-site Basin B having 22.6 acres. Basin B is located to the south west of the development. Runoff from this area will flow from the southwest to the north along with the on-site flows.

Pre Development Hydraulic Analysis

As the offsite flows are constant between the pre and post development conditions, the pre development hydraulic analysis is focused on just onsite Basin A. The *DEQ 8 Montana Standards for Subdivision Storm Drainage* is used in determining runoff coefficients for Basin A. The Rational Method is used to calculate peak runoff rates during the 2-yr 1 hour and the 100-yr 24 hour runoff events using a runoff coefficient of C=0.3 to describe the unimproved areas of Basin A. See Appendix B for a layout of the pre-development basins.

Post Development Conditions

The post-development conditions of the site will consist of the addition of an asphalt roadway system as well as residential construction and landscaping on each lot. The post-development area is further broken down into two separate basins, A1 and A2. According to preliminary analysis, the offsite runoff will be controlled by two detention ponds, one at the north of basin A1 and another at the north of basin A2. Appendix B shows the location of each detention area. The pond in basin A1 will collect drainage from the south east part of the site and outlet to the swale along the edge of the property and flow north. The pond in basin A2 will collect the remaining site flows and outlet into the roadway ditch along Amsterdam Road and continue west. Runoff from each detention area will be conveyed from the property at pre-development rates.

Post Development Hydraulic Analysis

The proposed development, like the pre-development is analyzed focusing on Basin A. The composite runoff coefficient of developed Basin A is broken down in Table 1.

Table 1 – Post Development Land Components

Description	Area	Area (%)	Runoff Coefficient
24 ft Asphalt Roads	3.4	5.27	0.95
58 Residential Lots Impervious (5000sf/lot)	6.43	9.97	0.95
58 Residential Lots Landscape (4000sf/lot)	5.14	7.97	0.1
Agricultural Land & Right of Way	47.57	73.75	0.3
2 Commercial Lots	1.96	3.04	0.8

The weighted runoff coefficient of Basin A is C=0.4. This coefficient is used for the flow rate calculation of both the basins. Additionally, the times of concentrations used for Basin A1 are applied to the flow rate calculation for both basins in order to provide the most conservative estimation of flow. Storm water detention will be utilized to attenuate runoff rates to pre-development conditions for the 2-yr 1 hour runoff event. Additionally, the ponds will be able to detain the volume difference between the pre and post development conditions.

Tables 2 and 3 below compare the pre and post development peak flow rates for both basins during a 2-year 1-hr event.

Table 2 - Basin A1 Peak Flows for 2-year 1-hr Event

	Time of Concentration (min)	Q_{peak} (cfs)	Hyd. Volume (ft^3)
Pre-Development	34	1.93	3,938
Post-Development	32.5	2.63	5,211
		Volume Difference	**1,273**

Table 3 – Basin A2 Peak Flows for 2-year 1-hr Event

	Time of Concentration (min)	Q_{peak} (cfs)	Hyd. Volume (ft^3)
Pre-Development	34	9.187	18,742
Post-Development	32.5	12.52	24,798
		Volume Difference	**6,056**

Tables 4 and 5 compare the pre and post development peak flow rates for both basins for a 100-year 24-hr.

Table 4 – Basins A1 Peak Flows for 100-year 24-hr Event

	Time of Concentration (min)	Q_{peak} (cfs)	Hyd. Volume (ft^3)
Pre-Development	34	4.629	9,444
Post-Development	32.5	6.31	12,494

Table 5 – Basins A2 Peak Flows for 100-year 24-hr Event

	Time of Concentration (min)	Q_{peak} (cfs)	Hyd. Volume (ft^3)
Pre-Development	34	29.37	59,923
Post-Development	32.5	30.03	59,456

Storage Facilities & Discharge Structures
Per *Chapter 4 of DEQ 8 Montana Standards for Subdivision Storm Drainage,* the storm water detention systems for the development will need to accommodate the 2-year 1 hour event.

Basin A1 Detention Pond
The pond in Basin A1 will serve as a 120,000 gallon (16,042 ft^3) fire pond for the area. Therefore the pond must be sized to hold the fire pond volume as well as the additional runoff from a 2-year event totaling 17,315 ft^3.

Pre-Development Q_{2yr}= 1.93cfs
Post-Development Q_{2yr}= 2.63cfs
Outlet Weir = 0.436ft wide

Basin A2 Detention pond
The pond in Basin A2 is designed to have an approximate storage capacity of 6,056 cubic feet.

Pre-Development Q_{2yr} = 9.19cfs
Post-Development Q_{2yr} = 12.5cfs
Outlet Weir = 0.525ft wide

Culverts
The culverts on the site are sized to accommodate post development peak runoff rates. The size of the culverts is conservatively modeled to ensure they are able to convey the highest post development flow of 12.5 cfs.

Maintenance Considerations
The detention ponds should be inspected to determine sediment accumulation. If a large amount of sediment is detected (6 inches), then the sediment must be removed from the bottom of the pond. The sediment may contain a significant amount of metals as well as the possibility of pesticides. All sediment removed from the facility shall be deposed of per the City of Amsterdam and Department of Environmental Quality Standards.

Summary
Stormwater runoff from the project site will be collected and detained on-site. During the construction of the site, the proposed system will collect and combine the stormwater from the various lots and convey the runoff to the north for detention prior to release. This measure protects from erosion caused by the release of stormwater runoff at greater velocities than previously experienced.

WATER SYSTEM

This section provides the information required in Part II.B of the Montana Department of Environmental Quality's (MDEQ's) Subdivision Application Form revised in December 2003. Specifically, the following information is presented in response to the requirements of Section 3 of Part II.B, which address individual water supply systems. Residents of the Amsterdam Subdivision will obtain domestic water from individual wells placed on each lot.

Significant hydrology and groundwater testing was completed for the original preliminary plat application in 2007 and 2008. At that time a public system was proposed to serve a much larger development. Much of the data from that application will serve as the supporting information contained within this application.

The nearest Public Water Supply (PWS) systems are located in the Town of Manhattan, City of Belgrade, River Rock, and the Four Corners Water and Sewer District, all between 6.5-7.0 miles away. This distance makes the connection to a PWS a financially problematic option. Therefore, individual water wells are a suitable solution for domestic water for the residences.

To substantiate the availability of a suitable water supply, supplementary information is provided in Appendix C including copies of applicable well logs and water quality information.

Groundwater Sources

Well data from the area of the site was obtained from a variety of sources including the following:

- Site information from drilling wells AV-1, AV-2, and Obs-1;
- Montana Bureau of Mine's (MBMG) Groundwater Information Center (GWIC) for well construction and geologic logs, water level and yield information, and water quality data;
- The USGS for water level data;
- Montana DEQ for water quality data from area public water supply wells;
- State and local sources for pumping test data from nearby sites; and
- Literature references for geologic and hydrogeological descriptions along with water level data.

A total of 202 wells were found in the MBMG GWIC database for T1S R3E Sections 10-15 and 22-24 (Figure 2). Well locations may not be precise as the database contains mostly simple quarter-section approximations. The database was also queried further for water level and water quality data. Information from the other sources noted is discussed below.

Figure 2: Well Locations

WELL LOG SUMMARY FROM MBMG

Sec	Wells	Depth (ft)			Yield (gpm)		
		Min	Max	Avg	Min	Max	Avg
10	15	100	359	192.8	20	1000	276.5
11	12	73	315	125.1	4	1500	153.3
12	4	80	160	117.0	30	40	35.0
13	106	55	453	188.4	2	500	49.4
14	40	20	460	95.6	3	300	36.4
15	4	143	216	179.8	15	75	37.0
22	2	75	100	87.5	18	25	21.5
23	7	35	410	139.7	10	600	150.4
24	12	23	238	139.2	12	65	30.7
Total	**202**	**20**	**460**	**159.2**	**2**	**1500**	**67.3**

Listed usages for the wells obtained from the MBMG search include the following:

- Domestic: 170
- PWS: 10
- Commercial: 2
- Industrial: 2
- Irrigation/Stockwater: 6
- Monitoring/Other/Unknown: 9

Hydrogeology and Hydrologic Conditions

Wells in the vicinity of the proposed well are predominantly finished less than 150 ft bgs in multiple confined and leaky-confined tertiary aquifers. Only five wells in the vicinity of the project are completed at depths greater than 350 ft bgs. Well logs in the area list fine-grained Quaternary colluvium ranging in thickness from a few feet to approximately 30 feet, underlain by inter-tongued Tertiary sediments consisting of sands, gravels, clays, claystone and sandstone. Multiple confining clay layers are present in the tertiary sediments, but they may not be laterally extensive.

The wells will be located in the larger, interconnected Gallatin Valley Aquifer. Data in the GWIC database list static groundwater levels in the deep wells between 106 - 164 ft bgs. Recharge to the alluvial aquifer occurs primarily from seepage from streams and irrigation canals (Hacket and others, 1960). Recharge to the deeper, leaky-confined aquifers occurs from up-gradient groundwater flow, precipitation infiltration into bedrock exposed in Camp Creek Hills and Gallatin Range and potential leakage from the overlying alluvial aquifer.

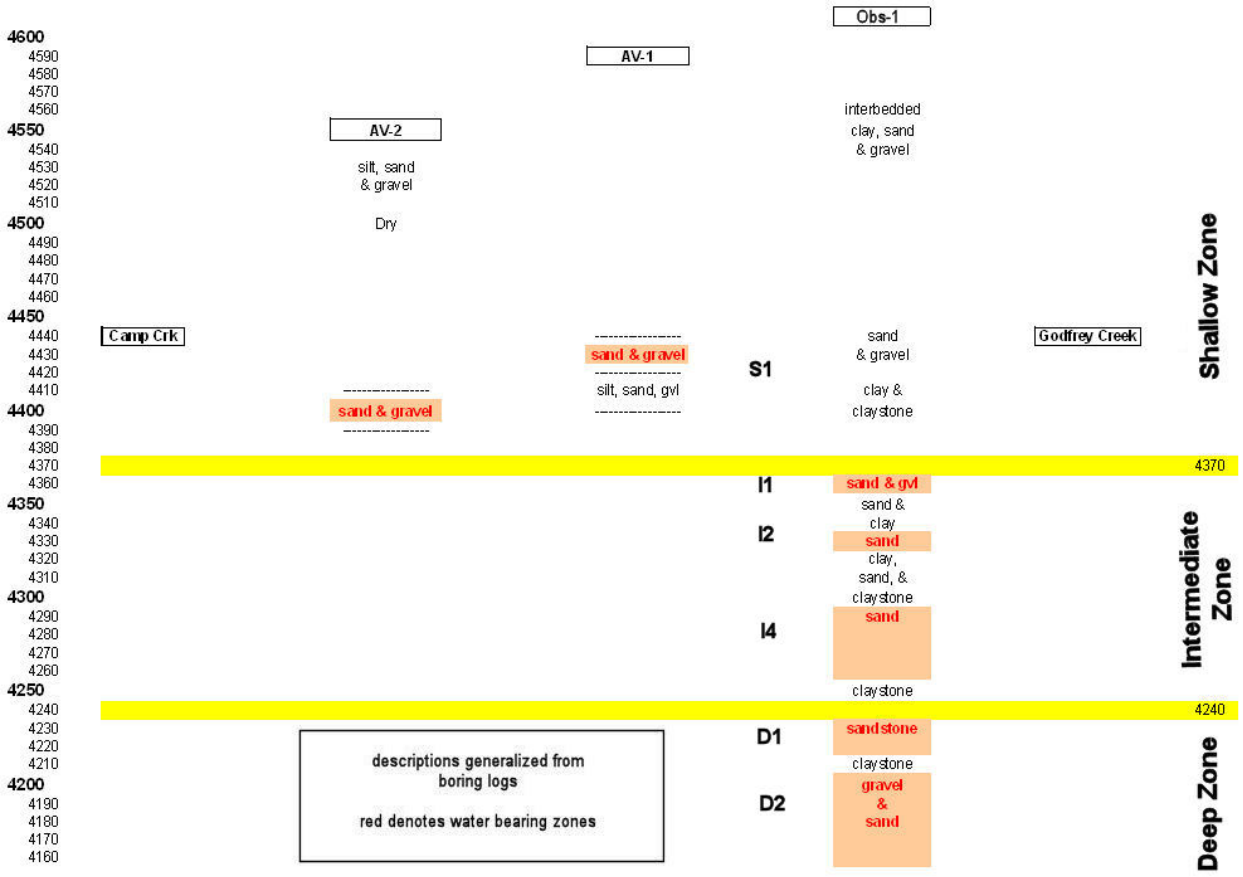
Although well logs in the area list multiple confining layers, it is doubtful these layers are continuous. In addition, numerous wells have been drilled through the confining layers, creating a conduit for vertical groundwater flow. Therefore, the aquifer located beneath the proposed subdivision is classified as leaky-confined for the purpose of this report and is assigned a rank of "Moderate Source Water Sensitivity" according to Table 2 of the Instructions for Completing a

PWS-6 Report for Community or Non-Community Non-Transient Public Water Supplies (DEQ Source Water Protection Program, 2002).

In September 2006 Red Tiger Drilling drilled a 460ft deep exploratory well in the vicinity of the proposed wells with oversight from PBS&J. Multiple layers of clay, silt, sand, and gravel were encountered. Water producing aquifers were encountered in the zones from 265 – 271ft bgs (50 gpm), 295 – 300ft bgs (20gpm), 335 – 340ft bgs (60gpm), 363 – 371ft bgs (100gpm) and 400ft bgs (85 gpm), but the water from these zones was sandy and would require a sand filter. An aquifer located in the zone 416 – 460ft bgs produced clear water in quantities over 100gpm. The driller was unable to drill deeper than 460ft bgs due to heaving sands, so the depth of this aquifer is not known. Water level in the exploratory well was measured at 163 feet below ground surface on October 15, 2006.

Groundwater is present beneath the site in a number of water bearing zones separated by finer grained units. Drilling logs from the site wells AV-1, AV-2, and Obs-1 were used to develop the schematic cross-section shown in Figure 3. The schematic is not to scale but is presented to illustrate the relative elevations of water bearing zones and surface water bodies. The schematic shows that the shallower water bearing zones intersected by wells AV-1 and AV-2 lie at roughly the same elevation as the two nearby creeks (Camp Creek and Godfrey Creek).

Figure 3: Site Cross-Section Schematic



The well log for Obs-1 on site describes the following water bearing zones and apparent flow rates:

- 265-271ft bgs (4,364-4,358ft MSL): 50gpm (I1)
- 295-300ft bgs (4,334-4,329ft MSL): 20gpm (I2)
- 335-371ft bgs (4,294-4,258ft MSL): 60-100gpm (I4)
- 400-413ft bgs (4,229-4,216ft MSL): 85gpm (D1)
- 416->460ft bgs (4,213-<4,169ft MSL): >100gpm (D2)

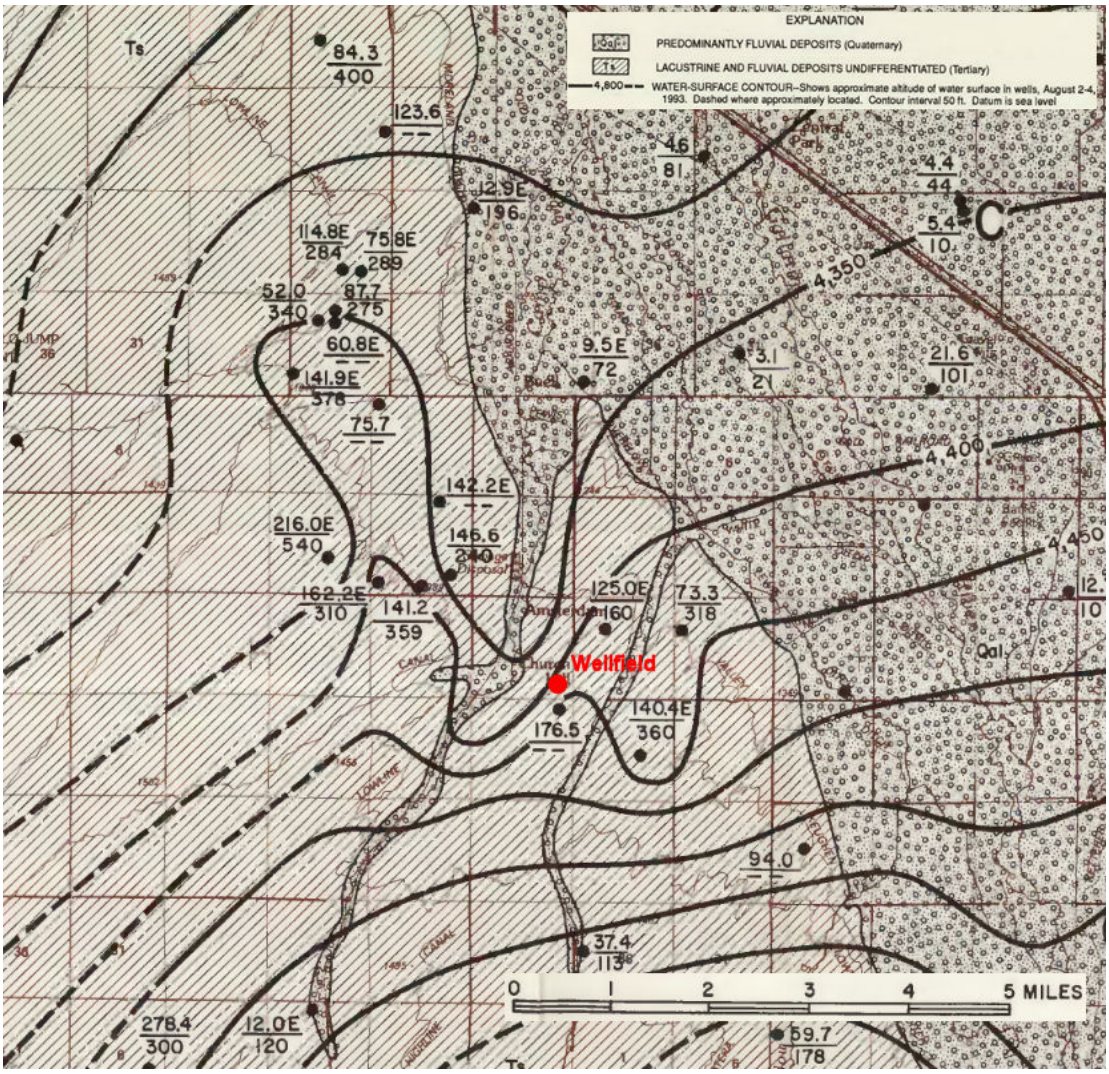
For comparison, the two Churchill North Subdivision wells produce from 248-259ft (4,283-4,272ft MSL) for PW-1 (GWIC 208723) or equivalent to the lower intermediate zone for Obs-1; and from 440ft (4,091ft MSL) for PW-2 (GWIC 220348) or deeper than the bottom of Obs-1.

For this evaluation the water bearing zones were broken into:

- "Shallow" (above elevation of 4,370ft MSL)
- "Intermediate" (elevation 4,370 to 4,240ft MSL), and
- "Deep" (below elevation 4,240ft MSL).

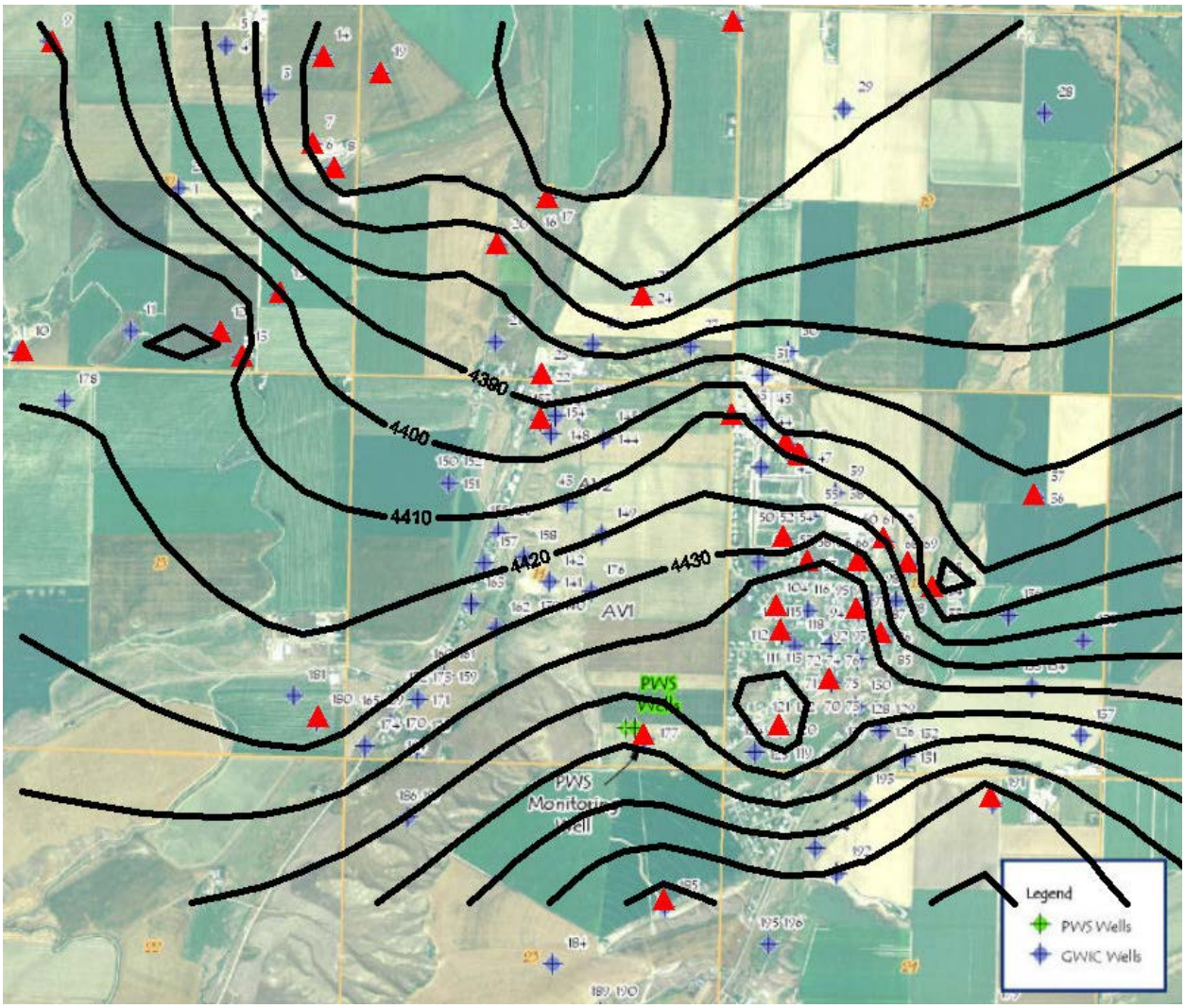
Contours of the depth to water in wells in the area from Slagle (1995) are shown in Figure 4, which depicts groundwater flow to the northwest at a gradient of 0.0426 in the immediate vicinity of the site. The upper number on the data points on Figure 4 is well depth, the lower number is depth to water.

Figure 4: Water Surface Contour Map (Slagle, 1995)



Water level data obtained from MBMG were used to develop a contour map using more wells in the vicinity of the site for greater resolution. A map of these contoured data is shown in Figure 5. The gradient shown is flatter than the regional map, at 0.013. The wells used were ones with open intervals deeper than 4,370 feet. An initial attempt to use all wells in the area indicated that at least some of the shallower wells are not connected to the deeper zones.

Figure 5: Potentiometric Map of the Amsterdam Village Area – Intermediate and Deep Zones

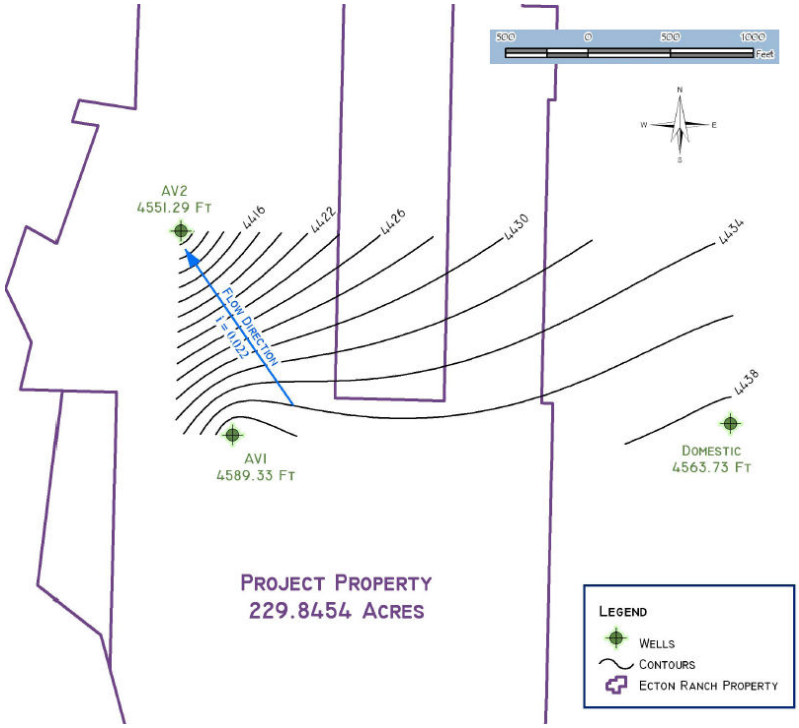


The static depth to water in wells compared to the depth of the water bearing units suggests the Tertiary aquifers are under pressure and confined (water levels rise in the wells above the top of the water bearing zones). Groundwater elevation differences in the data reviewed for the contour map above and well hydrographs discussed below suggest that the Shallow zone is not significantly hydraulically connected to the Intermediate and Deep zones. The difference in elevations between Intermediate and Deep zone wells is less significant, which may suggest these units are in communication.

Pumping test data from a deep zone irrigation well about 8 miles to the north (GWIC 217387) indicates that there is no connection between the deep zone and shallower zones. However, testing two other deep zone wells near the town of Manhattan (GWIC 223575 and 214959) shows a slight connection between the Deep zone and shallower zones.

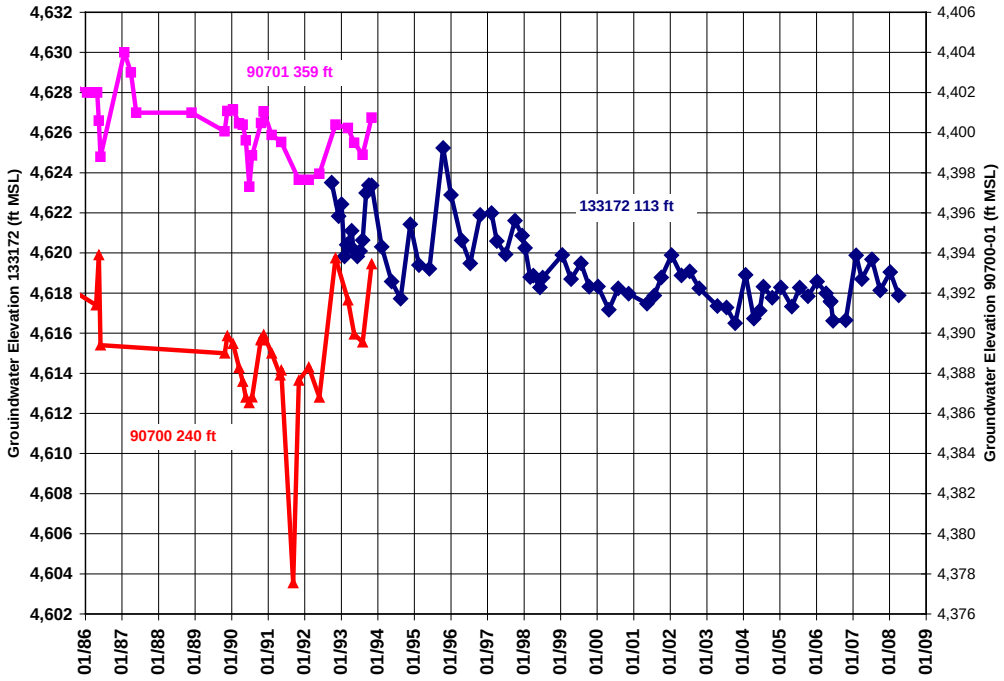
A map depicting groundwater contours for the shallow zone is shown in Figure 6. The contours are based on just three data points, but show a flow direction to the northwest, similar to the deeper zones.

Figure 6: Potentiometric Map of the Amsterdam Village Area – Shallow Zone



Hydrographs for three wells in T1S R3E are shown in Figure 7. The plots show that water levels declined slightly during the period 1986-2000, but appear to have remained stable since 2000. The wells show seasonal fluctuations of about 2-4ft with peaks generally in early to late spring and lows in the summer. The three wells are for different depths (113ft or 4545ft MSL, 240ft or 4300ft MSL, and 356ft or 4181ft MSL). The water levels indicate a significant downward gradient between the shallow and intermediate well (about 230ft) indicating confining units between these zones, and a rise or upward gradient between the intermediate and deeper wells (about 12 feet). This interpretation is a generalization because the wells are in different locations.

Figure 7: Well Hydrographs



Water Quality

Laboratory analytical data from the DEQ public water supply database and analysis results from site well samples were used to evaluate groundwater quality for the area around the proposed Amsterdam Village development. The MBMG GWIC database did not contain many samples within the nine section search area noted above, so the well search was expanded with wells beyond the original search area referred to below as "regional" water quality wells. Water Quality data obtained consists of the following:

- 13 site samples, including 5 each from wells AV-1 and AV-2 (only nitrate data for 8 of these samples) and 3 samples from Obs-1 (at two different depths);
- 11 samples from area PWS systems including 8 from Churchill North, 3 from the Churchill Retirement Home, 4 from Godfrey Canyon Estates, and 4 from the Manhatten Christian School. No data were available for the Dyksterhouse Subdivision in the DEQ database; and
- 22 GWIC samples from 16 locations outside the initial search area and referred to as "regional" wells (20 miles or less away from the site). The regional wells were classified by basin (Gallatin, Madison, or Jefferson).

A summary of the analysis results for all samples are contained in Appendix C. The location of the wells is shown on Figure 8 for regional wells and on Figure 9 for nearby wells. The well location for the Manhattan Christian School (F on map) appears erroneous; this well is in actuality located further to the east.

Figure 8: Regional Water Quality Sample Well Locations

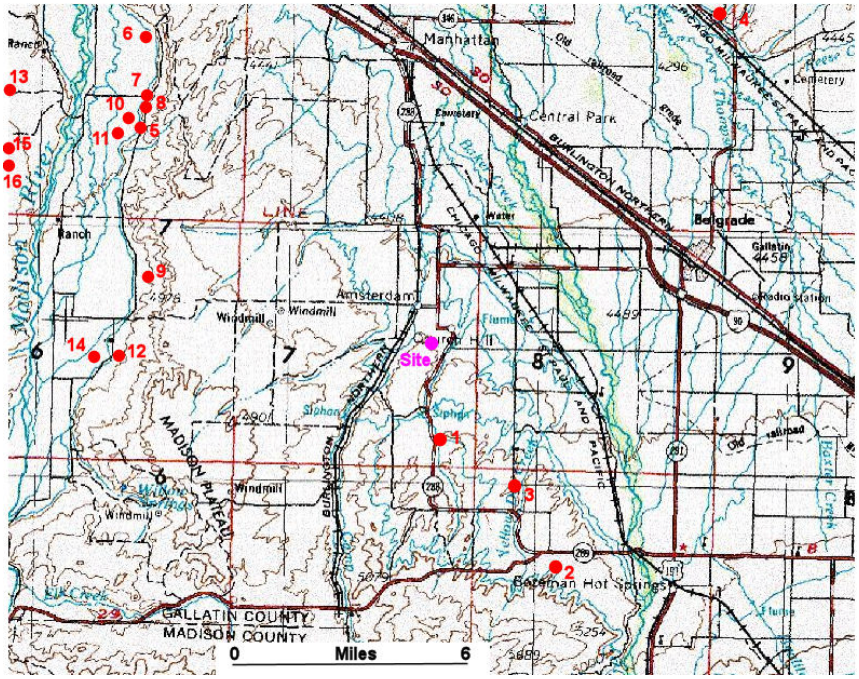
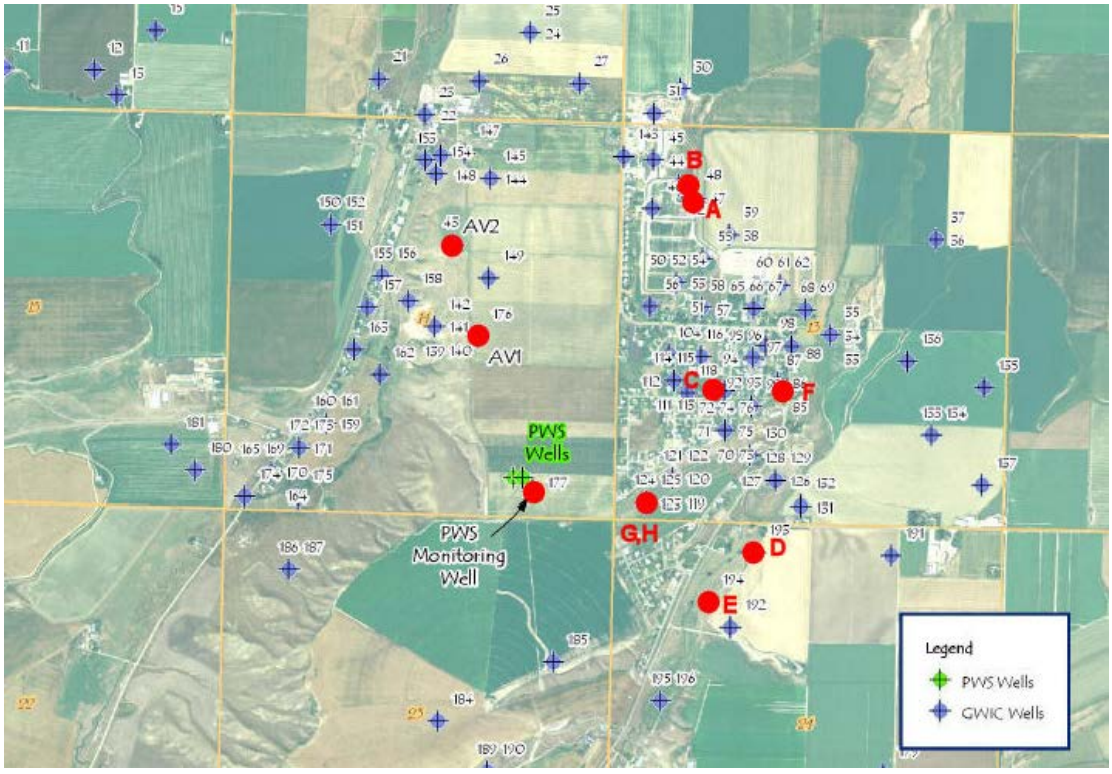
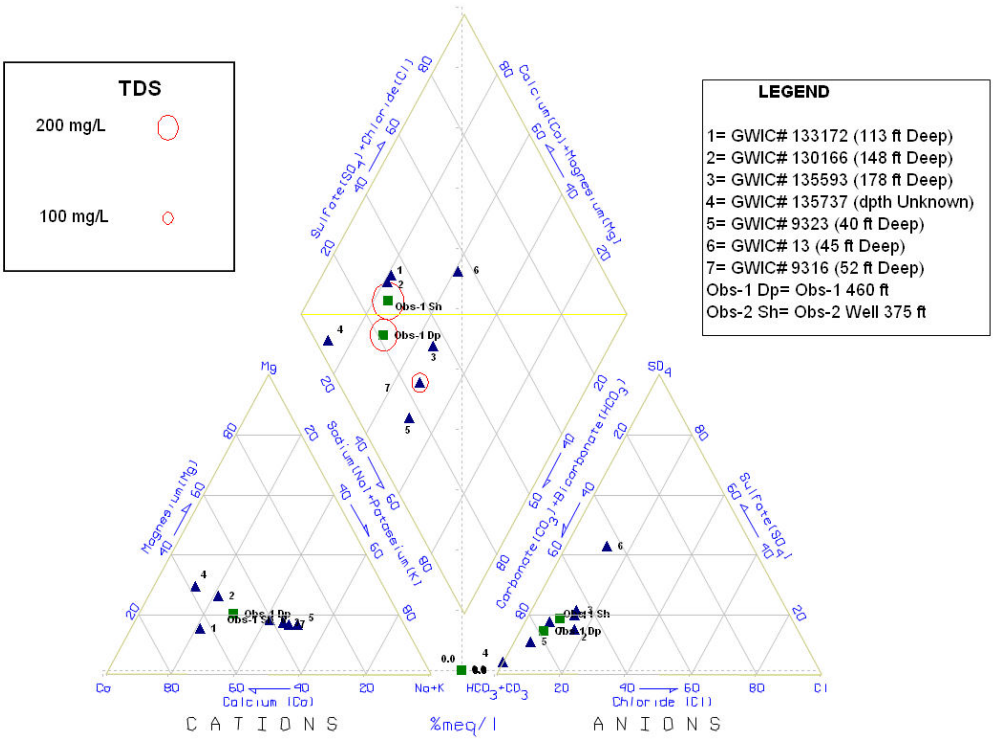


Figure 9: Nearby Water Quality Sample Well Locations



A piper diagram plot of the sample analysis data for wells 1-7 and two Obs-1 samples is shown in Figure 10. This plot summarizes the general characteristics of the groundwater and can be used to identify distinctly separate water types. The diagram shows that groundwater from all of these samples is generally similar and can be classified as calcium-carbonate type. The two Obs-1 samples plot in the same general area as all of the others indicating the water types are the same.

Figure 10: Piper Diagram of Select Well Samples



Exceeding groundwater standards in the regional samples is most prevalent for arsenic, with 14 of the 22 GWIC samples exceeding the standard of 10 ppb, with a range of 10-122 ppb. The closest wells to the site had concentrations of 5.6 ppb (#1), 5.6-10 ppb (#2), and 11.1 ppb (#3). The highest arsenic concentrations were for wells to the northwest near the Madison River.

Other exceedances for the regional wells include the Iron standard of 0.3 ppm (#1 at 0.33 ppm although a second sample was 0.005 ppm), the Sulfate standard of 250 ppm (#6 at 253 ppm although a second sample is 239 ppm, and #13 at 408 ppm), the nitrate standard of 10 ppm (#1 at 24.9 ppm but a second sample is 0.25 ppm), and the fluoride standard of 4 ppm (#1 at 11 ppm with a second sample at 0.3 ppm).

The local wells only showed exceedances for arsenic, with the range in concentrations being 2-17 ppb. Exceedances in the Obs-1 samples for iron, manganese, and aluminum could not be compared to other local wells because data was very limited or not available. Because of the

prevalence of arsenic at concentrations at or above the standard, this parameter was reviewed in greater detail. A summary of the arsenic data for the regional, local and site wells is shown on Table 6. The arsenic concentration data for each production zone and distance from Obs-1 is shown in Figure 11, with data from the wells close to the site only shown in Figure 12, with wells identified by zone.

Table 6 – Summary of Arsenic Data

Basin	Well	GWIC	Map ID	X	Y	Dist Frm MW-1	Grnd Elev	TD	Aquifer Elev	Unit	As Conc (ppb)
AH-Gallatin River	USGS Kammerman	133172	1	1507170.0	537444.2	12973	4682	113	4569	S	5.6
	Richard Bryan	130166	2	1522357.8	520803.0	33962	4982	148	4834	S	5.6
	Richard Bryan	130166	2	1522357.8	520803.0	33962	4982	148	4834	S	10
	Tom Kimm	135593	3	1516862.1	532263.5	21303	4778	178	4600	S	**11.1**
	Jim Scoggins	135737	4	1545328.0	592496.1	57978	4430	----	----	----	<1
AG-Madison River	Tom Rumbaugh	9323	5	1467578.2	577380.5	46631	4198	40	4158	S	**122**
	J&J VanDyk	13	6	1469130.1	590540.6	54264	4130	45	4085	S	**120**
	J&J VanDyk	13	6	1469130.1	590540.6	54264	4130	45	4085	S	**107**
	Dierdre Richardson	9316	7	1469130.1	582338.1	48497	4170	51.5	4118.5	S	**78**
	Steve Livingood	9317	8	1468618.3	581327.6	48226	4200	79	4121	S	**120**
	June Doak	16	9	1469874.9	558176.8	36532	4460	100	4360	S	**60**
	Marie Tinder	30	10	1467066.3	579434.4	48260	4155	108	4047	S	**116**
	Chuck&Roberta Williams	32	11	1467036.8	576445.5	46542	4225	145	4080	S	**89.4**
	Chuck&Roberta Williams	32	11	1467036.8	576445.5	46542	4225	145	4080	S	**101**
	H Shipton	6899	12	1462367.9	547864.7	43253	4302	180	4122	S	**45**
	TBE Stock Well 2	3	13	1450106.9	583220.7	64473	4425	----	----	----	5.3
	Ken Mills	890505	14	1464540.0	549013.0	41032	4318	----	----	----	**21**
AE-Jefferson R	Jack Cooper	9258	15	1422503.8	578778.2	87789	4190	60	4130	S	2.6
	Jack Cooper	9258	15	1422503.8	578778.2	87789	4190	60	4130	S	2.73
	Lane Brothers	9271	16	1441894.5	575303.7	68385	4415	209	4206	I	**19.4**
Gallatin-Local	Churchhill North PW1	208723	A	1507708.0	554260.9	4497	4531	257	4274	I	6
	Churchhill North PW1	208723	A	1507708.0	554260.9	4497	4531	257	4274	I	5
	Churchhill North PW1	208723	A	1507708.0	554260.9	4497	4531	257	4274	I	4
	Churchhill North PW1	208723	A	1507708.0	554260.9	4497	4531	257	4274	I	4
	Churchhill North PW2	220348	B	1507708.0	554260.9	4497	4531	440	4091	D	5
	Churchhill North PW2	220348	B	1507708.0	554260.9	4497	4531	440	4091	D	**13**
	Churchhill North PW2	220348	B	1507708.0	554260.9	4497	4531	440	4091	D	**13**
	Churchhill Ret Home	90740	C	1508159.9	551640.6	2926	4577	230	4347	I	6
	Churchhill Ret Home	90740	C	1508159.9	551640.6	2926	4577	230	4347	I	7
	Godfrey Can Est Well 1	90815	D	1507287.0	547473.8	3330	4541	188	4353	I	6
	Godfrey Can Est Well 1	90815	D	1507287.0	547473.8	3330	4541	188	4353	I	5
	Godfrey Can Est Well 2	146054	E	1507935.0	548817.1	2816	4531	188	4343	I	3
	Godfrey Can Est Well 2	146054	E	1507935.0	548817.1	2816	4531	188	4343	I	2
	Manh. Christian School	225403	F	1508877.7	551753.1	3624	4544	453	4091	D	**15**
	Manh. Christian School	225403	F	1508877.7	551753.1	3624	4544	453	4091	D	**17**
	Manh. Christian School	225403	F	1508877.7	551753.1	3624	4544	453	4091	D	**15**
Gallatin-Site	Obs-1	230271	Obs-1	1505551.0	550315.3	1	4629	460	4169	D	**25**
	Obs-1	230271	Obs-1	1505551.0	550315.3	1	4629	375	4254	I	9
	Obs-1	230271	Obs-1	1505551.0	550315.3	1	4629	375	4254	I	9
	AV-1	236239	AV-1	1504807.4	552374.4	2189	4590	165	4425	S	84
	AV-2	236240	AV-2	1504479.0	553621.7	3476	4547	148	4399	S	**10**

Figure 11: Plot of Arsenic Concentration versus Distance from Obs-1 (All Well)

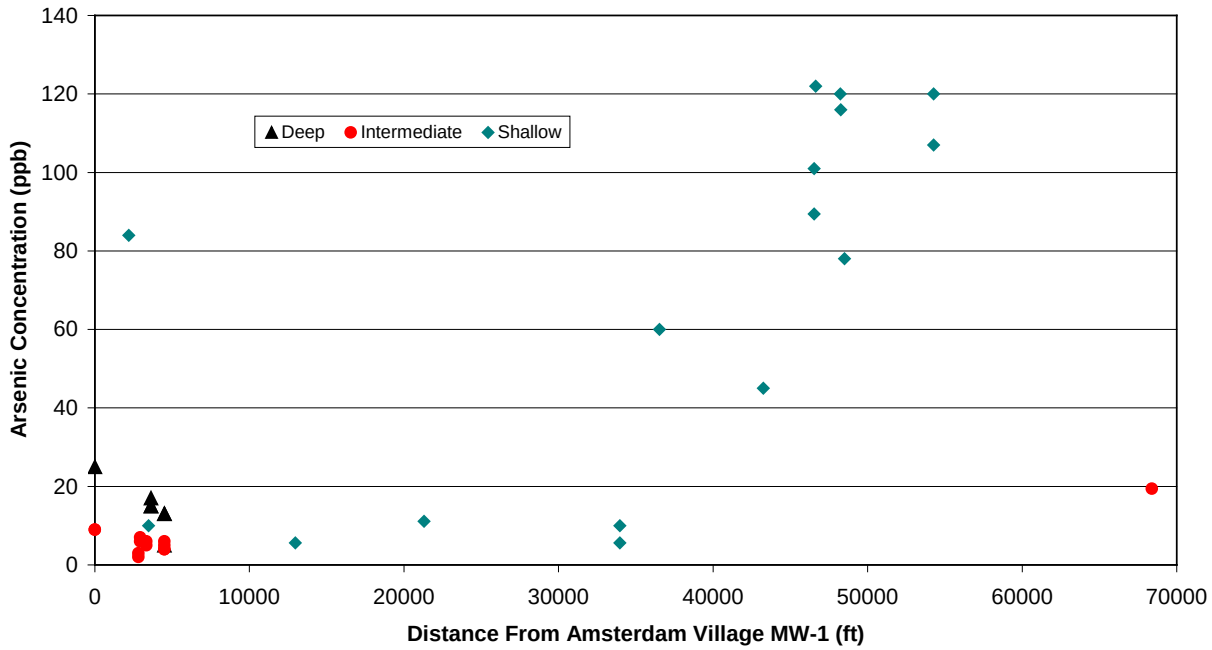
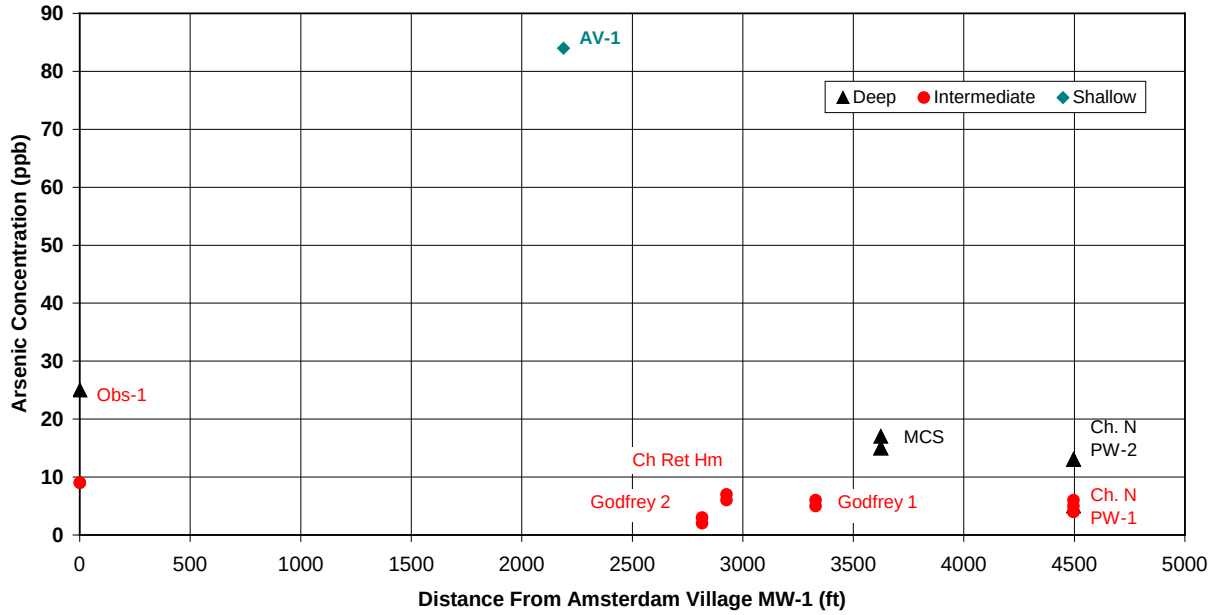


Figure 12: Plot of Arsenic Concentration versus Distance from Obs-1 (Local Wells)



The arsenic concentration plot on Figure 12 suggests that the Deep zone tends to have higher concentrations, with most above the standard of 10 ppb, while the Intermediate zone is below the standard. Samples from the Shallow zone also contain arsenic at and above the standard. The regional wells are all shallow except for one which is in the Intermediate zone and had an arsenic concentration of 19.4 ppb, higher than the local Intermediate zone wells. The regional Shallow zone wells are likely more representative of conditions specific to that area and may not be of particular relevance to the Shallow zone near the site.

Conclusion

A review of well logs from the Montana Bureau of Mines and Geology (MBMG) indicates that the average well depth in the vicinity of the site is 160 feet with the average yield at about 67gpm, although both depth and yield show a wide range. Most of the wells in the area produce less than 100gpm, with only 11 wells greater than that amount. There does not appear to be any correlation between depth and yield.

A review of regional and local water quality samples shows that groundwater from all three zones is generally similar and can be classified as calcium-carbonate type. Arsenic is prevalent in the groundwater, and data suggests that the Deep zone tends to have higher concentrations, with most above the standard of 10 ppb, while the Intermediate zone is below the standard. Samples from the Shallow zone also contain arsenic at and above the standard.

APPENDIX A

Sanitary Sewer System Calculations

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Dec 9 2014

Sanitary Sewer - Peak Flow in 8in Pipe

Circular

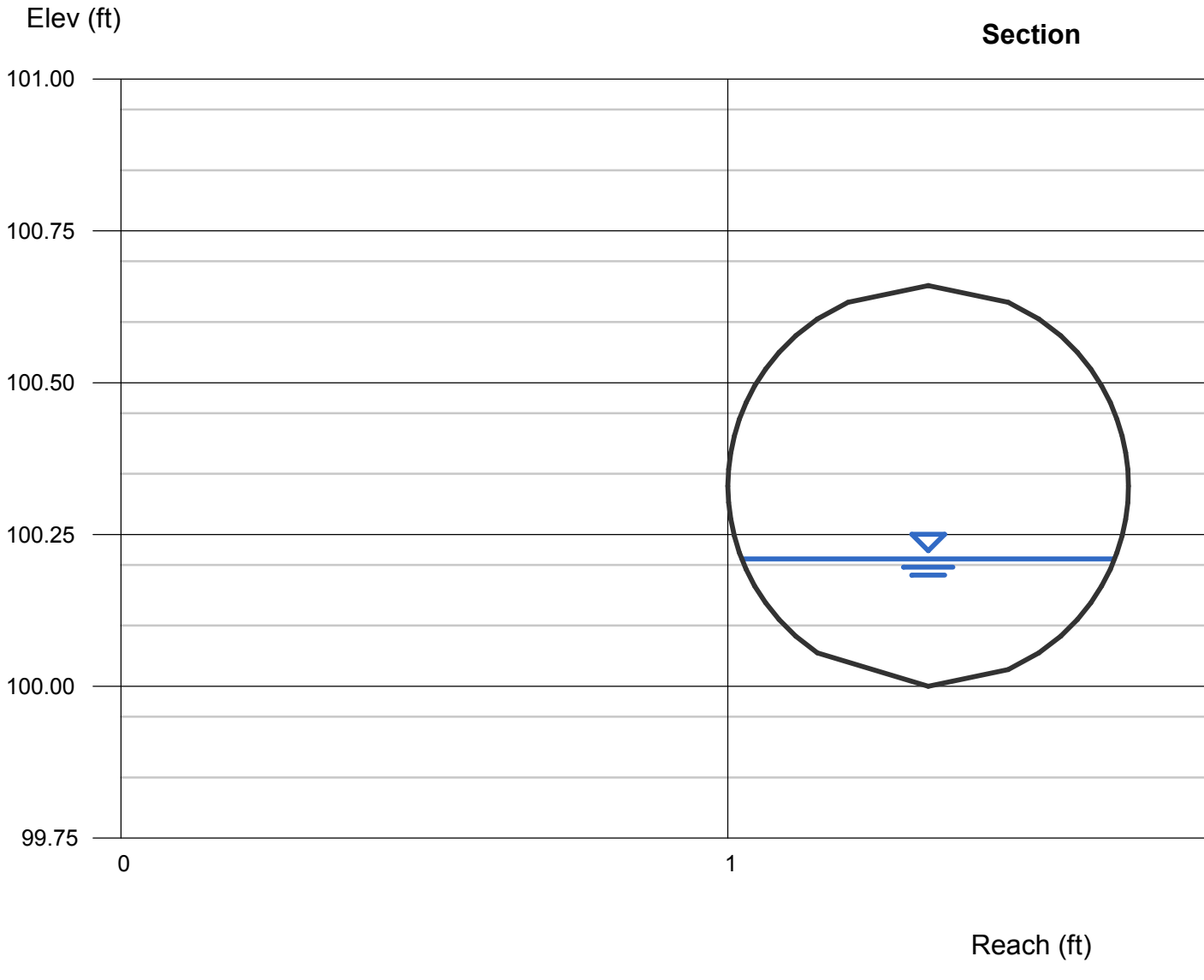
Diameter (ft)	= 0.66
Invert Elev (ft)	= 100.00
Slope (%)	= 0.40
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.16

Highlighted

Depth (ft)	= 0.21
Q (cfs)	= 0.156
Area (sqft)	= 0.09
Velocity (ft/s)	= 1.66
Wetted Perim (ft)	= 0.79
Crit Depth, Yc (ft)	= 0.19
Top Width (ft)	= 0.62
EGL (ft)	= 0.25



APPENDIX B

Storm Water Calculations

Hydrograph Report

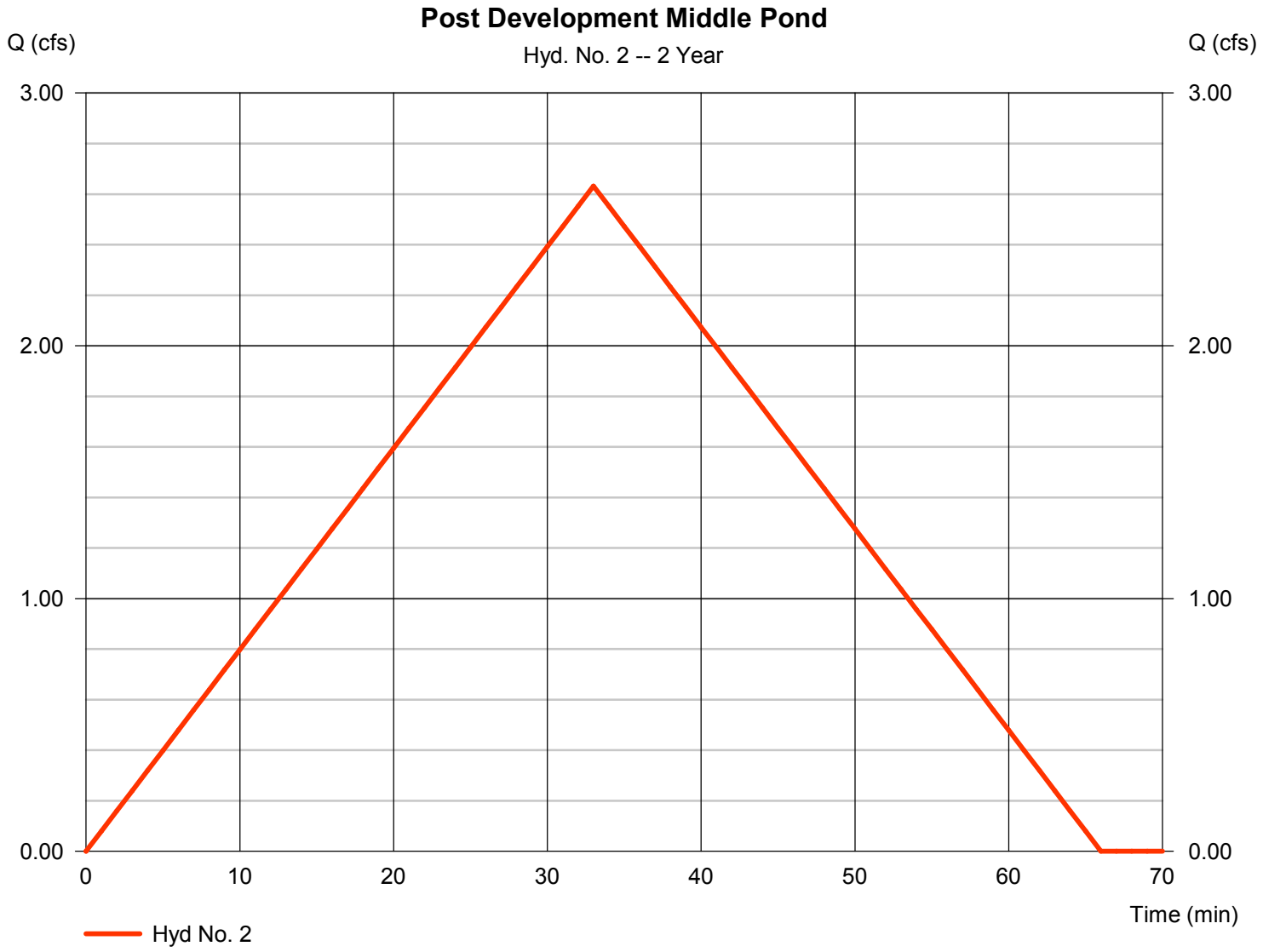
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 12 / 1 / 2014

Hyd. No. 2

Post Development Middle Pond

Hydrograph type	= Rational	Peak discharge	= 2.632 cfs
Storm frequency	= 2 yrs	Time to peak	= 33 min
Time interval	= 1 min	Hyd. volume	= 5,211 cuft
Drainage area	= 11.200 ac	Runoff coeff.	= 0.4*
Intensity	= 0.587 in/hr	Tc by TR55	= 33.00 min
IDF Curve	= AmsterdamIDF.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(10.400 x 0.30) + (0.800 x 0.90)] / 11.200



Hydrograph Report

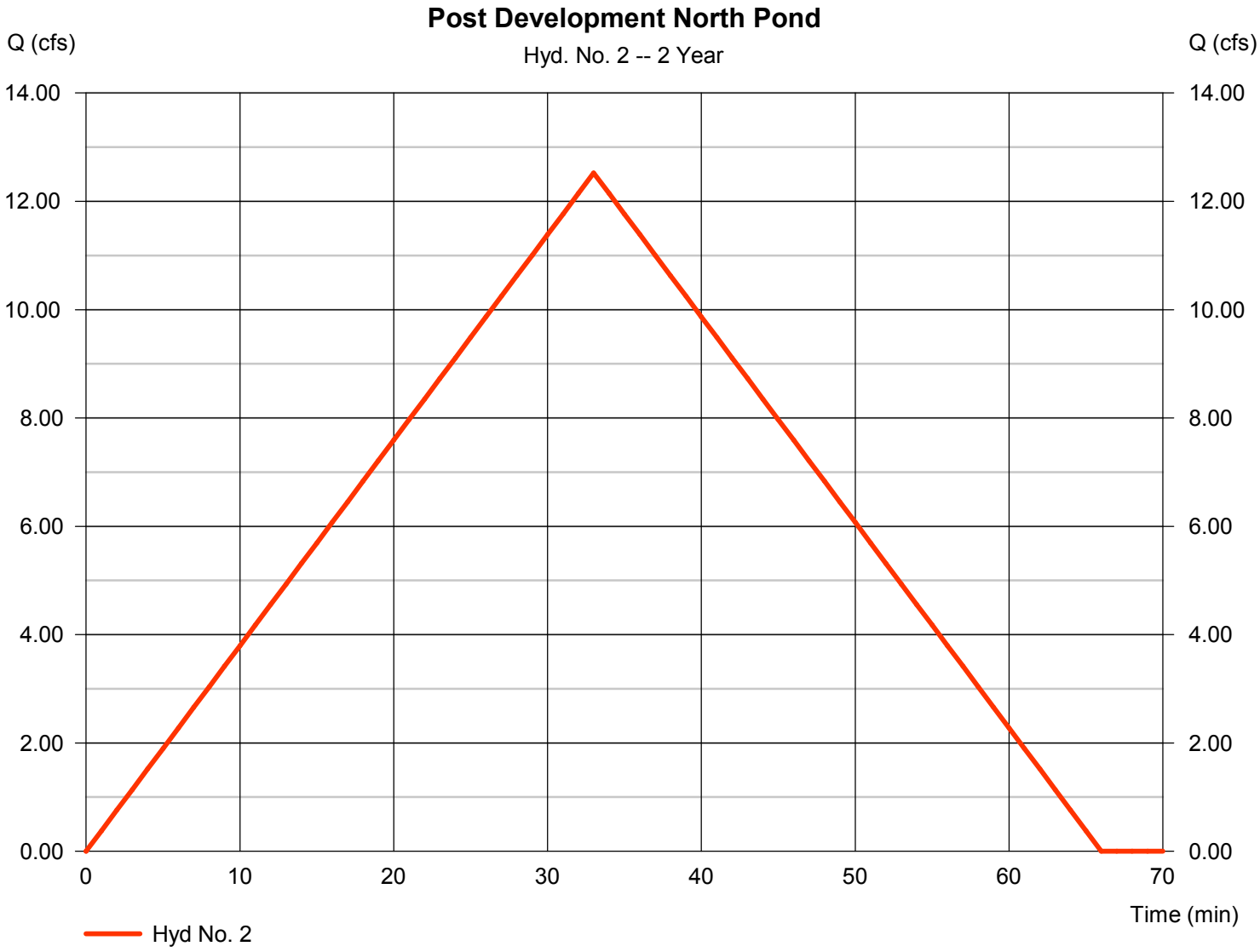
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 12 / 1 / 2014

Hyd. No. 2

Post Development North Pond

Hydrograph type	= Rational	Peak discharge	= 12.52 cfs
Storm frequency	= 2 yrs	Time to peak	= 33 min
Time interval	= 1 min	Hyd. volume	= 24,798 cuft
Drainage area	= 53.300 ac	Runoff coeff.	= 0.4*
Intensity	= 0.587 in/hr	Tc by TR55	= 33.00 min
IDF Curve	= AmsterdamIDF.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(10.400 x 0.30) + (0.800 x 0.90)] / 53.300



Hydrograph Report

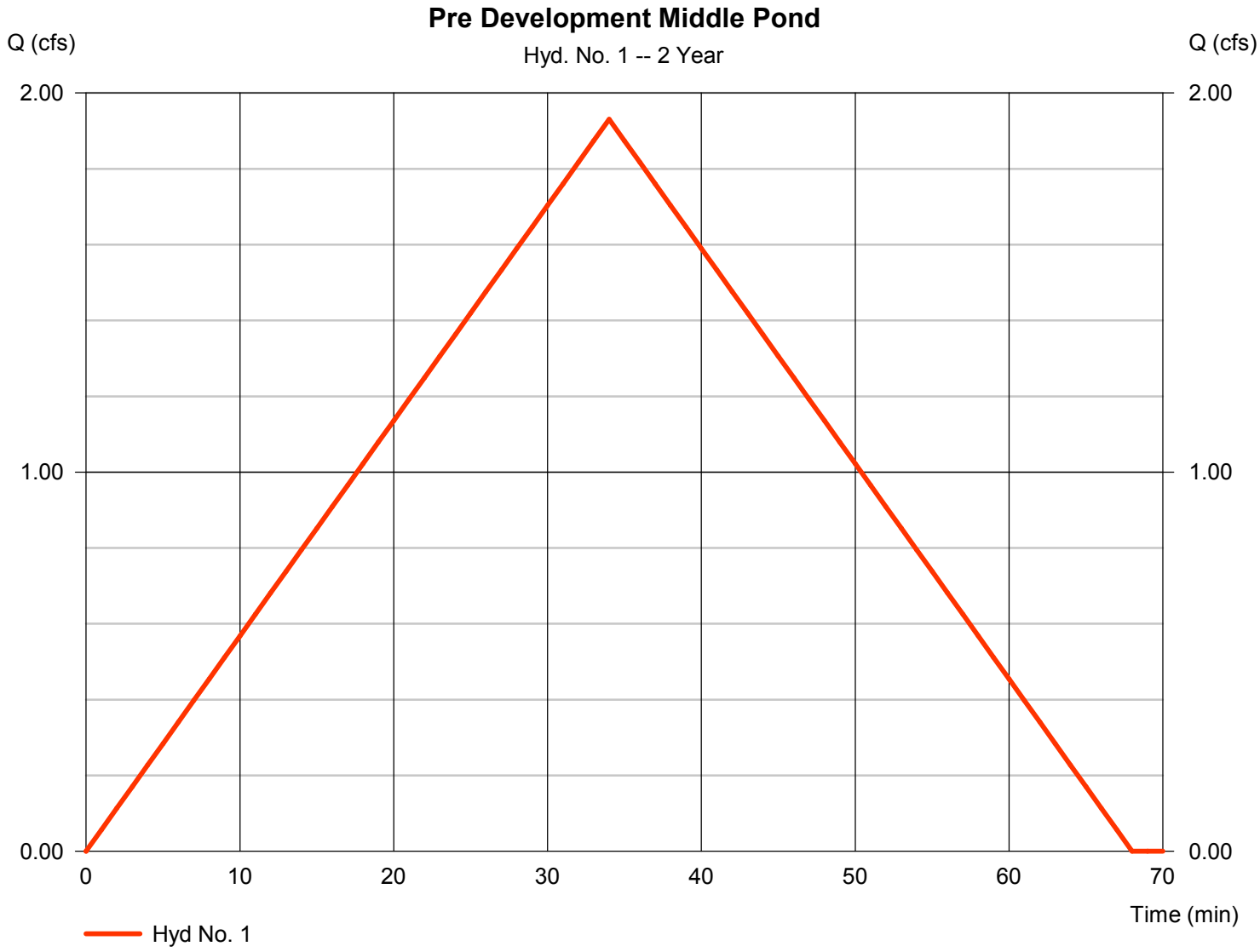
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 12 / 1 / 2014

Hyd. No. 1

Pre Development Middle Pond

Hydrograph type	= Rational	Peak discharge	= 1.931 cfs
Storm frequency	= 2 yrs	Time to peak	= 34 min
Time interval	= 1 min	Hyd. volume	= 3,938 cuft
Drainage area	= 11.200 ac	Runoff coeff.	= 0.3*
Intensity	= 0.575 in/hr	Tc by TR55	= 34.00 min
IDF Curve	= AmsterdamIDF.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(11.200 x 0.30)] / 11.200



Hydrograph Report

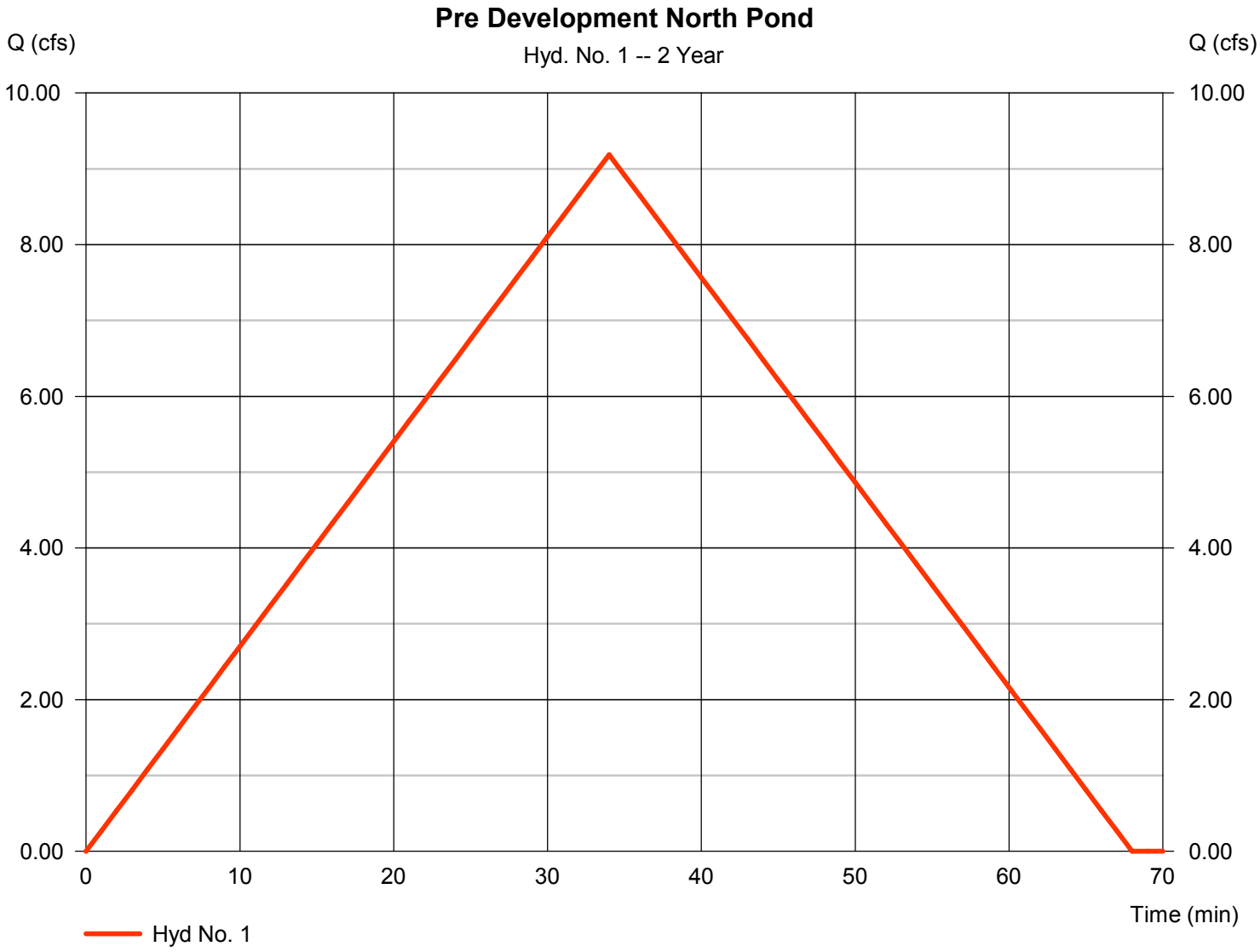
Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 Monday, 12 / 1 / 2014

Hyd. No. 1

Pre Development North Pond

Hydrograph type	= Rational	Peak discharge	= 9.187 cfs
Storm frequency	= 2 yrs	Time to peak	= 34 min
Time interval	= 1 min	Hyd. volume	= 18,742 cuft
Drainage area	= 53.300 ac	Runoff coeff.	= 0.3*
Intensity	= 0.575 in/hr	Tc by TR55	= 34.00 min
IDF Curve	= AmsterdamIDF.IDF	Asc/Rec limb fact	= 1/1

* Composite (Area/C) = [(11.200 x 0.30)] / 53.300



Weir Calculations – Middle Pond

The middle pond has is to contain 120,000 gallons (16,042 ft^3) of fire pond volume plus the volume for a 2-year event (1,273 ft^3). The pond is to be 3 feet deep plus an additional 1 foot of freeboard. At 2.8' the pond holds the required fire pond volume and at 2.99' the pond holds the fire pond volume together with the 2 year event. The weir is to have an elevation at the 2.8'. Conservatively the head at this location would be 1.2'. Using a trapezoidal weir, the width is

$Q = 3.367bh^{3/2}$

$1.931cfs = 3.367\ b\ (1.2')^{3/2}$

b = 0.436ft

Weir Calculations – North Ponds

The north ponds are to contain the 2- year storm event of 6,056 cubic feet. The ponds are to each be 2 feet deep plus an additional 1 foot of freeboard. Conservatively the head at this location would be 1'. Using a trapezoidal weir, the width is

$Q = 3.367bh^{3/2}$

$9.187cfs = 3.367\ b\ (1')^{3/2}$

b = 2.73ft

APPENDIX C

Water Quality and Quantity Data

	Water Quality Standards		
Map ID:			
Gwic Id	Drinking Water	Stock	Irrigation
Site Name	Standards		
Twnshp/Rng			
Sec			
Q Sec			
Aquifer			
Depth (ft)			
Comp Date			
Sample			
Sample Date			
Water Temp	--	---	---
Lab pH	--	---	---
Lab SC	--	---	---
Ca (mg/l)	--	---	---
Mg (mg/l)	--	2,000 mg/L	---
Na (mg/l)	250 mg/L [smcl]	2,000 mg/L	see SAR
K (mg/l)	--	---	---
Fe (mg/l)	0.3 mg/L [smcl]	---	---
Mn (mg/l)	0.05 mg/L [smcl]	---	2.0 mg/L
SiO2 (mg/l)	--	---	---
HCO3 (mg/l)	--	---	---
CO3 (mg/l)	--	---	---
SO4 (mg/l)	250 mg/L [smcl]	1,500 mg/L	[b]
Cl (mg/l)	250 mg/L [smcl]	1,500 mg/L	---
NO3 (mg/l)	10 mg/L [mcl]	100 mg/L	---
F (mg/l)	4 mg/L [mcl]	2 mg/L	---
OPO4 (mg/l)	--	---	---
Al (ug/l)	50-200 ug/L [smcl]	---	1,000 ug/L
As (ug/l)	10 ug/L [mcl]	50 ug/L	100 ug/L
B (ug/l)	--	---	---
Ba (ug/l)	2,000 ug/L [md]	---	---
Br (ug/l)			
Cd (ug/l)	5 ug/L [mcl]	10 ug/L	5 ug/L
Co (ug/l)	--	1,000 ug/L	50 ug/L
Cr (ug/l)	100 ug/L [mcl]	1,000 ug/L	100 ug/L
Cu (ug/l)	1,300 ug/L [md]	500 ug/L	200 ug/L
Li (ug/l)	--	---	2,500 ug/L
Mo (ug/l)	--	---	5 ug/L
Ni (ug/l)	--	---	200 ug/L
Pb (ug/l)	15 ug/L [mcl]	50 ug/L	5,000 ug/L
Sb (ug/l)	6 ug/L [mcl]	---	---
Se (ug/l)	50 ug/L [mcl]	50 ug/L	20 ug/L
Sr (ug/l)	--	---	---
Ti (ug/l)	--	---	---
V (ug/l)	--	---	---
Zn (ug/l)	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L

Key: **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; --- = Currently no

Basin AH - Gallatin River						
1			2		3	4
133172	133172	133172	130166		135593	135737
USGS Kammerman			Richard Bryan		Tom Kimm	Jim Scoggins
1S 3E	1S 3E	1S 3E	2S 4E	2S 4E	2S 4E	1N 4E
36	36	36	16	16	5	1
BCCD	BCCD	BCCD	BCCA	BCCA	BCBB	DDBD
120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS
113	113	113	148	148	178	
01/01/52	01/01/52	01/01/52				
1952Q0103	1952Q0104	2006Q1165	1992Q1213	2006Q1160	1994Q0073	2004Q0546
06/24/52	08/15/52	05/24/06	09/11/92	05/22/06	07/19/93	06/07/04
10.6	46.1		12.2			12.1
8.1	8.6	6.96	7.85	7.01	7.82	7.75
857	615	417	455	546	830	427
60	6.6	58.9	51.2	58.3	65.2	57.6
28	0.1	8.24	15.4	17.9	17.2	17.1
61	119	19.8	22.1	34.4	86.9	12.6
11	1.4	7.78	7.2	6.97	16.9	5.93
0.33		0.005	0.01	0.012	0.01	0.007
		0.003	<.002	<0.001	<.002	<0.001
47	7	53.2	50	38.8	51.8	59.9
172	104	167.9	244	215.9	344	264.7
0	4	0	0	0	0	0
83	116	36.8	33.8	67.4	82.7	5.88
75	31	23	9.8	33.1	46.8	2.13
24.9	0.25	2.18 P	0.466	1.19 P	3.35	<0.5 P
0.3	11	0.411	0.53	0.561	0.55	0.318
		<0.05	<.05	<0.05	0.54	<0.05
		<10	<20.	<10	<30.	35.8
		5.6	5.6	10	11.1	<1
190	300	44.1	59	67.6	130	39.4
		286	116	150	66.9	198
		<50	67	331	<100.	<50
		<1	<2.	<1	<2.	<1
		<2		<2	<2.	<2
		<2	<2.	3.43	<2.	4.62
		<2	<2.	2.43	<2.	<2
		11	<6.	9.22	<6.	14.6
		<10	<20.	<10	<20.	<10
		<2	<2.	<2	<2.	<2
		<2	<3.	<2	<2.	<2
		<2		<2		<2
		3.2	<.8	4.08	5.2	<1
		470	256	270	187	268
		<1	<10.	<1	<10.	<1
		10	15.2	18.6	8.2	<5
		<2	860	3.59	<2.	2.52

	Water Quality Standards			Basin AG - Madison River											
			Map ID:	5	6		7	8	9	10	11		12	13	14
Gwic Id	Drinking Water	Stock	Irrigation	9323	13		9316	9317	16	30	32		6899	3	890505
Site Name	Standards			Tom Rumbaugh	J&J Van Dyk CR-04		Dierdre Richardson	Steve Livingood	June Doak	Marie L Thider	Chuck and Roberta Williams		H Shipton BJSM-04	T&E Stock Well 2	Ken Mills
Twnshp/Rng				1N 2E	1N 2E	1N 2E	1N 2E	1N 2E	1N 2E	1N 2E	1N 2E	1N 2E	1S 2E	1N 1E	1S 2E
Sec				22	10	10	22	22	15	22	27	27	21	13	22
Q Sec				CDCC	DBAB	DBAB	ABBB	BADD	CDB	CABD	BBDA	BBDA	DBDB	DDDD	BCCB
Aquifer				120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS	120SDMS
Depth (ft)				40	45	45	51.5	79	100	108	145	145	180		
Comp Date				09/09/73			08/13/74	07/10/89	09/04/79		04/02/80	04/02/80			
Sample				19920 1396	19890 0557	19920 1405	19890 0588	19940 0567	19890 0567	19890 0569	19960 0692	20080 0036	19890 0571	19830 1141	19890 0568
Sample Date				09/23/92	05/04/89	09/23/92	05/10/89	09/17/93	05/05/89	05/05/89	05/09/96	07/18/07	05/09/89	11/09/83	05/05/89
Water Temp	---	---	---	13.3		11.1			13		11.7	12.3	16.9	13.6	17
Lab pH	---	---	---	8.34	7.9	7.91	8.05	7.66	7.69	7.84	7.72	6.93	8.07	8.09	7.61
Lab SC	---	---	---	703	1202.6	1262	754.1	698	1018.7	668.6	785	678	593.9	1746	1137.4
Ca (mg/l)	---	---	---	48.8	95.7	116	56.5	55.4	89.7	46.5	62	48.8	59	113	130
Mg (mg/l)	---	2,000 mg/L	---	13.7	24.8	31	14.7	15	21.2	13	16	12.2	26.4	11.2	31.7
Na (mg/l)	250 mg/L [smd]	2,000 mg/L	see SAR	78.9	108	113	84.8	73	84.4	74.6	78	77.4	27	227	54.9
K (mg/l)	---	---	---	18	23	26	12	11.3	21	11.3	19	18.7	5.2	28.8	18.5
Fe (mg/l)	0.3 mg/L [smd]	---	---	0.01	0.19	0.113	<.002	<.003	0.014	<.002	<.003	<0.005	<.002	0.19	<.002
Mn (mg/l)	0.05 mg/L [smcl]	---	2.0 mg/L	<.002	0.039	0.046	<.001	<.002	0.001	<.001	<.002	<0.001	<.001	0.014	<.001
SiO2 (mg/l)	---	---	---	66	55.9	60.8	50.2	54	60.8	49.5	60.8	57.1	50.7	31.9	55.6
HCO3 (mg/l)	---	---	---	376	330	382	360	343	334	334	290	257.7	284.9	188.4	290.8
CO3 (mg/l)	---	---	---	0	0	0	0	0	0	0	0	0	0	0	0
SO4 (mg/l)	250 mg/L [smd]	1,500 mg/L	[b]	32.7	239	253	60.5	43.5	193	40.4	111	80.8	24.9	408	216
Cl (mg/l)	250 mg/L [smd]	1,500 mg/L	---	16.5	58.4	84.6	25	31.4	29.3	18.6	37	30.9	32	192	43.4
NO3 (mg/l)	10 mg/L [md]	100 mg/L	---	1.17	0.01	<.2	1.5	0.59	0.56	0.9	2.63 P	1.57 P	2.5	5.2	21.5
F (mg/l)	4 mg/L [mcl]	2 mg/L	---	0.6	1.6	1.3	2.4	2.49	1.3	2.2	<1.	1.76	1.4	1.1	0.9
OPO4 (mg/l)	---	---	---	<.1	0.2	<.1	0.1	0.066	0.1	<.1		<0.05	0.1		<.1
Al (ug/l)	50-200 ug/L [smd]	---	1,000 ug/L	<50.	<30.	<50.	<30.	<30.	<30.	<30.	<30.	<2.0	<30.	<30.	<30.
As (ug/l)	10 ug/L [md]	50 ug/L	100 ug/L	122	120	107	78	120	60	116	89.4	101	45	5.3	21
B (ug/l)	---	---	---	394	670	621	730	552	540	390	442	424	190	90	220
Ba (ug/l)	2,000 ug/L [mcl]	---	---	35		65		42			34.2	24.9			
Br (ug/l)				<100.	<100.	288	<100.	117	<100.	<100.	154	77	<100.		<100.
Cd (ug/l)	5 ug/L [md]	10 ug/L	5 ug/L	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<2.	<0.1	<2.	<2.	<2.
Co (ug/l)	---	1,000 ug/L	50 ug/L					<2.			<2.	<0.1			
Cr (ug/l)	100 ug/L [mcl]	1,000 ug/L	100 ug/L	<2.	<2.	3.3	<2.	<2.	<2.	<2.	<2.	<0.1	<2.	5	<2.
Cu (ug/l)	1,300 ug/L [mcl]	500 ug/L	200 ug/L	2.5	<2.	<2.	8	<2.	16	5	<2.	0.5	3	3	<2.
Li (ug/l)	---	---	2,500 ug/L	120	190	208	190	186	100	160	97	117	130	69	60
Mo (ug/l)	---	---	5 ug/L	36	30	52	20	21.4	50	27	44	42.7	<20.	<20.	100
Ni (ug/l)	---	---	200 ug/L	<2.	<10.	2.7	<10.	<2.	<10.	<10.	9.2	0.169	<10.	<10.	<10.
Pb (ug/l)	15 ug/L [md]	50 ug/L	5,000 ug/L	<3.	<40.	<3.	<40.	<2.	<40.	<40.	<2.	<0.2	<40.	<40.	<40.
Sb (ug/l)	6 ug/L [md]	---	---					<2.			<2.	0.39			
Se (ug/l)	50 ug/L [md]	50 ug/L	20 ug/L					<1.			6.7	5.51		21	
Sr (ug/l)	---	---	---	352	640	808	320	317	600	240	488	459	360	1150	870
Ti (ug/l)	---	---	---	27	<1.	160	<1.	<10.	3	<1.	<10.	0.595	<1.	14	1
V (ug/l)	---	---	---	4.3	<1.	<5.	<1.	5.5	<1.	<1.	9.7	7.85	20	5	<1.
Zn (ug/l)	5,000 ug/L [smd]	24,000 ug/L	2,000 ug/L	12	<3.	6.4	17	10.1	6	687	<2.	0.3	30	160	19

Key: **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; **---** = Currently no

	Water Quality Standards			Basin AE-Jefferson River		
			Map ID:	15		16
Gwic Id	Drinking Water	Stock	Irrigation	9258		9271
Site Name	Standards			Jack Cooper		Lane Brothers
Twnshp/Rng				1N 1E	1N 1E	1N 1E
Sec				19	19	26
Q Sec				DDCB	DDCB	BDDD
Aquifer				120SDMS	120SDMS	120SDMS
Depth (ft)				60	60	209
Comp Date				06/15/83	06/15/83	07/08/70
Sample				1996Q0688	2008Q0067	1996Q0689
Sample Date				05/10/96	07/31/07	05/10/96
Water Temp	--	---	---	10.3	11.7	10.7
Lab pH	--	---	---	7.96	7.07	8.45
Lab SC	--	---	---	564	502	912
Ca (mg/l)	--	---	---	63.5	49.1	88.3
Mg (mg/l)	--	2,000 mg/L	---	16.8	13.6	8.9
Na (mg/l)	250 mg/L [smcl]	2,000 mg/L	see SAR	32.4	31.7	87.8
K (mg/l)	--	---	---	9.4	9.43	18.7
Fe (mg/l)	0.3 mg/L [smcl]	---	---	<.003	<0.005	0.071
Mn (mg/l)	0.05 mg/L [smcl]	---	2.0 mg/L	<.002	<0.001	0.291
SiO2 (mg/l)	--	---	---	37.4	33.2	27.2
HCO3 (mg/l)	--	---	---	250.34	209.1	184.95
CO3 (mg/l)	--	---	---	0	0	3.84
SO4 (mg/l)	250 mg/L [smcl]	1,500 mg/L	[b]	76.1	63.1	198
Cl (mg/l)	250 mg/L [smcl]	1,500 mg/L	---	14	13.8	71.5
NO3 (mg/l)	10 mg/L [mcl]	100 mg/L	---	1.23 P	0.871 P	< 25 P
F (mg/l)	4 mg/L [mcl]	2 mg/L	---	<1.	0.668	<1.
OPO4 (mg/l)	--	---	---		<0.05	
Al (ug/l)	50-200 ug/L [smcl]	---	1,000 ug/L	<30.	3.92	<30.
As (ug/l)	10 ug/L [mcl]	50 ug/L	100 ug/L	2.6	2.73	19.4
B (ug/l)	--	---	---	<80.	15.7	<80.
Ba (ug/l)	2,000 ug/L [md]	---	---	41.1	36	25.1
Br (ug/l)				<125.	<50	593
Cd (ug/l)	5 ug/L [mcl]	10 ug/L	5 ug/L	<2.	<0.1	<2.
Co (ug/l)	--	1,000 ug/L	50 ug/L	<2.	<0.1	<2.
Cr (ug/l)	100 ug/L [mcl]	1,000 ug/L	100 ug/L	<2.	<0.1	<2.
Cu (ug/l)	1,300 ug/L [md]	500 ug/L	200 ug/L	<2.	0.325	<2.
Li (ug/l)	--	---	2,500 ug/L	23	19.9	27
Mo (ug/l)	--	---	5 ug/L	16.7	16.2	12.6
Ni (ug/l)	--	---	200 ug/L	9.2	0.138	13.2
Pb (ug/l)	15 ug/L [mcl]	50 ug/L	5,000 ug/L	<2.	<0.2	<2.
Sb (ug/l)	6 ug/L [mcl]	---	---	<2.	<0.1	<2.
Se (ug/l)	50 ug/L [mcl]	50 ug/L	20 ug/L	<1.	1.09	4.3
Sr (ug/l)	--	---	---	765	784	1157
Ti (ug/l)	--	---	---	<10.	<1.0	<10.
V (ug/l)	--	---	---	8.1	0.43	<5.
Zn (ug/l)	5,000 ug/L [smcl]	24,000 ug/L	2,000 ug/L	<2.	<0.2	9

Key: **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; --- = Currently no

	Water Quality Standards	Churchhill North								Churchhill Ret. Home			Godfrey Canyon Estates				Manhatten Christian Schl			
Map ID:		A				B				C			D		E		F			
Gwic Id	Drinking Water	208723				220348				90740			90815		146054		225403			
Site Name		Churchhill North PW-1				Churchhill North PW-2				Churchhill Retirement Hm Well 2			Godfrey Canyon Estates Well 1		Well 2		Manhatten Christian School Well 2			
Twnshp/Rng		1S 3E				1S 3E				1S 3E			1S 3E				1S 3E			
Sec		14				14				13			24		24		13			
Q Sec		BBDB				BBDB				CBDA			BCC		BBD		CA			
Aquifer																				
Depth (ft)		280				440				230			188		144		463			
Comp Date		01/30/04				06/06/05				06/23/77			01/24/83		07/05/94		05/01/06			
Sample																				
Sample Date		12/12/05	07/24/07	01/08/08	04/01/08	12/12/05	04/30/07	01/08/08	04/01/08	03/02/04	06/07/04	10/10/06	06/21/04	03/21/07	06/21/04	03/21/07	05/17/06	11/07/06	06/21/07	01/15/08
Water Temp	---																			
Lab pH	---	7.6				7.7											7.8	7.9		
Lab SC	---	449				419											412	408		
TDS (mg/l)		310				261														
Ca (mg/l)	---																40	41		
Mg (mg/l)	---																5	5		
Na (mg/l)	250 mg/L [smcl]																34	34		
K (mg/l)	---																			
Fe (mg/l)	0.3 mg/L [smcl]																0.15	<0.01		
Mn (mg/l)	0.05 mg/L [smcl]																			
SiO2 (mg/l)	---																			
HCO3 (mg/l)	---																			
CO3 (mg/l)	---																			
SO4 (mg/l)	250 mg/L [smcl]	35				34											28	29		
Cl (mg/l)	250 mg/L [smcl]	17				16											15	14		
NO3 (mg/l)	10 mg/L [mcl]	2.75	3		3.32	1.44	2.84				3.2	3.15	4.23	3.89	3.05	3.55				
F (mg/l)	4 mg/L [mcl]	0.31	<0.1			0.27	0.29				0.42		0.29	0.21	0.22	0.19				
OPO4 (mg/l)	---																			
Al (ug/l)	50-200 ug/L [smcl]																			
As (ug/l)	10 ug/L [mcl]	6	5	4	4	<10	5	13	13	6		7	6	5	3	2		15	17	15
B (ug/l)	---																			
Ba (ug/l)	2,000 ug/L [mcl]	100	100			<2000	100				120		230	200	277	200				
Br (ug/l)																				
Cd (ug/l)	5 ug/L [mcl]	<5	<1			<5	<1				<1		<1	<1	<1	<1				
Co (ug/l)	---																			
Cr (ug/l)	100 ug/L [mcl]	<100	<10			<100	<10				<10		<1	<10	<1	<10				
Cu (ug/l)	1,300 ug/L [mcl]																			
Li (ug/l)	---																			
Mo (ug/l)	---																			
Ni (ug/l)	---	<100	<10			<100	<10			<10			<10	<10	<10	<10				
Pb (ug/l)	15 ug/L [mcl]																			
Sb (ug/l)	6 ug/L [mcl]	<6	<3			<6	<3			<3			<1	<3	<1	<3				
Se (ug/l)	50 ug/L [mcl]	<50	<5			<50	<5				<5		<2	<5	<2	<5				
Sr (ug/l)	---																			
Ti (ug/l)	---																			
V (ug/l)	---																			
Zn (ug/l)	5,000 ug/L [smcl]																			

Key: **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; -- = Currently no standard for this constituent

	Water Quality Standards	Site Wells													Data Ranges			
															Regional		Local	
Map ID:																		
Gwic Id	Drinking Water	236239					236240					230271						
Site Name		AV-1					AV-2					Obs-1						
Twnshp/Rng		1S 3E					1S 3E					1S 3E						
Sec		14					14					13						
Q Sec		DBA					BBA					DDC						
Aquifer																		
Depth (ft)		165					147.5					460		375				
Comp Date		6/2/2007					6/2/2007					09/27/06						
Sample																		
Sample Date		06/04/07	06/27/07	08/28/07	11/29/07	05/03/08	06/04/07	06/27/07	08/28/07	11/29/07	05/03/08	04/15/08	04/16/08	05/03/08	Min	Max	Min	Max
Water Temp	---														10.3	46.1	-----	-----
Lab pH	---	7.8	7.7	8.3	7.5	7.7	7.6	7.6	8.3	7.5	7.5	7.9	8.0	7.7	6.93	8.6	7.6	7.9
Lab SC	---	657	669	632	664	648	435	443	435	441	430	472	550	532	417	1746	408	449
TDS (mg/l)		480	425	430	419	469	292	269	283	259	365			394	-----	-----	261	310
Ca (mg/l)	---					22					222	62	72	67	6.6	130	40	41
Mg (mg/l)	---					9						14	13	10	0.1	31.7	5	5
Na (mg/l)	250 mg/L [smcl]					120					28	33	30	32	12.6	227	34	34
K (mg/l)	---					15					55	17	14	11	1.4	28.8	-----	-----
Fe (mg/l)	0.3 mg/L [smcl]					4.8					1.24d	**10.5**	**8.01**	0.11	<0.005	**0.33**	0.15	0.15
Mn (mg/l)	0.05 mg/L [smcl]										0.22d	**0.17**	**0.20**	<0.1	<0.001	**0.291**	-----	-----
SiO2 (mg/l)	---														7	66	-----	-----
HCO3 (mg/l)	---					331					279	214	229	222	104	382	-----	-----
CO3 (mg/l)	---					<1					<1	0	0	<1	0	4	-----	-----
SO4 (mg/l)	250 mg/L [smcl]					51					23	28	43	41	5.88	**408**	28	35
Cl (mg/l)	250 mg/L [smcl]	1	1	2	1	1	2	1	1	ND	<1	14	22	19	2.13	192	14	17
NO3 (mg/l)	10 mg/L [mcl]	0.56	0.48	0.56	0.56	0.66	0.64	0.48	0.75	0.64	0.67	1.74	3.11	3.14	<0.2	**24.9**	1.44	4.23
F (mg/l)	4 mg/L [mcl]														<1	**11**	<0.1	0.42
OPO4 (mg/l)	---														<0.05	0.54	-----	-----
Al (ug/l)	50-200 ug/L [smcl]					<100d					700d	**16,300**	**8,000**	<100	<2	35.8	-----	-----
As (ug/l)	10 ug/L [mcl]					84					10d	**25**	9	9	2.6	**122**	2	**17**
B (ug/l)	---													100	15.7	730	-----	-----
Ba (ug/l)	2,000 ug/L [mcl]					200						300	300	200	24.9	286	100	277
Br (ug/l)															<50	593	-----	-----
Cd (ug/l)	5 ug/L [mcl]					<1						<5	<5	<1	<0.1	<2	<1	<5
Co (ug/l)	---													<100	<0.1	<2	-----	-----
Cr (ug/l)	100 ug/L [mcl]					<10						<100	<100	<10	<0.1	5	<1	<100
Cu (ug/l)	1,300 ug/L [mcl]													<100	0.325	16	-----	-----
Li (ug/l)	---													<100	<6	208	-----	-----
Mo (ug/l)	---													<100	<10	100	-----	-----
Ni (ug/l)	---					<10						ND	ND	<10	0.138	13.2	<10	<100
Pb (ug/l)	15 ug/L [mcl]													<100	<0.2	<40	-----	-----
Sb (ug/l)	6 ug/L [mcl]											<6	<6	3	0.39	0.39	<1	<6
Se (ug/l)	50 ug/L [mcl]					<5						<50	<50	<5	<1	21	<2	<50
Sr (ug/l)	---													400	187	1157	-----	-----
Ti (ug/l)	---													<100	0.595	160	-----	-----
V (ug/l)	---													<100	0.43	20	-----	-----
Zn (ug/l)	5,000 ug/L [smcl]													<100	0.3	860	-----	-----

Key: **mg/L** = milligrams per Liter; **ug/L** = micrograms per Liter; --- = Currently no standard for this constituent

AV-1

Site Name: AMSTERDAM VILLAGE
GWIC Id: 236239

Section 1: Well Owner

Owner Name
AMSTERDAM VILLAGE
Mailing Address
10180 COTTONWOOD ROAD

City	State	Zip Code
BOZEMAN	MT	59718

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	14	NE¼ NW¼ SE¼

County GALLATIN **Geocode**

Latitude	Longitude	Geomethod	Datum
45.7502	111.3172	NAV-GPS	WGS84

Altitude	Method	Datum	Date

Addition AMSTERDAM VILLAGE **Block** **Lot**

Section 3: Proposed Use of Water

MONITORING (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Thursday, May 31, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	175	6.6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-3	120	6	0.25		WELDED	A53B STEEL
-1.5	155	2		220.0	FLUSH THREAD	PVC-SCH 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
155	165	2	1420	.010	FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	145	BENTONITE CHIPS	
145	175	10/20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 175
Static Water Level: 147.6
Water Temperature:

Air Test *
5 gpm with drill stem set at 170 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 147.6 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	2	TOP SOIL
2	13	SILT SAND
13	21	SILTY CLAY & SAND
21	29	FINE SAND GRAVEL & COBBLES
29	31	COURSE SAND
31	31.5	FINE SAND
31.5	77	SILT SAND
77	79	FINE SAND GRAVEL & COBBLES
79	81	COURSE SAND
81	91	75% COURSE SAND W/ GRAVELS
91	94	SILT SAND & FINE SAND
94	113	SILT SAND & SILTY CLAY
113	117	75% FINE SAND W/ MED GRAVELS
117	132	BROWN CLAY W/ LITE BROWN CLAYSTONE
132	136	FINE SAND & GRAVEL
136	137	SANDSTONE W/ FINE SAND
137	152	SANDSTONE W/ CLAY STREAKS
152	156	FINE HEAVING SAND
156	159.5	FINE SAND COUSE GRAVEL & CLAY STREAKS
159.5	161	CLAY
161	173	SANDSTONE & CLAY STONE
173	175	FINE SAND & MED GRAVEL W/ 5 GPM WATER

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: TROY HAUSER
Company: RED TIGER DRILLING
License No: MWC-365
Date Completed: 5/31/2007

AV-2
Site Name: AMSTERDAM VILLAGE
GWIC Id: 236240

Section 1: Well Owner

Owner Name
AMSTERDAM VILLAGE
Mailing Address
10180 COTTONWOOD ROAD

City	State	Zip Code
BOZEMAN	MT	59718

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	13	NE¼ NW¼ NW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.7536	111.3186	NAV-GPS	WGS84

Altitude	Method	Datum	Date

Addition	Block	Lot
AMSTERDAM VILLAGE		

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: ROTARY

Section 5: Well Completion Date
Date well completed: Friday, June 01, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	175	6.9

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	120	6.6	0.25		WELDED	A53B STEEL
-2	138	2		220.0	FLUSH THREAD	PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
138	148	2	1420	.010	FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	136	BENTONITE CHIPS	
136	175	10/20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 175
Static Water Level: 142.8
Water Temperature:

Air Test *

2 gpm with drill stem set at 174 feet for 1 hours.
Time of recovery 1 hours.
Recovery water level 142.8 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
MONITOR WELL #2

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	1.5	TOP SOIL
1.5	6	SILTY SAND
6	28	SILTY SAND & CLAY
28	54	FINE SAND GRAVEL & COBBLES
54	56	CLAY & SILTY CLAY
56	57	FINE SAND
57	81	FINE SAND GRAVEL & COBBLES
81	93	SILT SAND
93	95	FINE SAND GRAVEL & COBBLES
95	96	FINE SAND & SILT SAND
96	115	TITE FINE SANDS SHARP GRAVELS & COBBLES
115	149	SILTY CLAY & SANDSTONE
149	153	FINE SAND W/ SILT SAND
153	155	CLAY
155	158	FINE SAND & SILT SAND

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: TROY HAUSER
Company: RED TIGER DRILLING
License No: MWC-365
Date Completed: 6/1/2007

From	To	Description
158	175	STREAKED CLAY SANDSTONE FINE SAND & GRAVEL W/ 2 GPM WATER

Obs-1

Site Name: CTA LANDWORKS
GWIC Id: 230271

Section 1: Well Owner

Owner Name
CTA LANDWORKS
Mailing Address
10180 COTTONWOOD ROAD

City	State	Zip Code
BOZEMAN	MT	59718

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	14	SW¼ SE¼ SE¼

County GALLATIN **Geocode**

Latitude	Longitude	Geomethod	Datum
45.7446	111.3141	NAV-GPS	WGS84

Altitude	Method	Datum	Date

Addition THE VIRIDIAN VILLAGE **Block** **Lot**

Section 3: Proposed Use of Water

TEST WELL (1)
MONITORING (2)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, September 27, 2006

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	460	7.5

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	460	6	0.25		WELDED	A53B STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 460
Static Water Level: 409
Water Temperature:

Air Test *

100 gpm with drill stem set at 440 feet for 2 hours.
Time of recovery 2.5 hours.
Recovery water level 409 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	2	TOP SOIL
2	18	LITE BROWN CLAY
18	24	SILTY CLAY W/TRACES GRAVEL
24	38	FINE SAND GRAVEL & COBBLES
38	39	CLAY
39	40	FINE SAND & GRAVEL
40	41	CLAY
41	75	FINE SAND & GRAVEL
75	93	LITE BROWN SILT & CLAYSTONE
93	97	LITE BROWN CLAY & SILTY CLAY
97	103	SILT SAND
103	107	FINE SAND & GRAVEL
107	135	LITE BROWN SANDSTONE W/SILTSTONE
135	138	LITE BROWN SILTY CLAY
138	140	LITE BROWN SANDSTONE W/SILTSTONE

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: TROY HAUSER
Company: RED TIGER DRILLING
License No: WWC-598
Date Completed: 9/27/2006

Site Name: CTA LANDWORKS
GWIC Id: 230271
Additional Lithology Records

From	To	Description
140	164	LITE BROWN CLAY & SILTY CLAY
164	168	LITE BROWN SANDSTONE W/BLACK & RED COURSE SAND

168	171	LITE BROWN SILTY CLAY
171	174	LITE BROWN SILTY CLAY
174	178	LITE BROWN SANDSTONE W/ TRACES WHITE LIMESTONE
178	186	BROWN CLAY
186	191	FINE SAND & GRAVEL
191	194	FINE SAND W/SILTSAND
194	197	BROWN CLAY
197	205	CLAYSTONE W/CLAY STREAKS
205	224	BROWN CLAY
224	231	FINE SAND & GRAVEL
231	234	SANDSTONE
234	237	BROWN CLAY
237	247	FINE/COURSE SAND W/ MED GRAVELS
247	253	BROWN CLAY
253	256	SANDSTONE W/CLAYSTONE
256	257	BROWN CLAY
257	265	SANDSTONE W/CLAYSTONE
265	269	FINE SAND & GRAVEL W/ 50 GPM WATER
269	271	FINE SAND & GRAVEL
271	277	SILTSTONE
277	287	FINE SAND & GRAVEL W/ 12 GPM WATER
287	289	SANDSTONE W/SILTSTONE
289	295	BROWN SILTY CLAY
295	300	FINE/COURSE SAND W/ MED GRAVELS W/20 GPM WATER
300	316	SILTSTONE W/CLAYSTONE
316	317	MED GRAVELS
317	318	CLAY W/ SILTYCLAY STREAKS
318	320	FINE SAND & GRAVEL
320	329	SANDSTONE
329	335	CLAYSTONE
335	340	FINE/COURSE SAND W/40 GPM SANDY WATER
340	371	FINE/COURSE SAND W/ MED GRAVELS W/100 GPM SANDY WATER
371	396	CLAYSTONE W/SANDSTONE & CLAY STRINGERS
396	400	CLAYSTONE W/HEAVING SANDS 85 GPM SAND& WATER
400	413	SOFT SANDSTONE W/FINE/COURSE SAND STREAKS
413	416	CLAY W/CLAYSTONE STREAKS
416	426	SILTSTONE W/FINE SAND STRINGERS
426	460	FINE/COURSE SAND W/ MED GRAVELS 100 GPM WATER DEVELOPING FROM 440 FT

Churchill North PW-1

Site Name: CHURCHILL NORTH SUBDIVISION
GWIC Id: 208723
DNRC Water Right: C30005083

Section 1: Well Owner

Owner Name
CHURCHILL NORTH SUBDIVISION
Mailing Address
331 RUNJE BLVD

City	State	Zip Code
MANHATTAN	MT	59741

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	13	NW¼ SE¼ NW¼ NW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.755558	111.306007	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot
CHURCHILL NORTH		

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Friday, January 30, 2004

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	25	10
25	280	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.8	252.5	6	0.250		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
248	259	5		.100	SCREEN-CONTINUOUS-STAINLESS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	25	BENTONITE	
248	248	FIG K	

Section 7: Well Test Data

Total Depth: 280
Static Water Level: 105.25
Water Temperature:

Pump Test *

Depth pump set for test 245 feet.
182 gpm pump rate with 38.3 feet of drawdown after 16 hours of pumping.
Time of recovery 39 hours.
Recovery water level 105.7 feet.
Pumping water level 143.55 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	21	SILTY BROWN CLAY
21	36	BROWN CLAY WITH SMALL PEBBLES
36	40	SANDY SAND AND GRAVEL
40	128	SANDS AND GRAVELS SOME MIXED SILTS
128	153	CLEAN SAND AND GRAVEL
153	176	SOFT BROWN SILTSTONE AND BLENDING TO SILTY CLAY
176	188	SOUPY SAND WITH SCATTERED GRAVELS
188	192	LIGHT TAN SILTSTONE/ HARDPAN
192	197	MEDIUM BROWN FIRM SILTSTONE
197	208	HEAVING SAND TO FINE GRAVEL
208	213	FINE SAND WITH MIXED GRAVEL SOME CLAY
216	219	FINE HEAVING SAND
219	244	TAN SILTSTONE/ HARDPAN DRY
244	250	SILTY BROWN CLAY AND CLAYSTONE / SILTSTONE MIX
257	264	SAND AND GRAVEL, SLIGHTLY HEAVING
264	280	SILTSTONE, CLAYSTONE, SOFT SANDSTONE, DRY

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Company: POTTS DRILLING INC
License No: WWC-512
Date Completed: 1/30/2004

Churchill North PW-2

Site Name: CHURCHILL NORTH SUBDIVISION
GWIC Id: 220348

Section 1: Well Owner

Owner Name
CHURCHILL NORTH SUBDIVISION, CHURCHILL NORTH SUBDIVISION
Mailing Address
331 KUNJE BLVD.

City	State	Zip Code
MANHATTAN	MT	59741

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	30	SE¼ NE¼ SW¼ NW¼

County GALLATIN **Geocode**

Latitude	Longitude	Geomethod	Datum
45.7533	111.3039	NAV-GPS	NAD83

Altitude	Method	Datum	Date

Addition CHURCHILL NORTH **Block** **Lot**

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Monday, June 06, 2005

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	25	10
25	440	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
2	434	6	0.250		WELDED	A53B STEEL

There are no completion records assigned to this well.

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	25	BENTONITE	

Section 7: Well Test Data

Total Depth: 440
Static Water Level: 102.9
Water Temperature: 15.56

Pump Test *

Depth pump set for test 242 feet.
150 gpm pump rate with 88 feet of drawdown after 11 hours of pumping.
Time of recovery 14 hours.
Recovery water level 102 feet.
Pumping water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

THIS WELL IS DESIGNATED AS CHURCHILL NTH. PW2 DEQ ID # MT0004431

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	18	SANDY CLAY
26	39	DRY SAND & GRAVEL
26	115	DRY CLAYBOUND SAND & GRAVEL
115	158	SAND AND GRAVEL
158	172	DIRTY SAND & GRAVEL
172	185	SOFT TAN SILTSTONE
185	202	HEAVING SAND
202	227	CLAYS AND SILTSTONES
227	231	FINE TO COUSE SAND 15 GPM
231	250	TAN SILTSTONE
250	257	SILT AND SAND, HEAVING
257	269	TAN CLAY
269	270	FINE SAND
270	271	CLAY
271	281	SILTSTONE & SAND

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: POTTS DRILLING INC
License No: WWC-512
Date Completed: 6/6/2005

Site Name: CHURCHILL NORTH SUBDIVISION
GWIC Id: 220348
Additional Lithology Records

From	To	Description

281	299	CLAY
299	301	COURSE SAND
301	314	SOUPY SAND, CLAYS, SILTS, HEAVING
314	319	SOUPY SAND TO FINE GRAVELS
319	337	FINE SAND TO MED. COURSE GRAVELS W/ LENSES OF CLAY, SOME SANDS LIGHTLY CEMENTED, LOTS OF WATER BUT KEEPS YEILDING SAND EVEN W/ SCREEN
337	345	SOUPY SANDS, SOME COURSES
345	354.5	CLAY
354.5	367	SANDSTONE, MOD. SOFT, BLEEDS SAND
367	392	CLAY, CLAYSTONE, MUDSTONE, SILTSTONE, MAKES WATER BUT DIRTIES UP WHEN SURGED
392	394	STICKY CLAY
394	396	CLAY
396	399	SANDSTONE
399	402	CLAY
402	405	SAND, FINE TO MED. W/ SCATTER 1/4 -3/8 PEBBLES, MOD. CONSOLIDATED, 100 GPM
405	410	SEMI CONSOLIDATED SAND, FINE TO MED.
410	411	WHITE CEMENTED GRAVEL
411	435	FINE TO MED. COURSE SAND W/ 20% SMALL TO MED. GRAVELS. STRATIFIED BETWEEN LENSES OF FIRM BROWN TO GRAY SANDSTONE. SAND AND GRAVEL CAVES, SANDSTONE IS CONSOLIDATED
435	440	FIRM TO HARD GRAY SANDSTONE, LOTS OF WATER

Godfrey Canyon Estates Well 1

Site Name: GODFREY CANYON ESTATES
GWIC Id: 90815

Section 1: Well Owner

Owner Name
DYKSTERHOUSE HENRY
Mailing Address

City **State** **Zip Code**

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	24	SW¼ SW¼ NW¼

County **Geocode**
GALLATIN

Latitude	Longitude	Geomethod	Datum
45.736917	111.307043	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition **Block** **Lot**

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: CABLE

Section 5: Well Completion Date

Date well completed: Monday, January 24, 1983

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	152	8				

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
142	152	8			SCREEN

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
8	30	CEMENT	

Section 7: Well Test Data

Total Depth: 188
Static Water Level: 83.8
Water Temperature:

Pump Test *
Depth pump set for test _ feet.
64 gpm pump rate with _ feet of drawdown after 24 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 139.3 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	3	TOPSOIL
3	11	CLAY
11	27	CLAYBOUND GRAVEL
27	51	SANDY CLAY
51	82	SANDY GRAVEL
82	83	GRAVEL-WET
83	107	SANDSTONE & SAND
107	110	SANDY CLAY
110	117	SLOPPY SAND-CLAYBOUND
117	129	CLAY
129	140	SANDY CLAY
140	143	COARSE SAND
143	147	SAND & GRAVEL
147	152	SAND & COARSE GRAVEL
152	158	CLAY
158	160	CEMENTED GRAVEL
160	167	CLAY
167	168	CEMENTED GRAVEL
168	178	CLAY
178	188	CLAYBOUND GRAVEL; SLOPPY SAND & GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Company: VAN DYKEN DRILLING INC
License No: WWC-306
Date Completed: 1/24/1983

Godfrey Canyon Estates Well 2

Site Name: GODFREY CANYON ESTATES * WELL #2
GWIC Id: 146054
DNRC Water Right: 91467

Section 1: Well Owner

Owner Name
GODFREY CANYON ESTATES
Mailing Address
7200 CHURCHILL RD

City	State	Zip Code
MANHATTAN	MT	59741

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	24	SE¼ NW¼ NW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.740642	111.304626	TRS-SEC	NAD83

Altitude	Method	Datum	Date

Addition	Block	Lot
GODFREY CANYON ESTATES		

Section 3: Proposed Use of Water

DOMESTIC (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Tuesday, July 05, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	20	12
20	144	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.5	132	8	0.322			STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
132	137	8		70	SLOT SCREEN

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	20	CEMENT	

Section 7: Well Test Data

Total Depth: 144
Static Water Level: 67.67
Water Temperature:

Pump Test *

Depth pump set for test _ feet.
65 gpm pump rate with _ feet of drawdown after 24 hours of pumping.
Time of recovery _ hours.
Recovery water level _ feet.
Pumping water level 120 feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	1	TOPSOIL
1	17	CLAY WITH SOME SMALL GRAVEL
17	24	GRAVEL AND SAND
24	36	HARD BROWN CLAY
36	43	GRAVEL AND SAND
43	75	CLAYBOUND GRAVEL AND SAND
75	132	CLAYSTONE
132	135.5	COARSE SANDS SOME GRAVEL
135.5	138	SOFTER CLAYSTONE
138	140	HARD CLAYSOTNE
140	141	CLAYBOUND PEA GRAVEL
141	144	SOFT BROWN CLAY

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: VAN DYKEN DRILLING INC
License No: WWC-380
Date Completed: 7/5/1994

Site Name: US GEOLOGICAL SURVEY - KAMMERMAN
GWIC Id: 133172

Section 1: Well Owner

Owner Name		
KAMMERMAN DELBERT		
Mailing Address		
6911 KIMM ROAD		
City	**State**	**Zip Code**
BOZEMAN	MT	59715

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	36	SE¼ SW¼ SW¼ NW¼

County	Geocode
GALLATIN	

Latitude	Longitude	Geomethod	Datum
45.7094	111.3061	MAP	NAD27

Altitude	Method	Datum	Date
4658			

Addition	Block	Lot

Section 3: Proposed Use of Water

MONITORING (1)

Section 4: Type of Work

Drilling Method:

Section 5: Well Completion Date

Date well completed: Tuesday, January 01, 1952

Section 6: Well Construction Details

There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.7	185	8				STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
15	113	8			PERFORATED CASING

Annular Space (Seal/Grout/Packer)

There are no annular space records assigned to this well.

Section 7: Well Test Data

Total Depth: 113
Static Water Level: 15.2
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

HOLE DRILLED BY CONTRACTOR FOR US GEOLOGICAL SURVEY. PRINCIPAL WATER BEARING ZONE 16-100 FEET BELOW LAND SURFACE. HOLE DRILLED TO DEPTH OF 882 FEET AND PLUGGED BACK TO 185 FEET BELOW LAND SURFACE.

Section 9: Well Log

Geologic Source

120SDMS - SEDIMENTS (TERTIARY)

From	To	Description
0	23	SILT- SANDY- CALCAREOUS- TUFFACEOUS- BUFF; CONTAINS PEBBLES.
23	32	GRAVEL- SANDY- SILTY. GRAVEL IS COMPOSED OF PEBBLES DERIVED FROM TERTIARY BEDS AND VOLCANIC ROCKS.
32	65	SILT- SANDY- CALCAREOUS- BUFF; CONTAINS PEBBLES.
65	85	GRAVEL- SILTY. GRAVEL IS COMPOSED OF VOLCANIC AND METAMORPHIC ROCKS AND FRAGEMENTS OF TERTIARY BEDS
85	92	SAND- SILTY- POORLY SORTED- CALCAREOUS.
92	100	GRAVEL- SANDY; CONTAINS FRAGMENTS OF BUFF CLAY- STONE.
100	125	SILT- SANDY- CALCATEOUS- TUFFACEOUS- BUFF; CONTAINS FRAGMENTS OF SILSTONE.
125	155	CLAY- CALCAREOUS- TUFFACEOUS- LIGHT-BROWN; CONTAINS FRAGMENTS OF SILTSTONE.
155	174	SILT- SANDY- CLAYEY- CALCAREOUS- TUFFACEOUS- BUFF
174	180	GRAVEL- SANDY- CALCAREOUS- TUFFACEOUS
180	225	SILT- SANDY- CLAYEY- TUFFACEOUS- BUFF
225	232	SAND- SILTY- POORLY SORTED
232	248	SILT- SANDY- CALCAREOUS- TUFFACEOUS- BUFF
248	252	GRAVEL- SANDY
252	280	SILTSTONE- SANDY- CALCAREOUS-

		TUFFACEOUS- BUFF

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: USGS
License No: -
Date Completed: 1/1/1952

Site Name: US GEOLOGICAL SURVEY - KAMMERMAN
GWIC Id: 133172
Additional Lithology Records

From	To	Description
280	284	VOLCANIC ASH- GRAY
284	305	GRAVEL- SANDY AND SILTY
305	323	SAND AND SILT- CALCAREOUS; CONTAINS NUMEROUS DARK MINERALS
323	354	SILTSTONE- SANDY- CALCAREOUS- TUFFACEOUS- BUFF; INTERBEDDED WITH TAN LAMINATED CLAYSTONE
354	363	SAND- POORLY SORTED; CONTAINS PEBBLES
363	385	SILTSTONE- CLAYEY- CALCAREOUS- TUFFACEOUS- BUFF
385	428	SAND POORLY SORTED
428	458	CLAYSTONE- SILTY- SLIGHTLY CALCAREOUS- BUFF
458	461	VOLCANIC ASH- CALCAREOUS
461	503	CLAY AND CLAYSTONE- SILTY- CALCAREOUS- TUFFACEOUS- TAN
503	558	CLAY AND CLAYSTONE- SILTY- CALCAREOUS- LIGHT-GREEN
558	590	CLAYSTONE- SILTY- PYRITIC- BLUISH-GREEN
590	725	CLAY AND CLAYSTONE; PYRITIC- DARK-BLUE; FOSSILIFEROUS (OSTRACODES AT 715 FT)
725	749	SAND- POORLY SORTED- COMPOSED CHIEFLY OF QUARTZ- GARNET- DARK MINERALS- CALCITE AND PYRITE GRAINS
749	793	CLAY- SILTY- DARK-BLUE- CONTAINS GYPSUM FRAGMENTS WHICH PROBABLY OCCUR IN THIN LAYERS
793	859	CLAY AND CLAYSTONE; DARK-BLUE- FOSSILIFEROUS (OSTRACODES AT 820 AND 835 FT); CONTAINS SILTSTONE FRAGMENTS
859	882	SAND- ANGULAR- BLUISH; CONTAINS PEBBLES. SAND IS COMPOSED CHIEFLY OF QUARTZ- FELDSPAR AND GNEISS FRAGMENTS. THIS MATERIAL IS PROBABLY DERIVED FROM WEATHERED PRECAMBRIAN GNEISS. WELL PLUGGED BACK TO 185 FEET BELOW LAND SURFACE

GWIC Id: 159966
DNRC Water Right: C099519-00

Section 1: Well Owner

Owner Name		
LEEP ELDON		
Mailing Address		
1930 BAXTER DR		
City	**State**	**Zip Code**
BOZEMAN	MT	59715

Section 2: Location

Township	Range	Section	Quarter Sections
01S	03E	13	NW¼ SE¼ SW¼
County			**Geocode**
GALLATIN			

Latitude	Longitude	Geomethod	Datum
45.746032	111.302572	TRS-SEC	NAD83
Altitude	**Method**	**Datum**	**Date**

Addition	Block	Lot
THE SETTLEMENT		

Section 3: Proposed Use of Water

PUBLIC WATER SUPPLY (1)

Section 4: Type of Work

Drilling Method: ROTARY

Section 5: Well Completion Date

Date well completed: Wednesday, October 02, 1996

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	21	16
0	441	8

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2.5	282	8	0.280		WELDED	STEEL
8	405	6	0.280		WELDED	STEEL

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
409	419	6		.06	SLOTS
419	430	6		.08	SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	22	BENTONITE	
403.3	404	K PACKER	

Total Depth: 441
Static Water Level: 113
Water Temperature:

Pump Test *

Depth pump set for test 400 feet.
290 gpm pump rate with _ feet of drawdown after 8 hours of pumping.
Time of recovery 0.25 hours.
Recovery water level 113 feet.
Pumping water level 205.6 feet.

* *During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

WELL WAS DRILLED WITH FLUID CIRCULATION FROM 280-441 FIG K PACKER-403.3 TO 409 5IN BLANK TOP-404 TO 409 .050 SCREEN-409 TO 414 .060 SCREEN-414.25 TO 419 .080 SCREEN-419.5 TO 430 5IN BLANK-430 TO 441

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	15	SILTY BROWN CLAY
15	60	DRY TIGHT GRAVELS
60	145	GRAVELS WITH OCCASIONAL CLAYS
145	165	STRATIFIED GRAVEL SANDSTONE AND CLAYSTONE
165	175	BROWN CLAYSTONE
175	176	SAND AND GRAVEL
176	214	SANDSTONE AND CLAYSTONE
214	215	FINE TO MEDIUM SAND
215	220	FINE TO COARSE SAND
220	250	CLAYBOUND SAND
250	268	CLAY
268	272	VERY FINE SAND
272	292	SANDSTONE WITH CLAY
292	299	COARSE SAND LOTS OF WATER
299	323	SOFT CLAY

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: POTTS DRILLING INC
License No: WWC-512
Date Completed: 10/2/1996

Site Name: LEEP ELDON
GWIC Id: 159966
Additional Lithology Records

From	To	Description
323	328	HARD CLAY
328	345	SOFT WHITE BROWN CLAY
345	380	FIRM DENSE BROWN CLAY
380	385	SANDS TO COARSE GRAVEL
385	410	STRATIFIED SAND SANDY CLAY AND GRAVEL
410	430	MEDIUM SANDS TO GRAVELS
430	441	BROWN SILTY CLAY