## FMC Idaho LLC, Pocatello, Idaho

### FMC OU REMEDIAL DESIGN
### GROUNDWATER REMEDIAL ACTION

# PRELIMINARY ENGINEERING DESIGN SUBMITTAL

- Preliminary Remedial Design Report
- Design Drawings
- Groundwater Treatability Study Report
- Calculations
- Specifications
- Construction Quality Assurance Plan

January 2015

MWH

# FMC Idaho LLC, Pocatello, Idaho

## FMC OU REMEDIAL DESIGN
## GROUNDWATER REMEDIAL ACTION
# PRELIMINARY REMEDIAL DESIGN REPORT

January 2015

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# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| ADA | Americans with Disabilities Act |
| AFLB | American Falls Lake Bed |
| AFM | Anderson filter media |
| amsl | above mean sea level |
| AOC | Administrative Order of Consent |
| ARAR | applicable or relevant and appropriate requirements |
| bgs | below ground surface |
| BMPs | best management practices |
| BSTS | Bench-Scale Treatability Study |
| cfs | cubic feet per second |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CF | coagulation/flocculation |
| COCs | contaminants of concern |
| CQAP | Construction Quality Assurance Plan |
| CV | comparative value |
| ESD | Explanation of Significant Difference |
| EMF | Eastern Michaud Flat |
| EPA | U.S. Environmental Protection Agency |
| EPCRA | Emergency Planning Community Right-to-Know Act |
| ERP | Emergency Response Plan |
| ET | evapotranspirative |
| EZHS | Extraction Zone Hydrogeological Study |
| EZHWP | Extraction Zone Hydrogeological Work Plan |
| FeP | ferrophos |
| FMC | FMC Corporation |
| FRP | fiber-reinforced plastic |
| FS | feasibility study |
| FSPs | field sampling plans |
| ft | feet |
| gpm | gallons per minute |
| GSR | Green and Sustainable Remediation |
| GWCCR | Current Groundwater Conditions Report |
| HASP | Health and Safety Plan |
| HDPE | high density polyethylene |
| ICAIP | Institutional Controls Implementation and Assurance Plan |
| ICs | institutional controls |
| IDEQ | Idaho Department of Environmental Quality |
| IRODA | Interim Record of Decision Amendment |

| | |
|---|---|
| JSAs | Job Safety Analyses |
| MCC | motor control center |
| MCLs | maximum contaminant levels |
| MDD | maximum dry density |
| mg/l | milligrams per liter |
| MWH | MWH Americas, Inc. |
| NPSH | net positive suction head |
| OMC | optimal moisture content |
| OM&M | operation, maintenance and monitoring |
| OU | operable unit |
| OSHA | Occupational Safety and Health Administration |
| OSWER | Office of Solid Waste and Emergency Response |
| P&IDs | piping and instrumentation diagrams |
| POTW | publicly owner treatment works |
| PSCS | Preliminary Site Characterization Summary |
| PSDs | particle size distribution |
| PSVP | Performance Standard Verification Plan |
| PVC | polyvinyl chloride |
| $P_4$ | elemental phosphorus |
| QA | quality assurance |
| QAPP | Quality Assurance Project Plan |
| QC | quality control |
| RA | remediation area/remedial action |
| RAC(s) | redial action contractor(s) |
| RAO | remedial action objective |
| RBC | risk based concentrations |
| RCRA | Resource Conservation and Recovery Act |
| RD | remedial design |
| RDRA | Remedial Design/Remedial Action |
| RDWP | Remedial Design Work Plan |
| RI | remedial investigation |
| ROD | Record of Decision |
| SFS | Supplemental Feasibility Study |
| SPCC | Spill Prevention, Control and Countermeasure |
| SRI | Supplemental Remedial Investigation |
| SWHASP | Site-Wide Health and Safety Plan |
| SWMR | Site-wide Stormwater Management Design Report |
| SWMUs | solid waste management units |

| | |
|---|---|
| SUA | Southern Undeveloped Area |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TI | technical impracticability |
| TMDL | Total Mass Daily Load |
| TODP | Transportation and Off-Site Disposal Plan |
| UAO | Unilateral Administrative Order |
| VFD | variable frequency drive |
| WUA | Western Undeveloped Area |
| WQC | Water Quality Criteria |
| WTP | Water Treatment Plant |

# 1.0 INTRODUCTION

## 1.1 PURPOSE AND SCOPE

This Preliminary (30%) Groundwater Remedial Design (RD) Report (Report) has been prepared on behalf of FMC Corporation (FMC) and presents the organization, objectives, data, and design associated with the groundwater remedy for the FMC Plant Operable Unit (FMC OU) of the Eastern Michaud Flats (EMF) Superfund Site. The FMC OU is located in Power County in Idaho, approximately 2.5 miles northwest of Pocatello (see Figures 1-1 and 1-2). The EMF Site includes two adjacent production facilities, the former FMC Corporation elemental phosphorus (P4) processing plant that ceased operation in 2001 and a phosphate fertilizer processing facility currently operated by the J.R. Simplot Company. The EMF Site is shown on Figure 1-1 and encompasses both the FMC and Simplot plants and surrounding areas (Off-Plant OU) affected by releases from these facilities.

The FMC OU, consisting of the FMC Plant Site and other FMC-owned properties at the EMF Site, is on privately-owned fee land, most of which is located within the exterior boundaries of the Fort Hall Indian Reservation. As shown on Figure 1-2, the FMC Plant OU consists of the FMC Plant Site (i.e., the former operating facility located south of Highway 30), the Southern and Western Undeveloped Areas (SUA and WUA) that are also located to the south of Highway 30, and FMC-owned Northern Properties located to the north of Highway 30. The easternmost portions of the FMC OU are located outside the reservation boundary.

This Report is one of the work elements being conducted pursuant to the remedial actions set forth in the Interim Amendment to the Record of Decision for the EMF Superfund Site FMC Operable Unit (IRODA; Environmental Protection Agency [EPA], 2012) and a RD/Remedial Action (RA) Unilateral Administrative Order (UAO) issued by the EPA on June 10, 2013 (EPA, 2013) which became effective on June 20, 2013. This Report presents the design for the selected groundwater remedy identified in the IRODA and the UAO. The Selected Groundwater Remedy includes groundwater extraction and treatment, and requires long-term monitoring and institutional controls (ICs). A more detailed description of the selected remedy for the FMC OU is presented in Section 2.5.2.

The objectives of the FMC OU Groundwater RD are to prepare engineering plans and technical specifications that meet UAO requirements and are suitable for procuring construction contractors to implement the selected remedy. In accordance with the UAO, the Report presents a detailed description of the activities to be completed to fully implement the Selected Remedy. As specified in UAO Paragraph 30.e., and consistent with the design sequencing described in Section 1.3, this Report contains:

1. 30% Design Drawings (Appendix A).

2. Bench-Scale Treatability Study Report (Section 4.2 and Appendix B)
3. Design analysis, including assumptions and parameters, design restrictions, design calculations for the 30% Groundwater RD (Section 5.0 and Appendix C).
4. Preliminary list of technical specifications (Section 6.1).
5. Preliminary Draft Construction Quality Assurance Plan (Section 6.2 and Appendix E)
6. Preliminary Draft Operation, Maintenance, and Monitoring (OM&M) Plan (Section 7.5).
7. Preliminary Draft Performance Standard Verification Plan (Section 7.4)
8. Draft Institutional Controls Implementation and Assurance Plan (Section 7.6)
9. A description of how the Remedial Action will be implemented in a manner that minimizes environmental impacts consistent with EPA's Principles for Greener Cleanups, Office of Solid Waste Emergency Response (OSWER, Aug, 2009) and Region 10's Clean and Green Policy (Aug, 2009) (Section 5.6 and Specification 01585 – Green and Sustainable Practices).
10. Preliminary remedial action schedule for the Groundwater RD (Section 8.0).

## 1.2 COMPLIANCE DURING REMEDIAL DESIGN WITH APPLICABLE REGULATORY REQUIREMENTS

This RD has been prepared, and the actual RA activities will be performed, in accordance with the *Superfund Remedial Design and Remedial Action Guidance* (EPA, 1986). The intent is to design the Selected Remedy such that it:

- Complies with the IRODA, and
- Fulfills the UAO.

EPA guidance documents will be used throughout the design process as the basis for development of work plans, sampling plans, monitoring plans, and other supporting documents. EPA guidance documents used for these purposes include:

- EPA Superfund Remedial Design and Remedial Action Guidance OSWER Directive 9355.0-4A, June 1986) and other EPA RD/RA guidance.
- EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans (EPA, 2001).
- EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans (EPA, 2002).
- EPA QA/G-4, Data Quality Objectives Process for Hazardous Waste Site Investigations (EPA, 2006).

All plans and design documents included in this, and subsequent iterations of this Report, will be submitted for review and approval by the EPA.

## 1.3 DESIGN SEQUENCING

The Groundwater RD has been sequenced to mirror the requirements of Section IX of the UAO and will include the following submittals:

- Preliminary (30%) RD;
- Intermediate (60%) RD, if determined to be necessary[1];
- Pre-Final (90%/95%) RD; and
- Final (100%) RD

The anticipated RD and RA schedule for the groundwater remedy is presented in Section 8.0.

## 1.4 PROJECT ROLES AND RESPONSIBILITIES

The overall organizational structure showing the key personnel for the FMC OU RD is illustrated in Figure 1-3. The responsibility and authority of each organization is presented below. Additional discussion regarding the project roles and responsibilities related to the overall RD project quality assurance/quality control (QA/QC) is included in Appendix A.

### 1.4.1 ENVIRONMENTAL PROTECTION AGENCY

EPA is the lead agency governing the remediation of the FMC OU. EPA issued the IRODA and UAO, and is responsible for approving all plans and reports related to implementing the Selected Remedy. The EPA Remedial Project Manager is Mr. Jonathan Williams.

### 1.4.2 FMC CORPORATION

As the responsible party, FMC is implementing the Selected Remedy in accordance with the UAO. FMC has overall responsibility for procuring consultants and contractors to perform the work, budgeting and securing the necessary funds, and assuring that the requirements of the UAO are met. The FMC Project Coordinator is Dr. Marguerite Carpenter. The FMC Alternate Project Coordinator is Mr. Robert Forbes.

[1] Pursuant to UAO Paragraph 30.f., if Respondent determines during RD planning that a 60% Intermediate RD is necessary, Respondent shall submit the Intermediate (60%) RD for EPA comment. The Intermediate RD must: 1) be a continuation and expansion of the preliminary design; 2) address all EPA's comments regarding the Preliminary RD; and 3) include the same elements as are required for the Preliminary RD.

### 1.4.3 MWH AMERICAS, INC.

MWH Americas, Inc. (MWH) will serve as the Supervising Contractor. MWH is a global technical consulting, engineering, and construction firm, with a reach-back capacity to more than 7,000 employees. MWH provides expertise in all aspects of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) projects, including remedial investigations, human health and ecological risk assessments, feasibility studies, RD/RA, treatability testing, permitting, construction, and operation and maintenance of completed designs. The various technical issues that will be involved with the FMC OU RD/RA work require access to personnel with experience in specific technical areas. MWH provides these capabilities, and can draw on specific personnel for additional resource support and input as necessary.

The core MWH FMC OU project team will consist of a select group of professionals based in Salt Lake City, Utah that specialize in CERCLA compliance, remedial earthwork design, and groundwater extraction system design. Many of the MWH team have worked together on other projects, and several have worked on FMC Pocatello projects for over 15 years. The specific individuals involved in the remedial design for the groundwater remedy and their respective roles are as follows:

**Project Director.** Mr. Marc Bowman is the MWH Project Director. He will be responsible for the contractual commitments and for ensuring that the necessary resources are dedicated to the project. He also will assure the technical, budget, and schedule requirements are met. Mr. Bowman has over 26 years of CERCLA experience and has managed several complex, interdisciplinary remediation projects for CERCLA and Resource Conservation and Recovery Act (RCRA) sites throughout the western United States, including in EPA Region 10.

**RD Manager.** Mr. Rob Hartman will serve as the MWH Remedial Design Manager. Mr. Hartman will be responsible for day-to-day communication with the FMC Project Coordinator as well as with the MWH staff assigned to perform the various project tasks. As MWH RD Manager, he will define and clarify the scope of work and objectives for each major activity. Mr. Hartman has over 25 years of experience including 16 years in the mining and mineral processing industry as a project manager and remediation project director. His experience has focused on CERCLA, Remedial Investigation/Feasibility (RI/FS), RD/RA and emergency removal actions, RCRA waste unit closure and corrective action, and facility decommissioning and asset recovery.

**Engineering Manager.** Mr. Chad Tomlinson will serve as the MWH Engineering Manager and the primary design interface to the MWH RD Manager. He will be responsible for coordinating the necessary resources to accomplish the design of the various elements and to complete the groundwater remedy RD phase. He will ensure that the various plans and design submittals meet the requirements of the UAO and SOW. Mr. Tomlinson has over 20 years of experience with

the development, design, permitting, construction, operation, and reclamation of mine facilities. Project experience has included tailings impoundments, heap leach facilities, water storage dams, sedimentation dams, and storage ponds. Mr. Tomlinson is a registered professional (civil) engineer (registered PE in Idaho) with a technical specialty in geotechnical engineering.

**Project Technical Lead.** Mr. David (Dave) Miklas will serve as the RD water treatment plant project technical design leader. His responsibilities will include development of key design parameters and confirming the project deliverable requirements. Additional duties are the identification of project resource needs and coordinating recruitment of experienced individuals to efficiently complete the project's design requirements. During Mr. Miklas' 35-year career he has participated in hydraulic and water treatment project conceptual development, preliminary engineering, final design, equipment procurement, construction, commissioning and start-up. Dave is a registered professional (civil) engineer.

**Program QA/QC Leader.** Mr. Michael Gronseth will serve as the Program QA/QC Manager. Mr. Gronseth will oversee all quality QA/QC related to the RD of the FMC OU. Mr. Gronseth has over 25 years of experience with environmental remediation and has served as the QA/QC manager for the MWH's Federal Operations for the past 8 years. In this capacity, Mr. Gronseth has been involved with the development of Corporate QA/QC policies and is responsible for the implementation of contract and corporate QA/QC programs.

## 1.5 DOCUMENT ORGANIZATION

The remainder of this document consists of the following:

- Section 2.0 describes the site background, site characteristics, nature and extent of groundwater contamination, and a summary of the ROD and Selected Remedy.
- Section 3.0 summarizes the Groundwater RD considerations relevant to the overall RAOs and the performance standards defined under the UAO.
- Section 4.0 provides a summary of the design studies conducted to date to support the design of the groundwater remedy.
- Section 5.0 provides the preliminary (30%) RD for the groundwater remedy including key design criteria, description of proposes treatment process, and monitoring and institutional controls to support the remedy.
- Section 6.0 provides a list and description of accompanying design plans and preliminary list of specifications.
- Section 7.0 provides a summary of the supporting documents ("other named plans").
- Section 8.0 presents a schedule for the groundwater remedial design.

- Section 9.0 is the reference section.
- Appendix A: Preliminary (30%) Drawings
- Appendix B: Bench-Scale Treatability Study Report
- Appendix C: Calculations and Design Criteria
- Appendix D: Specifications
- Appendix E: Construction Quality Assurance Plan

# 2.0 PROJECT BACKGROUND SUMMARY

This section provides an overview of the FMC OU and a summary of information assembled during the EMF Superfund Site RI/FS and FMC OU Supplemental Remedial Investigation and Supplemental Feasibility Study (SRI/SFS). This section includes a brief description of the site including the physical setting, brief synopsis of the history and response actions, and a summary of the nature and extent of contaminants as identified during the RI and SRI at the site. More detailed information is contained in the Remedial Investigation for the Eastern Michaud Flats Site (EMF RI Report; BEI, 1996); Supplemental Remedial Investigation Report for the FMC Plant Operable Unit (SRI Report MWH, 2009a); Groundwater Current Conditions Report for the FMC Plant Operable Unit (GWCCR; MWH, 2009b); and Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit (SRI Addendum Report; MWH, 2009c), which are in the Administrative Record for the Site.

## 2.1 SITE DESCRIPTION

### 2.1.1 LOCATION

The FMC OU, which includes the former plant process areas, other areas related to the plant operation, and adjacent FMC-owned areas, occupies approximately 1,450 acres in Power County, Idaho approximately 2.5 miles northwest of the city of Pocatello (see Figures 1-1 and 1-2). Over the years, numerous names have been used to describe FMC-owned properties. As part of the IRODA, EPA developed a table to clarify the terminology and definitions below to describe different geographic areas within and adjacent to the FMC Plant. Table 2.1 contains the definition of terms for geographic areas at the FMC facility as adapted from the inset table on pages 2 and 3 of the IRODA.

### 2.1.2 TOPOGRAPHY

The EMF Site is located approximately 2.5 miles northwest of the city of Pocatello in the funnel-shaped Portneuf River Valley. The valley virtually closes at the southern end of Pocatello at the Portneuf Gap. East of Pocatello, the Pocatello Mountain Range rises from about 4,400 feet to about 6,500 feet above mean sea level. The Bannock Range then bounds the west side of Pocatello and the Lower Portneuf River Valley. The north end of the Bannock Range is just south of the FMC OU. The Bannock Range and Michaud Flats meet along an escarpment that runs east–west through the FMC OU.

**Table 2.1 Definition of Terms for Geographic Areas at the FMC Facility**
(Adapted from Inset Table on Pages 2 and 3 of the IRODA)

| Term Used in the IROD | Description |
|---|---|
| FMC Plant | This is used as a generic term throughout the IRODA to describe the FMC Corporation Elemental Phosphorus Production Facility in Pocatello, Idaho. |
| FMC Facility | All areas owned by FMC. Sometimes used as *Facility* (see IRODA Figure 3). Groundwater contamination on the Facility is not being segregated between the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) for the purpose of the remedy in this IRODA. |
| FMC Operable Unit (OU) | All areas owned by FMC that are addressed by CERCLA actions. The boundaries for the FMC Facility and the FMC OU are the same; however, the RCRA Ponds, although located within these concurrent boundaries, are not part of the FMC OU or CERCLA action. Groundwater beneath the FMC Facility is covered under this CERCLA action and therefore is part of the FMC OU. Sometimes referred as the *FMC Plant OU* (see IROD Figure 4). |
| Former Operations Area | Areas within the FMC Facility where any production-related operations occurred. This includes all the FMC-owned properties except the Northern Properties, Southern Undeveloped Area (SUA), and Western Undeveloped Area (WUA). The RCRA Ponds are located within the boundaries of the Former Operations Area but are not part of the CERCLA action. See IROD Figure 3. |
| Former Elemental Phosphorus ($P_4$) Production Area | Areas within the FMC Facility where primary elemental phosphorus production occurred, including the furnace building, secondary condenser, phosphorus dock, slag pit, and the former kiln scrubber ponds and calciners. See IRODA Figure 5. |
| CERCLA Ponds | Areas within the FMC Facility where process wastes were managed in unlined surface impoundments and are addressed under this IRODA. See IROD Figure 5. |
| RCRA Ponds | Areas within the FMC Facility where process wastes were managed under RCRA in lined surface impoundments that have been capped. These ponds are managed under RCRA and are not being addressed under this Interim ROD Amendment. The RCRA Ponds are within the boundaries of the FMC OU and the Former Operations Area, however they are not considered part of the area addressed by CERCLA action. See IROD Figure 5. |
| Slag Pile | Area containing most of the above grade slag by-product from FMC Plant operations. See IRODA Figure 5. |
| Northern Properties | Areas owned by FMC north of Highway 30 comprised of Parcels 1-6. These areas were not part of any elemental phosphorus processing operations. See IROD Figure 3. |

| Term Used in the IROD | Description |
|---|---|
| Western Undeveloped Area (WUA) | Area west of the Former Operations Area within the FMC Facility. This area was not part of any elemental phosphorus processing operations. See IRODA Figure 3. |
| Southern Undeveloped Area (SUA) | Area south of the Former Operations Area within the FMC Facility. This area was not part of any elemental phosphorus processing operations. See IRODA Figure 3. |

### 2.1.3 METEOROLOGY

The EMF Site is semi-arid, with approximately 11 inches of precipitation per year. Net annual evapotranspiration rates typically exceed annual precipitation. Prevailing winds are from the southwest. There is also a secondary wind component out of the southeast which appears to be a drainage wind that flows out of the Portneuf River valley, primarily at night.

### 2.1.4 GEOLOGY

The FMC Plant OU and surrounding area are located at the juncture between the Basin and Range physiographic province to the south and the Snake River Plain to the north (Dohrenwend, 1987). The FMC Plant OU is located at the northern base of the Bannock Range where it merges with the Michaud Flats. The Bannock Range is part of the Basin and Range Province and the Michaud Flats is part of the Snake River Plain. The SUA of the FMC Plant OU is located at the northern end of the Bannock Range and the former operational areas of the FMC elemental phosphorus production facility are located primarily on the Michaud Flats. The FMC Plant OU is underlain by a sequence of Starlight Formation volcanics and sediments, overlain by the interfingered American Falls Lake Beds (AFLB) -Sunbeam Formation. These are overlain by Michaud Gravel and Aberdeen Terrace deposits. Finally, a mantling of loess is present at higher elevations and a veneer of alluvium covers lower areas. Loess deposits are much thicker in portions of drainages where they have been reworked and re-deposited. The regional geology, including the FMC Plant OU, is shown on Figure 2-1 as mapped by K.L Othberg in an unpublished report by the Idaho Geological Survey in April 1997.

The stratigraphy of the FMC Plant OU generally can be described as discontinuous layers of unconsolidated sediments deposited on an erosional surface that was incised in volcanic bedrock. Fill material encountered during drilling and excavating consists of reworked native soil, imported soil and other materials generated during the facility operations. The materials were stored and/or placed around the FMC Plant Site during the operation of the facility and during decommissioning activities. Fill and other source material at the FMC Plant Site observed during SRI drilling includes reworked native (loess, sand, and gravel), slag, ore (including calcined ore and bull rock), ferrophos, concrete, asphalt, silica, calciner pond solids, phossy solids, precipitator solids, and coke (including coke fines). Soil types encountered during SRI drilling include loess, gravels and clays. Material up to boulder size and possibly larger was encountered beneath the site during drilling near the furnace building (remedial area [RA-B]) at depths below 60 feet bgs. Bedrock was encountered during drilling near the calciner solids storage area (RA-E) and included basalt, rhyolite, and tuffs.

### 2.1.5 HYDROLOGY AND HYDROGEOLOGY SETTING

Major surface water features of the region near the FMC OU include the Snake River, Portneuf River, and the American Falls Reservoir which are presented in Figure 2-2. There are no naturally-occurring perennial surface water systems within the FMC OU. Surface water runoff

from the FMC OU former operations area from rain is infrequent and is entirely contained within the FMC Plant Site property.

Basalt and gravel aquifers underlay the Michaud Flats. These aquifers are recharged by groundwater from the adjoining Bannock and Pocatello mountain ranges and from the Pocatello Valley aquifer. The Michaud Flats aquifer system can be divided into a shallow aquifer and a deeper aquifer. The deeper aquifer is the primary water-producing aquifer within the Michaud Flats. Groundwater flows within the regional aquifer system discharge to the Portneuf River, American Falls Reservoir, or the Fort Hall Bottoms. Between I-86 and the American Falls Reservoir, the Michaud Flats aquifer system discharges approximately 200 cubic feet per second (cfs) of groundwater to the Portneuf River. The American Falls Lake Beds (AFLB) form an aquitard that separates the shallow from the deeper aquifers within the Michaud Flats area, but the AFLB are not present along part of the Portneuf River in the area of Batiste Springs. Groundwater depths range from more than 150 feet (ft) below ground surface (bgs) in the southern portion of the FMC OU to 45 ft bgs in the northwestern area of the FMC plant area. In the northern portion of the FMC OU, groundwater is approximately 60 ft bgs. The SRI sampling encountered groundwater at depths typically greater than 90 ft bgs at the FMC plant area. As presented in Figure 2-3, groundwater flow beneath the former operations area generally flows to the north from the Bannock Range and then to an east-northeasterly flow as the Bannock Range groundwater merges with the Michaud groundwater system. FMC- and Simplot-impacted groundwater discharges and mixes with the Portneuf River in the area between and including Swanson Road Spring and Batiste Spring, and then migrates into the Off-Plant OU as surface water. Total groundwater discharge to the Portneuf River from the west, including flow from the EMF Site, in the area between and including Swanson Road Spring and Batiste Spring has been estimated to be between 36 to 55.5 cubic feet per second (cfs) (Groundwater Model Report; MWH, 2010b) and approximately 20 cfs (Simplot, 2013). From the area of these springs, the Portneuf River flows north through a portion of the Fort Hall Indian Reservation and then enters the American Falls reservoir.

### 2.1.6 ECOLOGICAL SETTING

Much of the FMC OU was an industrial facility and much of the land surface has been disturbed, resulting in limited areas with vegetation inside the FMC OU. Major terrestrial vegetation cover types and wildlife habitats include agricultural, sagebrush steppe, and wetland/riparian. Wildlife habitats in the vicinity include sagebrush steppe, grassland riparian, cliff, and juniper. The most significant aquatic habitats in the vicinity are the Portneuf River, associated springs and riparian corridor, and the Fort Hall Bottoms. These areas are designated wetlands under the National Wetland Inventory of the U.S. Fish and Wildlife Service. The Portneuf River supports an extensive riparian community, which is an important source of food, cover, and nesting sites for many wildlife species.

## 2.2 SITE HISTORY

The FMC elemental phosphorus facility, occupying most of the property that FMC owns south of Highway 30 near Pocatello and referred to as the "FMC Plant Site," ceased production in December 2001. From 2002 through 2006, the facility was decommissioned and its infrastructure was demolished to ground level. The FMC facility operated essentially continuously from 1949 (prior to that time the site was primarily in agricultural use) through 2001.

The FMC facility produced elemental phosphorus from phosphate-bearing shale ore mined regionally. The shale, combined with coke and silica, was fed into four electric arc furnaces located in the furnace building (within RA-B). The furnace reaction primarily yielded gaseous elemental phosphorus, CO gas, slag, and ferrophos (FeP). The elemental phosphorus gas was subsequently condensed to a liquid state and stored in sumps and tanks prior to shipment off-site as product. Elemental phosphorus will burn upon contact with air. Therefore, to prevent oxidation, the condensed phosphorus product was kept covered with water from the time it was produced through loading and transport off-site.

As summarized in Section 2.3, some feed stocks, byproducts (including air emissions) and products of historical operations at the FMC Plant Site contain elevated levels of constituents of potential concern (primarily metals and radionuclides). Historical management of these materials has resulted in impacts to soils and shallow groundwater at the FMC Plant OU. In addition, downgradient discharge of shallow groundwater from beneath the FMC Plant OU into the Portneuf River has contributed to the impairment of surface water quality in the Off-Plant OU; however, based on mass loading calculations performed by Simplot (Simplot, 2012 and Simplot, 2013), it is estimated that FMC-impacted groundwater migrating downgradient from the FMC Plant Site northern boundary accounts for less than 5 percent of the total mass load of EMF Site contaminants migrating to the river (i.e., Simplot is the predominant source of contamination to the river).

### 2.2.1 RI/FS FOR THE EASTERN MICHAUD FLATS

FMC, Simplot and EPA entered into a CERCLA Administrative Order on Consent (AOC) in May 1991 under which the companies agreed to conduct a RI/FS for the site. During the RI/FS the site was divided into three "Subareas:" 1) the FMC Subarea, consisting of the FMC plant and other FMC-owned properties at the site; 2) the Simplot Subarea, consisting of the Simplot plant and other Simplot-owned properties at the site; and 3) the Off-Plant Subarea, consisting of the remainder of the site. EPA changed these designations to the FMC Plant OU, the Simplot Plant OU, and the Off-Plant OU after its 1998 Record of Decision (ROD) for the EMF Site (1998 ROD, EPA, 1998).

As required under the 1991 Eastern Michaud Flats AOC (1991 AOC), FMC and Simplot developed a number of EMF Site studies and reports. These included the Preliminary Site

Characterization Summary (EMF PSCS; BEI, 1994) and the EMF RI Report. EPA reviewed and approved these reports. EPA conducted the baseline ecological and human health risk assessments concurrently with the companies' RI/FS work and issued the draft and final reports for those risk assessments in July 1995 and July 1996, respectively. The conclusions of those risk assessments were incorporated into the FS Report for the FMC Subarea (1997 FMC Subarea FS Report; BEI, 1997) and the 1998 ROD.

### 2.2.2 2012 IRODA AND 2013 UAO FOR REMEDIAL DESIGN AND REMEDIAL ACTION

The IRODA for the EMF Superfund Site FMC Operable Unit (EPA, 2012) was signed by EPA Region 10 on September 27, 2012. The IRODA presents the interim remedy for the Site as selected by EPA. A summary of the IRODA selected remedy is presented below in Section 2.4.2.

On June 10, 2013, EPA Region 10 issued a UAO to FMC for Remedial Design and Remedial Action, EPA Docket No. CERCLA-10-2013-0116 (EPA, 2013), that became effective on June 20, 2013. The UAO defines the specific actions FMC will undertake to design and implement the selected remedy at the FMC OU in accordance with the IRODA.

## 2.3 NATURE AND EXTENT OF SOIL CONTAMINATION

A description of the nature and extent of soil contamination is provided in the Remedial Design Work Plan (RDWP; MWH, 2013) and the Soil Remedial Action Remedial Design Report (Soil RDR; MWH, 2014a). The nature and extent of soil contamination is presented is summarized in Section 2.3 of the Soil RDR and is not repeated here.

## 2.4 NATURE AND EXTENT OF GROUNDWATER AND SURFACE WATER CONTAMINATION

Many groundwater studies, including routine long-term groundwater monitoring, have been completed over the years. The results of these studies were compiled and evaluated in the GWCCR that EPA approved in 2009.

Groundwater at the EMF Site flows northward from the western and central portions of the FMC OU and contamination is limited to the area south of I-86 by converging flow of groundwater from the west and northwest (see Figure 2-3). Groundwater from the western and central portions of the FMC OU is swept eastward, south of I-86, and joins groundwater from the Joint Fence Line/Calciner Ponds Area and from the Simplot Plant. In the Joint Fence Line/Calciner Ponds Area, groundwater from the western part of the Simplot gypsum stack flows in a northwesterly sweeping arc across the Simplot property boundary flows beneath FMC OU where it commingles with flows from the eastern portions of the FMC OU, and exits to the northeast near monitoring well 110. Virtually all groundwater beneath the EMF facilities discharges to the Portneuf River between Batiste Spring and the spring at Batiste Road (aka Swanson Road

Springs) and as bank seeps and baseflow to the river in the reach bounded by these springs (MWH, 2009b).

The GWCCR concluded that the groundwater quality and the area of EMF-impacted groundwater essentially remained unchanged from 1991 through 2010. Table 2.2 shows maximum detected groundwater concentrations during the 1991 through 2008 period, the range of contaminants, and associated maximum concentration levels (MCLs). As shown on Table 2.2, arsenic is the primary risk-driving constituent in groundwater at the FMC OU and is the only constituent in the extracted groundwater that is expected to exceed its respective comparative value (CV). The extent of groundwater contamination at the FMC OU is defined by arsenic concentrations above the MCL in shallow groundwater. The extent of arsenic concentrations above the MCL in shallow groundwater encompasses less extensive areas where other groundwater contaminants of concern (COCs) exceed their CVs. Total phosphorus/orthophosphate concentrations in shallow groundwater exceed background concentrations but total phosphorus/orthophosphate is not a COC in groundwater because there is no CV. However, because groundwater underflowing the FMC OU merges with contaminated groundwater underflowing the Simplot OU and virtually all of the combined groundwater from the EMF facilities discharges to the Portneuf River where there is a Total Mass Daily Load (TMDL) target for total phosphorus pursuant to the Clean Water Act. Thus, total phosphorus/orthophosphate is considered a COC due to the migration EMF groundwater to surface water that currently exceeds the TMDL target for in-stream total phosphorus concentrations in the Portneuf River. The extent of arsenic and phosphorus/orthophosphate groundwater contamination at the FMC OU is presented on Figure 2-4 and 2-5, respectively.

## Table 2.2

## EMF Site Groundwater COCs Identified in the 1998 ROD
## Updated Comparative Values and FMC Plant OU Groundwater COCs

| TABLE 36 FROM THE 1998 ROD FOR THE EMF SITE - RISK BASED AND MAXIMUM CONCENTRATION OF CONTAMINANTS OF CONCERN IN GROUNDWATER | | | | | UPDATED GROUNDWATER COMPARATIVE VALUES, SUMMARY OF GROUNDWATER RESULTS[1] AND IDENTIFICATION OF FMC PLANT OU GROUNDWATER COCS | | | |
|---|---|---|---|---|---|---|---|---|
| Substance of Concern | Units | Maximum Detected Concentration | Risk Based Concentration | Maximum Contaminant Level (MCL) | Updated Comparative Value (CV)[2] | Percentage of Results for FMC Wells >= CV[3] | Maximum Detected Concentration (2000-2008)[4] | FMC Plant OU Groundwater COC |
| Antimony | mg/l | 1.07 | 0.006 | 0.006 | 0.006 | 1.5% | 0.0073 [5] | |
| Arsenic | mg/l | 5.53 | 0.000048 | 0.05 | 0.01 | 66.4% | 0.393 | **X** |
| Beryllium | mg/l | 0.083 | 0.000019 | 0.004 | 0.004 | 0.0% | Zero detected results | |
| Boron | mg/l | 89 | 1.36 | - | 7.3 | 0.3% | 6.24 | |
| Cadmium | mg/l | 3.9 | 0.008 | 0.005 | 0.005 | 0.2% | 0.0013 | |
| Chromium | mg/l | 7.58 | 0.077 | 0.1 | 0.1 | 0.1% | 0.0118 | |
| Fluoride | mg/l | 2,815 | 0.93 | 4 | 4 | 7.0% | 193 | **X** |
| Manganese | mg/l | 91.2 | 0.077 | - | 0.05 | 44.4% | 2.66 | **X** |
| Mercury | mg/l | 0.0043 | 0.0046 | 0.002 | 0.002 | 1.1% | 0.00028 | |
| Nickel | mg/l | 3.46 | 0.299 | 0.1 | 0.73 | 0.0% | 0.0451 | |
| Nitrate | mg/l | 660 | 25.03 | 10 | 10 | 18.5% | 46.1 | **X** |
| Radium-226 | pCi/L | 7.09 | 0.39 | 5* | 5* | 6.4% [6] | 1.46 [7] | |
| Selenium | mg/l | 19.73 | 0.07 | 0.05 | 0.05 | 4.9% | 0.204 | **X** |
| Thallium | mg/l | 9.09 | 0.001 | 0.002 | 0.002 | 1.7% | 0.0085 [8] | |
| Vanadium | mg/l | 22.317 | 0.108 | - | 0.18 | 1.9% | 0.182 | **X** |
| Zinc | mg/l | 28.9 | 3.92 | - | 71 | 0.0% | 0.0209 | |
| Tetrachloroethene | mg/l | 0.035 | 0.001 | 0.005 | 0.005 | 3.9% | >0.001 | |
| Trichloroethene | mg/l | 0.028 | 0.002 | 0.005 | 0.005 | 0.8% | >0.001 | |
| Gross Alpha [b] | pCi/L | 1,690 | - | 15 | 15 | 4.0% | 325 [9] | |
| Gross Beta [c] | pCi/L | 1,355 | - | 4 mrem/yr | 4 mrem/yr | NC [10] | 960 | |

Table 2.2 (Continued)

## EMF Site Groundwater COCs Identified in the 1998 ROD
## Updated Comparative Values and FMC Plant OU Groundwater COCs

| Substance of Concern | Units | Maximum Detected Concentration | Risk Based Concentration | Maximum Contaminant Level (MCL) | Updated Comparative Value (CV)[2] | Percentage of Results for FMC Wells >= CV[3] | Maximum Detected Concentration (2000-2008)[4] | FMC Plant OU Groundwater COC |
|---|---|---|---|---|---|---|---|---|
| Elemental phosphorus | mg/l | NA | NA | NA | 0.00073 | 6.2% | 0.258 | **X** |
| Total cyanide | mg/l | NA | NA | NA | 0.2 | 4.8% | 0.43 [11] | |

Key (*1998 ROD Table 36*):

*Combined Ra 226 and Ra 228

[a] RBCs for groundwater based on drinking water and watering homegrown produce. RBC value based on cancer risk of 10-6 or HQ=1

[b] Individual radionuclides potentially responsible for elevated gross alpha and gross beta levels are also COPCs. These include, but are not limited to Lead-210, Polonium-210, Potassium-40, Thorium-230, Uranium-234, and Uranium-238.

[c] Beta particle and photon activity based on consumption of 2 liters/day

**Shaded chemicals are COCs identified in the FS** (*1997 FS Reports for EMF Subareas*)

Notes (*Updated Information*) :

[1] The FMC Plant OU groundwater results are from monitoring locations: 100-series wells are 100 through 191 inclusive; the TW-series wells are TW-1 through TW-12 inclusive (including shallow, intermediate and deep); the selected 500-series wells are 500, 501, 502, 514, 515, 516, 517, 521, 522, 523, 524 and 525; and Batiste Spring and Swanson Road Spring (aka the Spring at Batiste Road).

[2] The Comparative Values (CVs) are taken from Table 4.2-1 "Groundwater Representative Concentrations and Comparative Values" in the GWCCR, June 2009 Final.

[3] The percentage of valid results greater than the CV are for all results through May 2008 for the wells listed in note 1.

[4] The maximum valid detected result based on monitoring from January 2000 through May 2008 for the wells listed in note 1.

[5] For the antimony results with a detection limit below the CV, only 1 of 41 results (2.4%) is greater than the CV. That single result >= CV was at northern Joint Fenceline Area well 110 and does not appear to be attributable to FMC Plant OU sources.

[6] Percentage is for combined Ra-226 and Ra-228 activity >= CV.

[7] Maximum value is maximum combined result for Ra-226 plus Ra-228; maximum Ra-226 result is 0.57 pCi/l.

[8] Only 2 of 21 results from 2000 were reported detected above the CV and zero of 36 results from 2001 were reported detected above the CV (including the same wells sampled during 2000), the sporatic detection of thallium above the CV but below the representative (background) levels is consistent with the findings of the EMF RI that thallium is not related to FMC Plant OU sources.

[9] As described in detail in the GWCCR, June 2009 Final, the only gross alpha results that exceed the CV are at Joint Fenceline Area wells 161 and 164 and representative (background) well 515 and are not related to FMC Plant OU sources.

[10] A percentage was not calculted as results are in pCi/l and not comparable to the CV in mrem/yr.

[11] For the 2000-2008 cyanide results, only 4 of 79 results (5%) are greater than the CV; no post-2001 results are >= CV.

## 2.5 INTERIM RECORD OF DECISION AMENDMENT

The IRODA presents the selected remedy for groundwater underlying the FMC OU. The selected interim amended remedy will protect human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through containment of contaminated soils with engineering controls and institutional controls. Groundwater extraction from the shallow aquifer will provide hydraulic containment of contaminated groundwater, thereby preventing further down-gradient migration of FMC OU COCs. Land use restrictions will limit FMC OU activities to commercial/industrial uses, prohibit activities that may disturb the implemented remedial actions, and restrict human consumption of groundwater. Land use restrictions will also strictly manage when, where, and how non-remedial action excavation can occur (for example, digging to access utility lines).

### 2.5.1 REMEDIAL ACTION OBJECTIVES FOR SITE GROUNDWATER

The remedial action objectives (RAOs) for groundwater underlying the FMC OU include the following elements:

- Prevent potential ingestion of groundwater containing COCs in concentrations exceeding risk-based concentrations (RBC) or ARARs, or site-specific background concentrations if RBCs or ARARs are more stringent than background.
- Reduce the release and migration of COCs to the groundwater from FMC OU sources resulting in concentrations in groundwater exceeding RBCs or applicable, relevant and appropriate requirements (ARARs), or site-specific background if RBCs or ARARs are more stringent than background.
- Restore groundwater that has been impacted by the FMC Facility to meet RBCs or ARARs for COCs, or site-specific background levels if RBCs or ARARs are more stringent than background, within a reasonable restoration timeframe.
- Reduce the release and migration of COCs to surface water from FMC OU sources at concentrations exceeding RBCs or ARARs, including water quality criteria pursuant to Sections 303 and 304 of the Clean Water Act.

### 2.5.2 SELECTED REMEDY SUMMARY FOR SITE GROUNDWATER

The selected remedy for site groundwater at the FMC OU replaces the remedy selected in the 1998 ROD. The remedy addresses metals and other COCs identified in groundwater underlying the FMC OU. The selected remedy for the site groundwater at the FMC OU includes the following components:

- Install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby preventing contaminated groundwater from migrating beyond the

FMC OU and into the Simplot OU and/or adjoining springs or the Portneuf River. Extracted groundwater will be treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin(s) within the FMC OU, where it would percolate down to recharge groundwater or evaporate into the atmosphere. The preliminary design is based on installing multiple extraction wells located along the northeastern FMC Plant Site boundary. Extracted groundwater will either be (1) pumped to a municipal treatment facility in Pocatello for treatment and released in accordance with a National Pollution Discharge Elimination System (NPDES) permit, or (2) treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin(s) within the FMC OU, where it would percolate down to recharge groundwater or evaporate into the atmosphere (see Figure 2-6). As described in Section 5.0, FMC has discontinued pursuing discharge of extracted groundwater to the Pocatello water pollution control (treatment) facility.

- Implement a long-term groundwater monitoring program to evaluate the performance of the soil and groundwater remedial actions to determine their effectiveness in reaching the cleanup levels, and provide information needed for developing a final groundwater remedy protective of human health and the environment if the current interim remedy cannot meet cleanup requirements within an acceptable timeframe. The long-term groundwater monitoring program will be based on the currently approved Interim CERCLA Groundwater Monitoring Plan (MWH, 2010b).

- Implement and maintain institutional controls that include environmental land use easements prohibiting activities that may disturb implemented remedies (such as digging in capped areas) and restrict the use of contaminated groundwater;

- Conduct operations and maintenance of implemented remedial actions.

Other actions, including post-closure activities at the RCRA-regulated units, have been and continue to be performed at the FMC Facility. These actions are not part of the FMC OU because they are conducted under RCRA requirements for closed hazardous waste management units. The post-closure work performed at these units remains regulated under RCRA.

# 3.0 REMEDIAL DESIGN CRITERIA AND COMPONENTS

This section presents the Selected Remedy work elements, objectives, and performance standards as defined in the IRODA and UAO. This section also identifies the RD components that define how the selected remedy will be implemented at the FMC OU.

Note that as discussed in Section 1.3, this Preliminary (30%) RD submittal is intended to provide enough information related to all groundwater RA major work elements in order to gain consensus on the approach before proceeding with developing the detailed design (i.e., the Intermediate (60%), if determined to be necessary[2], Pre-Final (90%/95%), and Final (100%) design).

## 3.1 GROUNDWATER REMEDY DESIGN AND CONSTRUCTION ELEMENTS

The groundwater remedial design and construction elements are presented below.

### 3.1.1 GROUNDWATER EXTRACTION SYSTEM

The groundwater extraction system will consist of a network of extraction wells located in the northeastern corner of the former FMC Plant Site to capture impacted shallow groundwater before it can migrate downgradient beyond the FMC Plant Site boundary. Groundwater modeling indicates that up to eleven (11) extraction wells will be sufficient for hydraulic capture (containment) of the remaining plume before it leaves the FMC Plant OU. The extracted groundwater will be treated on-site and then placed in one or more percolation / evaporation basins located in the WUA of the FMC Plant Site.

As stated in the IRODA, EPA recognizes that operation of the extraction system will not likely achieve the groundwater quality ARARs throughout the FMC Plant OU within a reasonable timeframe (the groundwater model indicates that it will require >100 years to restore groundwater quality below the arsenic MCL within the FMC Plant Site). During implementation of the groundwater extraction remedy, the aquifer system will be stressed and additional site-specific data will be collected to determine if the groundwater restoration RAO can be achieved within a reasonable timeframe. The data and information obtained during implementation of the groundwater extraction system may indicate a need for modification of the system or operation of the system that is substantively different than the implemented groundwater remedial action (per the Remedial Action Work Plan [RAWP]) and operation of the system (per the OM&M Plan) that presumably would be documented in an Explanation of Significant Difference (ESD), IRODA amendment and/or final ROD. The data and information obtained during implementation of the groundwater extraction system may also indicate a need for a Technical

[2] Pursuant to UAO Paragraph 30.f., if Respondent determines during RD planning that a 60% Intermediate RD is necessary, Respondent shall submit the Intermediate (60%) RD for EPAcomment. The Intermediate RD must: 1) be a continuation and expansion of the preliminary design; 2) address all EPA's comments regarding the Preliminary RD; and 3) include the same elements as are required for the Preliminary RD.

Impracticability (TI) or other waiver for a portion of the groundwater plume that would also be documented in an ESD, IRODA amendment and/or final ROD. ICs will remain in place to control groundwater use until RBCs and MCLs (or site-specific background levels where those are higher) for groundwater COCs are achieved at the FMC Plant OU.

*Objective*: The objectives of the extraction well system are to 1) restore groundwater that has been impacted by site sources to meet RBCs or MCLs for the COCs, or site-specific background levels where those are higher, wherever practicable and within a timeframe that is reasonable given the particular circumstances of the site, and 2) reduce the migration of COCs in groundwater to surface water that result in concentrations exceeding risk-based concentrations (RBCs) or chemical-specific ARARs, including water quality criteria (WQC) pursuant to the Clean Water Act.

*Performance Standards*: There are two performance standards for the extraction well system. The first is to demonstrate hydraulic control of groundwater at the northeastern boundary of the FMC Plant Site. The current groundwater model indicates that 11 extraction wells with a combined pumping rate of approximately 530 gallons per minute (gpm) will achieve hydraulic control. The second performance standard, to be met after the required annual average pumping rate has been met and sustained, is extraction of groundwater containing COCs sufficient to meet RBCs and MCLs (or site-specific background levels where those are higher) as measured at the appropriate monitoring locations at the FMC Plant OU and Off-Plant OU, as determined by EPA.

## 3.2 GROUNDWATER REMEDY MONITORING ELEMENTS

The groundwater RA monitoring elements are presented below.

### 3.2.1 INSTITUTIONAL CONTROLS PROGRAM

FMC will implement legally enforceable ICs with respect to all or part of the FMC Plant OU, as appropriate for the needed control, and will include any or all of the following in addition to those institutional controls already in place:

a. Prevent any future ingestion of or exposure to contaminated groundwater (i.e., deed restrictions or restrictive covenants including prohibitions on extraction and consumption of impacted groundwater).
b. Restrictions on the types of activities and/or development (e.g., limited to commercial or industrial);
c. Prohibition of intrusive activities, construction and/or excavation at RAs designated for gamma or ET caps; and,
d. A soil/fill management plan that would be incorporated into deed restrictions to ensure that disturbance, management, and/or disposition of site-impacted soil/fill are controlled.

***Objective**:* In conjunction with the Groundwater RA elements, the objectives of the institutional controls program are to prevent potential ingestion of groundwater containing COCs having concentrations exceeding RBCs or MCLs (chemical-specific ARARs), or site-specific background concentrations if those are higher.

***Performance Standard**:* The performance standard for this element of work is implementation of the Institutional Controls Implementation and Assurance Plan (ICIAP; MWH, 2014b) that will include the elements described above.

### 3.2.2 GROUNDWATER MONITORING

The groundwater monitoring element of work includes sampling and analysis of groundwater from selected wells and the evaluation and reporting of monitoring data.

***Objective**:* The objective of the groundwater monitoring is to collect sufficient data of known, defined quality to evaluate the performance of the source control measures (ET cap element of the Soil Remedial Action) and the groundwater extraction system in 1) reducing the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding RBCs or chemical-specific ARARs, specifically MCLs, or reduce to site-specific background concentrations if those are higher, and 2) restoring groundwater that has been impacted by site sources to meet RBCs or MCLs for the COCs, or site-specific background levels where those are higher, wherever practicable and within a timeframe that is reasonable given the particular circumstances of the site.

***Performance Standard**:* The performance standards for the groundwater monitoring element of work are as follows:

1. Groundwater monitoring, sampling, analysis and reporting will continue pursuant to FMC's Interim CERCLA Groundwater Monitoring Plan (MWH, 2010b) until the Final CERCLA Groundwater Monitoring Plan, as a component of the Remedial Action Plan, is approved by EPA.

2. Consistent with the Interim CERCLA Groundwater Monitoring Plan (MWH, 2010b), the final CERCLA groundwater monitoring program will be coordinated with FMC's RCRA and Calciner Pond remedial action groundwater monitoring programs. The Final CERCLA Groundwater Monitoring Plan also will specify methods for evaluation of potential changes and/or trends in site-related groundwater constituents and groundwater conditions on an FMC Plant OU-wide basis.

3. Once installation of the groundwater extraction system has been completed and the annual average pumping rate has been achieved, the Final CERCLA Groundwater Monitoring Plan will specify the appropriate monitoring locations at the FMC Plant OU and Off-Plant OU, as determined by EPA, to measure progress toward achieving the

Groundwater Extraction System objective and performance standards specified in Section 3.1.1 above.

## 3.3 OPERATION, MAINTENANCE AND MONITORING PROGRAM

The groundwater remedy OM&M element of work includes development of OM&M Plan for the groundwater extraction system (e.g., groundwater extraction wells, pumps, piping and instrumentation and controls) and the water management system. For water management (on-site treatment and discharge to one or more percolation / evaporation basins located in the WUA), the OM&M Plan includes detailed operational and maintenance procedures for the treatment system process, piping and percolation pond(s).

***Objective**:* The objective of the groundwater remedy OM&M is to assure the groundwater extraction and management systems continue to perform as designed and installed.

***Performance Standard**:* Specific performance standards for the groundwater remedy OM&M program will depend on the final design of the groundwater extraction and water management systems. The performance standards will be finalized and documented in the Remedial Action Work Plan.

# 4.0 Design Studies to Support Groundwater Remedy

This section presents a summary of the supplemental studies performed to support the design of the groundwater remedy including the following:

- Extraction Zone Hydrogeological Study (EZHS) – Performed to assess the groundwater quality and aquifer characteristics for the purpose of designing the Hydraulic Containment System.
- Bench-Scale Treatability Study (BSTS) – Performed to assess the optimum treatment technology and process train for reducing groundwater COCs below their respective treatment standards.

## 4.1 HYDROGEOLOGICAL STUDY

The EZHS was implemented as described in the Extraction Zone Hydrogeological Work Plan (EZHWP, MWH, 2013b). Three extraction wells and six piezometers were installed in the extraction zone located along the northeast boundary of the FMC Plant Site. The extraction wells were completed based on the lithology and groundwater chemistry profiling and the piezometers were completed to mirror the construction of the extraction wells. Groundwater quality samples were collected from each of the three extraction wells during the six-hour pump tests and a time and flow-weighted composite sample was collected from the combined flow from the three extraction wells during the 72-hour hydraulic containment pump test. A complete description of the Hydrogeological Study can be found in the Hydrogeological Study Report (MWH, 2014c). The following are a summary of the findings of the EZHS:

- The lithology was as expected (predominantly silt to a depth of about 25 feet overlying predominantly gravels, with varying silt and sand overlying the clay or silt of the AFLB). The AFLB was encountered at about 4,372 (EW-01), 4,367 (EZ-02) and 4,363 (EW-03) feet above mean sea level (amsl) which were in the expected range of 4,350 and 4,375 feet amsl (MWH, 2014c).
- The saturated thickness of the shallow groundwater zone above the AFLB is about 30 feet, as expected.
- Extraction well screens were set from the top of the AFLB to slightly above the static water level. Based on sieve analysis of the saturated zone, the slot size was set at 0.120 inch compared to the preliminary design for 0.02 inch slot. The larger slot size is advantageous for achieving optimal well yield.
- Water quality in the individual extraction wells and the composite sample from all three wells was generally consistent with the estimated average concentrations (Table 7-4 of the SFS Report (MWH, 2010a) and concentration contour maps from the GWCCR) for the purpose of the preliminary groundwater remedy design. The water quality results for

the composite sample for those parameters that have a City of Pocatello POTW Influent Standard did not exceed that standard.

- Well yields and hydraulic conductivities within the extraction zone were lower than assigned in the original groundwater flow model (MWH, 2010c). The hydraulic conductivity values for the extraction zone within the original model ranged from approximately 105 to 658 feet/day (with an average of 430.2 feet/day) compared to the lower hydraulic conductivity values obtained during aquifer testing of the extraction wells, which ranged from approximately 29 to 486 feet/day (with an average of 269.3 feet/day). These lower values were input into the updated flow model.

- The updated groundwater flow model simulation shows that the preliminary design for five extraction wells at flows of about 100 gpm per well (based on the original model) is not realistic based on observed hydraulic conductivities in the extraction zone.

- A simulation of a reconfigured multiple well extraction system (refined preliminary design) based on eleven extraction wells pumping at rates consistent with well capacities observed during the pump tests appears to effectively capture the groundwater from the majority of the FMC site and generally achieved hydraulic containment comparable to the preliminary design based on the original flow model. The total combined flows of both the refined and preliminary designs are similar, at 514 and 531 gpm respectively. However, a portion of the groundwater in the joint fenceline area, near the boundary with the Simplot property, does appear to bypass on the eastern side of the simulated extraction well system and is not captured by the simulated FMC wells or the Simplot extraction or production wells. The preliminary design for the extraction zone well and piezometer network is shown in Figure 4-1.

Overall, the study met the objective of providing extraction zone specific hydrogeologic and water quality information to advance the RD and specifically to refine the design of the groundwater remedy selected for the FMC OU.

## 4.2 BENCH-SCALE TREATABILITY STUDY

In accordance with the UAO for the groundwater RD/RA for the FMC OU, FMC performed bench-scale treatability testing per the BSTS Work Plan (MWH, 2014d). The primary objective of the treatability testing was to determine the most appropriate coagulant type, coagulant dose, required mixing rates, and optimum pH to lower the arsenic level below the current EPA drinking water standard of 10 µg/L. The focus of the treatability was arsenic due to the fact that arsenic is the primary risk-driving constituent in groundwater at the FMC OU and is the only constituent in the extracted groundwater that is expected to exceed its respective CV. The treatability study also evaluated the removal of total phosphorus, which, although there is no groundwater CV, will be reduced to a target of 0.3 mg/L as described in the SFS (MWH, 2010a).

The sludge produced during the treatability testing was analyzed for eight (8) RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using the toxicity characteristic leaching procedure (TCLP) to determine whether the sludge will likely be hazardous or non- hazardous.

The treatability testing was performed by FLSmidth under the direction of MWH. Concurrently, and additional treatability study was performed by Parsons under the supervision of FMC to provide further validation of the results. In general, the tasks performed in support of the treatability study consisted of the following:

- Analysis of raw groundwater to determine the characteristics of the water, with particular emphasis on measuring the concentrations of arsenic in its various valence states (i.e. As(III) and As(V))
- Bench-scale jar testing to determine the most appropriate coagulant, dosing rate, mixing rate, and pH required for effective removal of arsenic and phosphorus to levels below the treatment goals of 10 µg/l and 300 µg/l, respectively
- Water quality characterization of the supernatant to measure treatment effectiveness
- Testing to determine the physical and chemical characteristics of the precipitate (i.e., sludge)

The treatability testing was performed using the bulk groundwater samples collected during the 72-hour aquifer (pump) testing completed as part of the EZHS.

A complete description of the treatability testing is provided in the Bench-Scale Treatability Study Report provided in Appendix B. A summary of the conclusions and recommendations from the treatability study is provided below:

- Inorganic arsenic present in the groundwater is >99% oxidized (i.e. is present as As(V)). Therefore an oxidation treatment process is not need to be included upstream of the coagulation process.
- Dose response curves produced expected trends, and results independently generated by FLS/MWH and Parsons are in good correlation.
- Ferric chloride is more effective than aluminum sulfate at reducing the concentration of both arsenic and phosphorus for this application.
- A ferric dose of 80 mg/L $FeCl_3$ (27.5 mg/L as Fe) will sufficiently lower the concentration of both arsenic and phosphorus to levels below the respective treatment goals of 10 µg/l and 300 µg/l, with the aid of a roughly 1 mg/L anionic flocculation polymer.
- Testing of various mixing schemes suggests that the coagulation/flocculation process tested is not highly sensitive to variations in flocculation energies. Mixing results do not suggest specific design parameters. Mixing energies should be designed according to the selected equipment and should be optimized at plant startup.

- Very little difference in arsenic and phosphorus removal was observed at the various pH set points tested. This result suggests that there is little to no benefit in adjusting the pH of the groundwater upstream of the coagulation/flocculation process.
- The subject groundwater contains a sufficient pH buffering capacity and it is not expected that additional alkalinity will need to maintain an optimal pH range of 6 to 8.
- Direct filtration would require a fairly small nominal particle size filter, or additional measures, to increase size and strength of floc.
- Sedimentation is sufficient for solid-liquid separation for the proposed treatment process, and additional filtration should not be necessary.
- Using the selected ferric chloride dose of 80 mg/l as $FeCl_3$ with 1 mg/l anionic polymer, the treated water is expected to meet all treatment goals for discharge to the on-site infiltration basin.
- The sludge generated from the coagulation/flocculation treatment process was below toxicity characteristic thresholds for RCRA 8 metals, and as such is expected to be fit for disposal as non-hazardous waste at a municipal landfill after being dewatered to a solids concentration great enough to pass the paint filter test (typically 10-16% solids by dry weight).
- A very low suspended solids concentration is expected in the influent groundwater stream. As such, sludge generated from the treatment process are expected to be composed primarily of $Fe(OH)_3$. This should be considered in designing the sludge conditioning and dewatering process.

# 5.0 Preliminary (30%) Groundwater Remedial Design

This section presents the engineering design specifics for the groundwater RD described in Section 3.0. Specifically, this section and referenced Appendices presents the following;

- Reference to the design drawings associated with the design elements (Appendix A).
- Design analysis, including assumptions and parameters, design restrictions, and references to design calculations (Appendix C).
- Demonstration that the design meets the applicable Performance Standards specified in the UAO and RDWP with respect to the groundwater remedy.

As described in the Remedial Design Work Plan, in response to a preliminary inquiry concerning the potential to discharge extracted groundwater to the City of Pocatello's waste water treatment plant, the City of Pocatello replied in a letter dated October 28, 2009, *"We are concerned about the potential effects of this discharge on our WWTP operations and Biosolids Land Application Program. In addition, the volume of remediated groundwater would use a large hydraulic capacity in our plant and severely limit our ability to serve our existing customers with their future needs without considerable capital outlay."* The status of the City of Pocatello WWTP operations and Biosolids Land Application Program has not changed substantively since 2009; therefore, FMC has discontinued pursuing groundwater management option A - discharge of extracted groundwater to the POTW. FMC is proceeding with the RD based on groundwater management option B - construction and operation of an on-site water treatment system, in which extracted groundwater will be treated and then discharged to an evaporation/infiltration basin located in the Western Undeveloped Area (WUA).

## 5.1 HYDRAULIC CONTAINMENT ZONE SYSTEM DESIGN

A description of the extraction zone design basis is presented in this section.

### 5.1.1 EXTRACTION WELL SPACING AND PUMPING RATES

Based on the updated groundwater flow model, 11 extraction wells will be installed in the approximate locations presented in Figure 4-1 and will extract groundwater at a combined rate of approximately 531 gallons per minute. The target capture zone that hydraulically contains groundwater containing arsenic above the MCL at the northeast boundary of the FMC Plant Site has been refined (compared to the SFS preliminary design) based on the updated groundwater flow model and reconfigured multiple well extraction system (refined preliminary design). As summarized in Section 2.4 and detailed in the GWCCR, the extent of groundwater contamination at the FMC OU is defined by arsenic concentrations above the MCL in shallow groundwater. The extent of arsenic concentrations above the MCL in shallow groundwater encompasses less extensive areas where other groundwater COCs exceed their CVs. As also described in detail in the GWCCR, groundwater in the deep aquifer zone below the American Falls Lake Bed (AFLB)

deposits in the extraction zone does not contain concentrations of EMF-related COCs above CVs, and the vertical extent of these COCs is limited to the shallow groundwater zone above the AFLB. Thus, the target capture zone is the areal extent of arsenic above the MCL in the shallow aquifer zone above the AFLB along the northeast boundary of the FMC Plant Site. The areal (two-dimensional) target capture zone is shown on Figure 5-1. Prior to advancing to the Intermediate, if determined to be necessary, and/or Pre-final RD, additional model simulations may be performed to further optimize design of the extraction well network.

### 5.1.2 EXTRACTION WELL AND PIEZOMETER DESIGN

A typical schematic of the extraction wells is presented in Figure 5-2. As shown in Figure 5-2, the extraction wells will be completed to a total depth of approximately 100 ft bgs. In addition to the main 4- or 6- inch extraction well casing, a separate 1-inch PVC sounding tube will be completed in the same bore hole and fitted with a pressure transducer to provide real time monitoring of groundwater elevations to allow for evaluation drawdown in the containment area. Each well will be completed with a pitless adapter to allow for all piping and instrumentation to be contained underground to protect from weather.

The piezometers wells will be constructed of 2-inch diameter, flush-threaded, Schedule 40 PVC riser connected to 2-inch diameter, flush threaded sections of Schedule 40 PVC screen, with a PVC end or cap. The screened sections of the piezometers/monitoring wells will consist of 0.010-inch factory slotted screen. The depth interval for the screen in each piezometer will be placed according to field observations and will mirror the depth and screened interval of the nearest extraction well.

### 5.1.3 EXTRACTION ZONE INSTRUMENTATION AND CONTROLS

Each extraction well will be fitted with a variable frequency drive (VFD) to allow for variations in pumping rates based on observed drawdown. The VFDs will be wired to the pressure transducers which will have a determined set point to maintain the required drawdown and net positive suction head (NPSH) to prevent the pumps from cavitating. Additionally, each extraction well will have a magnetic flow meter to measure the flow rate from each well in addition to necessary check and isolation valves for backflow prevention as well as to allow for isolation of each extraction well for maintenance.

### 5.1.4 EXTRACTION ZONE CONSTRUCTION

As discussed in Section 5.1.2, the wells will be completed with a pitless adapter. Each extraction well will have a 2-inch discharge pipe that will be manifolded to a main 6-inch extraction pipe that will convey extracted groundwater to the water treatment plant (WTP). All pipes will be installed below the frost line (approximately 36-inches) to prevent freezing.

## 5.2 WATER TREATMENT PLANT DESIGN

A description of water treatment design basis is presented in this section. Preliminary design drawings for the WTP including site layout, architectural, piping and instrumentation (P&IDs), electrical, etc. are provided in Appendix A. Process design calculations that forms the basis of design for the WTP, are provided in Appendix C-1. A simplified process flow diagram, which captures the general process description, is presented in Figure 5-3.

### 5.2.1 PROCESS DESCRIPTION

The process design for the WTP consists of a coagulation/flocculation (CF) system. As determined by the BSTS, ferric chloride at a dose of 80 mg/L will be used as the coagulant. The CF process will also be aided by the addition of an anionic polymer at a rate of 1 mg/L. The settled solids (sludge) from the coagulation/flocculation process will be pumped to a solids dewatering system consisting of a sludge conditioning tank and a filter press.

The preliminary design calls for a single treatment train capable of treating an average flow of 515 gpm and a maximum flow of 600 gpm. Extracted groundwater and liquid generated from the dewatering system and the WTP floor slumps will be combined in a rapid mix tank at the front of the treatment train. The rapid mix tank will be elevated to a total height of 23.5 feet above slab grade and will allow for gravity flow through the CF system; thereby, reducing the amount of pumping and energy consumed during the treatment process.

Due to the relatively low rate of solids generation, one sludge holding tank and one filter press have been selected and will have sufficient capacity to handle the solids loading. The filter press will be run as a batch operation and will utilize inline polymer injection for sludge conditioning. It is estimated that the filter press will generate a dewatered cake with a solids content of approximately 20%, allowing for the solids to pass a paint filter test required for disposal. As discussed in Section 4.2, TCLP analysis indicates that the sludge will be non-hazardous. Therefore, the dewatered sludge will be conveyed to a roll-off container and sent to the local municipal landfill. Sampling protocol for the dewatered solids is described in the OM&M Plan described in Section 7.5.

### 5.2.2 RECOMMENDED PROCESS EQUIPMENT

For the purpose of the preliminary design, a DensaDeg® unit manufactured by Degremont Technologies has been selected. The DensaDeg® unit is an optimized CF system consisting of a rapid mix tank, flocculation tank, and a high rate clarifier. Influent, filtrate, and floor sump streams will be combined and ferric chloride will be added at the rapid mix tank. A flocculation tank follows the rapid mix tank where an anionic polymer is added and flocs are allowed to form at a controlled mixing rate. Following the flocculation tank, the water is discharged to a high rate clarifier to settle and thicken the precipitated solids. A portion of the settled solids are recycled back to either the rapid mix or flocculation tank to further enhance solid-liquid

separation. The supernatant gravity flows from the clarifier tank into an effluent tank and then to the infiltration basin.

### 5.2.3 WATER TREATMENT FACILITY INSTRUMENTATION AND CONTROL

The groundwater extraction and treatment system has been designed as an automated system to reduce the amount of on-site field staff required to run the plant. Both the extraction and treatment systems will be controlled by a centralized program logic controller (PLC) and motor control center (MCC) located at the WTP. The general control philosophy for the groundwater remedy is as follows:

- The extraction zone system will be controlled by programming the pumps to be controlled via the VFDs to maintain a set drawdown measured by the collocated piezometers. The VFDs will decrease or increase the flow to maintain the set drawdown. In addition, the blending tank will have a high level alarm that will shut-off the pumps if the level in the blending tanks reaches a predetermined level. It is anticipated that following commissioning and start-up, the pumps should be able to run at more or less a constant rate.
- Extracted groundwater will be pumped directly to the rapid mix tank at the front of the treatment train, where it will be combined with liquid generated from the dewatering system and the WTP floor slumps. The groundwater flow to the treatment train will be measured by a magnetic flow meter that will be wired to the PLC.
- Mixing in the rapid mix and flocculation tanks will be controlled by mixers each wired to a VFD to allow for the mixing rate to be increased or decreased to optimize treatment.
- The sludge collected at the base of the clarifier will be either wasted to the sludge tank or recycled back to the rapid mix tank or flocculation tank to aid in floc formation. The rate of sludge recycling and wasting will be controlled by progressive cavity pumps wired to VFDs; sludge recycling rate and point of injection will be optimized at startup.
- A sludge holding tank will be used to receive the wasted solids prior to dewatering. This sludge holding tank will allow for storage of sludge between manually started batch dewatering operations. The sludge holding tank will have a level control wired to the PLC. If the sludge tank reaches a high level the sludge blowdown pump will stop and signal an alarm.
- The filter press dewatering operation will be manually started by an operator and will run until a low tank level is reached in the sludge holding tank or until the operator manually ends the dewatering cycle.
- Water removed from the solids via the dewatering operation (i.e., filtrate) and filter press wash water will be discharged to a centralized sump that will also receive washdown water and other process related liquid streams. The water collected in the sump will be pumped back to the rapid mix tank. The pumping rate from the sump will be controlled by VFDs wired to a level transducer in the sump to maintain a predetermined liquid level

in the sump. The PLC will signal an alarm upon high flow rate or high sump level for longer than the time delay to alert the operator to investigate the cause of the excessive flow into the sump.

- The supernatant (i.e., treated water) from the clarifier will gravity flow into the treated water tank. and then to the infiltration basin. Treated water flow from the treated water tank will be measured by a magnetic flow meter that will be wired to the PLC.
- All process tanks will be fashioned with a high level float switch that will automatically shut off the extraction system if a predetermined high level is reached in any of the tanks. This will prevent loss of containment of the water in the unlikely event that these predetermined high levels are reached.

## 5.3 GENERAL DESIGN CRITERIA FOR GROUNDWATER REMEDY

### 5.3.1 MATERIALS OF CONSTRUCTION

Two types of piping will be used in the extraction zone, groundwater treatment and disposal systems. All below-grade piping will be high density polyethylene pipe (HDPE). All above ground piping, specifically within the WTP, will be Schedule 80 polyvinyl chloride (PVC)

All tanks with the exception of the ferric chloride and effluent tanks will be carbon steel and will be epoxy coated to protect against corrosion. The ferric chloride tank will be fiber reinforced plastic (FRP) or fiberglass due to the corrosive nature of the solution. Totes will be used for the polymer that will assist in the CF and dewatering processes. The treated water tank will be standard carbon steel.

Valves, flow meters, and pumps will be selected as part of the Pre-Final (90%/95%) design and will be selected to be compatible with the liquids being handled.

### 5.3.2 ARCHITECTURAL CRITERIA

The WTP will consist of one building. The majority of the building will have an open floor plan that houses the treatment process equipment, including the coagulation/flocculation/sedimentation system, sludge dewatering system (tank and filter press), treated water tank, ferric chloride tank, and polymer totes. A separate, partitioned compartment of the WTP building will house the control room and MCC/electrical room for the treatment system and a restroom and storage/maintenance room.

Dewatered solids will be conveyed outside of the WTP building to a covered dewatered solids loading area.

The WTP building has been designed to be compliant with the Americans with Disability Act (ADA) Compliant. Additional design criteria related to the WTP building is provided on the Architectural Drawings presented in Appendix A and in Appendix C-2.

### 5.3.3 STRUCTURAL CRITERIA

General structural design criteria for the WTP are provided in Appendix C-3.

### 5.3.4 SECONDARY CONTAINMENT

The treatment equipment area of the WTP building will have a floor trench drain system that gravity drains to a centralized sump located within the building footprint. The liquids contained in the sump will be pumped back to the rapid mix tank and circulated through the CF system.

The ferric chloride tank will be situated in a secondary containment area with a capacity of 125% of the maximum stored volume. A containment sump will also be provided for the ferric chloride off-loading area, which will be designed to capture any spills that may occur during off-loading from ferric chloride delivery trucks. This outside sump will need to be manually pumped out using a portable pump.

### 5.3.5 ELECTRICAL CRITERIA

Standby Generator. The standby generator will be sized to provide standby electrical power to key components of the treatment operation in the event of loss of utility power for equipment and operator protection. The generator will use a diesel fuel engine as its driver and will be housed in a sound attenuating enclosure.

Electrical Transformers. Electrical transformers will be installed to convert the medium voltage utility power available at the site to 480-volt, 3-phase power for use at the WTP and extraction zone. An existing power line will be extended to the new WTP location. The WTP building transformer will be at ground level, located outside of the new WTP building. Power will be fed from the transformer into a MCC located in the electrical room in the WTP. A separate transformer will be mounted in the electrical room to covert 480-volt power to 120/208-volt power for the lighting panel board and any other lower voltage demands. An extraction zone transformer will be mounted in the vicinity of the extraction wells to provide 480-volt, 3-phase power to each well head.

Overhead Power Supply. The current design brings power to the WTP using existing overhead utility power lines.

A preliminary load list for all electrical components is provided in Appendix C-4.

### 5.3.6 HVAC CRITERIA

The open floor plan process equipment area of the treatment building will only require heating to protect against freezing. This will be achieved using ceiling- or wall-mounted propane unit heaters. The partitioned control room, MCC/electrical room, storage/maintenance room, and restroom will have heating, ventilation, and air conditioning (HVAC). Propane will be used for heating these partitioned rooms and air conditioning will be provided by an electric air

conditioning unit with a condensing unit mounted at ground level outside of the WTP building. HVAC equipment will be situated on the mezzanine located above these rooms.

### 5.3.7 SANITARY SEWER AND POTABLE WATER SUPPLY

The WTP building will be plumbed to potable water. Potable water supply is available at the current training center located northwest of the future WTP. The sanitary system at the WTP will either be provided by a septic system or possibly connected to the existing sanitary sewer system located at the existing training center. If connected to the existing sanitary sewer system, it will require that sanitary waste be pumped due to the low grades of the future sanitary lines that are not sufficient for gravity flow to the future connection points. A decision on how sanitary sewer system is pending evaluation of potential redeveloped opportunities in RA-G (North). Potable water will be supplied by extending an existing 8-inch line that will provide a more than sufficient supply of potable water to the WTP, including water supply for a fire suppression system if determined to be necessary

## 5.4 INFILTRATION BASIN

The treated extracted groundwater will be discharged to an infiltration basin located in the WUA. The sizing of the infiltration basin took into consideration the design flow rate from into the WTP (600 gpm maximum), annual evaporation rates for the Pocatello area, and expected infiltration rates based on information obtained from the hydrological testing results from soil collected from the WUA during Data Gap Investigation. Sizing calculations for the infiltration basin are provided in Appendix C-5. The location of the infiltration basin has been selected to take advantage of the existing borrow pit generated during the capping of the RCRA ponds. Based on the sizing calculations, the design basis for the infiltration pond is presented in Table 5.1.

**Table 5.1 Infiltration Pond Design Basis**

| Dimension | Value | Unit |
|---|---|---|
| Pond Surface Length | 790 | feet |
| Pond Surface Width | 790 | feet |
| Pond Surface Area | 14.3 | acres |
| Total Pond Depth | 20 | feet |
| Pond Freeboard | 1 | foot |
| Pond Side Slopes | 5 | 5H:1V |
| Pond Bottom Length | 590 | feet |
| Pond Bottom Width | 590 | feet |
| Pond Bottom Surface Area | 8.0 | acres |
| Maximum Storage Volume | 72.73 | million gallons |

To create the required dimensions for the infiltration basin, an additional 200,000 CY of material will be excavated from the existing borrow area. Design drawings showing the grading of the infiltration basin are provided in Appendix A.

## 5.5 STORMWATER MANAGEMENT PLAN

A Site-Wide Storm Water Management Design Report (SWMR) for the site was developed and will be finalized as part of the Soil RD. Based on the current stormwater design, stormwater falling on the WTP will be conveyed either via overland and/or channelized flow to Pond 3. Given the relatively small portion of the capture area that the WTP occupies, the stormwater runoff from the WTP will have a negligible impact on the magnitude of runoff from the design storm events.

## 5.6 GREEN AND SUSTAINABLE REMEDIATION

Below are green and sustainable remediation (GSR) considerations for the design of the WTP. The areas where GSR has been evaluated are related to: (1) Construction Materials (characteristics and manufacturing considerations), (2) Construction Methods, and (3) Low Impact/Sustainability measures undertaken during construction.

### 5.6.1 CONSTRUCTION MATERIAL CONSIDERATIONS

Energy Star compliant equipment and premium-efficiency motors will be specified for use throughout the design if available and prudent. An energy efficient design targets energy efficient motors for continuous use, regular use, and larger motors. In addition, the current layout allows for gravity flow through the system to minimize pumping to reduce long-term energy consumption.

“Green” concrete with a percentage of fly ash will be utilized if available and prudent. The percentage of fly ash in the concrete will be dependent upon the required strength of the concrete. Since fly ash is considered a waste product from coal-fired power plants, the replacement of Portland cement with fly ash is considered to reduce the greenhouse gas “footprint” of concrete. The production of one ton of Portland cement produces approximately one ton of carbon dioxide compared to zero carbon dioxide being produced using existing fly ash (http://www.us-concrete.com/ef_technology/index.asp). Therefore, for every ton of fly ash used, one ton of carbon dioxide emissions are prevented.

### 5.6.2 LOW- IMPACT DEVELOPMENT/SUSTAINABILITY

Studies including the EZHS and BSTS have been performed to refine the design basis in order to optimize the selected groundwater remedy while enhancing its environmental reliability.

The selected groundwater remedy has been designed to minimize waste consumption. The treated water will be discharged to an infiltration basin in the WUA, where it will either

evaporate or infiltrate into the groundwater. The solids dewatering system seeks to reduce waste volume by creating a low moisture content cake. Filtrate from the dewatering system as well as liquid collected in the floor drains will be pumped back to the blending tank to minimize the generation of liquid waste.

The chemical tank/tote volumes have been optimally sized based on tanker or truck capacity for each specific chemical to minimize the number of chemical deliveries to the site.

The use of a package reactor/high-rate clarifier/thickener unit within the WTP combines separate pieces of equipment into a single unit allowing for a smaller building footprint, a more reliable process, and lower heating requirements due to the smaller volume of these units.

## 5.7 INSTITUTIONAL CONTROLS

ICs will be implemented following the soil and groundwater RA with the goal of protecting the integrity of the remedy and to preclude uses at the FMC OU Site that would result in unacceptable risks from exposure to contaminants. The ICs are detailed in the ICIAP (MWH, 2014b).

# 6.0 Accompanying Plans and Specifications

The design drawings and calculations are presented in Appendix A and C, respectively.

## 6.1 TECHNICAL SPECIFICATIONS

A preliminary list of technical specifications is provided in Appendix D. Due to the preliminary status of the design, it is premature to develop technical specifications as a majority of the equipment has not been finalized. The technical specifications that will be adhered to by the remedial action contractor(s) (RAC(s)) during the RA will be developed as part of the Pre-Final (90%/95%) RD. The Technical Specifications are contract documents that provide the written requirements for materials, equipment, systems, standards, and workmanship for implementing the RA in accordance with the RD.

## 6.2 CONSTRUCTION QUALITY ASSURANCE PLAN

The RA draft construction quality assurance plan (CQAP) is included in Appendix E. The CQAP describes the site-specific components of the QA program to ensure to the extent practicable that the completed RA meets or exceeds all RD criteria, plans, and specifications. The CQAP focuses on the installation of the extraction wells and piezometers. The CQAP will be updated to include aspects pertaining to the construction of the WTP as part of the Pre-Final (90%/95%) Groundwater RD.

## 6.3 HEALTH AND SAFETY PLAN

The FMC Site-Wide Health and Safety Plan (SWHASP, FMC, 2013) that was initially transmitted to EPA on July 15, 2013 pursuant to the requirements of the RD/RA UAO. An updated SWHASP was provided to EPA on December 27, 2013 and any future updates to the SWHASP will also be provided to EPA at the time of revision. A copy of the updated December 2013 SWHASP, which is the current version, is not included with this RD Report. The SWHASP was prepared in accordance with U.S. EPA guidance, Occupational Safety and Health Administration (OSHA) requirements outlined in 29 CFR 1920. Addenda and/or Job Safety Analyses (JSAs) will be prepared as necessary during the RA process to address task-specific health and safety topics. The SWHASP presents the minimum requirements for all site workers and on-site contractors involved with the RA. The RA Contractor(s) will be required to prepare their own task-specific health and safety plans that are as stringent as, or otherwise comply with, the SWHASP.

# 7.0 Supporting Documents ("Other Named Plans")

## 7.1 EMERGENCY RESPONSE PLAN

The draft Emergency Response Plan (ERP) describes the procedures to be used in the event of an accident or emergency at the FMC OU (for example, power outages, slope failure, etc) during remedial action activities associated with implementation of the soil and groundwater remedy. The draft ERP includes the following:

- Name of the person(s) or entity responsible for responding in the event of an emergency incident;
- Plan and date(s) for meeting(s) with all appropriate authorities under the circumstances, including emergency response personnel and hospitals if relevant;
- Spill Prevention, Control, and Countermeasures (SPCC) Plan, as required
- Notification activities in accordance with Paragraph 57 of the UAO in the event of a release of hazardous substances requiring reporting under Section 103 of CERCLA, 42 U.S.C. § 9603, or Section 304 of the Emergency Planning and Community Right-to-know Act ("EPCRA"), 42 U.S.C. § 11004; and
- A description of all necessary actions to ensure compliance with Section XXI (Emergency Response) of the UAO in the event of an occurrence during the performance of the Work that causes or threatens a release of waste material from the FMC OU that constitutes an emergency or may present an immediate threat to public health or welfare or the environment.

To eliminate the creation of multiple ERPs for the site, the ERP submitted with the Pre-final Soil RD Report (ERP; MWH, 2014e) has been updated to include components of the groundwater RA that are applicable.

## 7.2 TRANSPORTATION AND OFF-SITE DISPOSAL PLAN

The Transportation and Off-Site Disposal Plan (TODP) describes the measures FMC will take to ensure compliance with Paragraph 35 (Off-Site Shipments of Waste Material) of the UAO. The TODP includes the following:

- Proposed locations and routes for off-site shipment of waste material;
- Identification of communities affected by shipment of waste material; and
- Description of plans to minimize impacts on affected communities.

To eliminate the creation of multiple TODPs for the site, the TODP submitted with the Pre-Final Soil RD Report (MWH, 2014f) has been updated to include components of the groundwater RA that are applicable.

## 7.3 FIELD SAMPLING AND QUALITY ASSURANCE PLANS

The field sampling plans (FSPs) supplement the quality assurance project plans (QAPPs) and address all sample collection activities. Rather than a single QAPP and FSP, the individual work plans will each include a QAPP and FSP specific to the sampling / data acquisition in that plan, as appropriate.

The FSPs will be written so that a field sampling team unfamiliar with the project would be able to gather the samples and field information required. The FSPs will be prepared consistent with Guidance for Conducting Remedial Investigations and Feasibility Studies, EPA/540/G-89/004 (EPA, 1988), and in accordance with Section XI (Quality Assurance, Sampling, and Data Analysis) of the UAO.

## 7.4 PERFORMANCE STANDARD VERIFICATION PLAN

The preliminary draft Performance Standards Verification Plan (PSVP) for Groundwater includes a specific description of the post-remedial action verification activities that will be performed to assess the long-term performance of the groundwater remedy. Specifically, the preliminary draft PSVP for Groundwater outlines the sampling and data analysis procedures that will be used to evaluate whether the groundwater extraction system is achieving hydraulic capture as defined in the UAO.

## 7.5 OPERATION MAINTENANCE AND MONITORING PLAN

The preliminary draft Operation, Maintenance and Monitoring Plan (OM&M Plan) provides the OM&M requirements for the extraction system, WTP, and infiltration basin. Specifically, the OM&M Plan outlines the operational, maintenance and sampling requirements necessary to properly operate the plant. This includes general start-up and commissioning procedures, sampling requirements and frequencies for influent, effluent, and filter cake, instrumentation and control philosophy description, contingent actions, etc. The preliminary draft OM&M Plan will be updated as part of the Pre-final (90/95%) Groundwater RD to include more specific information.

## 7.6 INSTITUTIONAL CONTROL IMPLEMENTATION AND ASSURANCE PLAN

The draft ICIAP describes the plan to implement, maintain, and monitor ICs at the FMC OU for both soil and groundwater. The ICs described in the draft ICIAP, (MWH, 2014b) are intended to protect the integrity of the soil and groundwater remedies and to preclude uses at the FMC OU that would result in unacceptable risks from exposure to contaminants in groundwater and soil in accordance with the IRODA and UAO. As described in FMC's response to EPA, Idaho Department of Environmental Quality (IDEQ) and Shoshone Bannock Tribes comments on the March 2014 Soil RD submittal, a draft ICIAP, revised as appropriate, was submitted with the Soil remedy Pre-Final (90/95%) Engineering Design Submittal.

# 8.0 Schedule for RD and RA

The preliminary schedule for the groundwater RD and RA is presented in Table 8.1. Actual milestone dates are shown in **bold** font.

**Table 8.1 Schedule for RD/RA Deliverables and Preliminary Construction Schedule for the Groundwater Remedy**

| RD Deliverable / Work Element | Date |
|---|---|
| Submit Groundwater Remedy – Preliminary (30%) RD Package | **January 30, 2015** |
| EPA Comments on 30% Groundwater RD Package | April 3, 2015 |
| Submit Groundwater Remedy – Intermediate (60%) RD Package, if determined to be necessary[3] | May 29, 2015 |
| EPA Comments on 60% Groundwater RD Package, if determined to be necessary[3] | July 30, 2015 |
| Submit Groundwater Remedy – Pre-Final (90%/95%) RD Package<br>Submit Draft Groundwater Remedial Action Work Plan (Concurrent with Pre-Final RD Package) | September 25, 2015 |
| EPA Comments on 90%/95% Groundwater RD Package<br>EPA Comments on Draft Groundwater Remedial Action Work Plan | November 24, 2015 |
| Submit Groundwater Remedy – Final (100%) Design Package<br>Submit Final Groundwater Remedial Action Work Plan (Concurrent with 100% RD Package) | December 15, 2015 |
| EPA Approval Groundwater Remedy Final RD and RAWP | January 18, 2016 |
| Pre-Construction Inspection and Meeting | February 17, 2016 |
| Start of Construction | March 2, 2016 |
| Completion of Construction (approx. 10 months) | January 7, 2017 |

[3] Pursuant to UAO Paragraph 30.f., if Respondent determines during RD planning that a 60% Intermediate RD is necessary, Respondent shall submit the Intermediate (60%) RD for EPA comment. The Intermediate RD must: 1) be a continuation and expansion of the preliminary design; 2) address all EPA's comments regarding the Preliminary RD; and 3) include the same elements as are required for the Preliminary RD.

# 9.0 REFERENCES


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EPA, 2013. Unilateral Administrative Order for Remedial Design and Remedial Action, EPA Docket No. CERCLA-10-2013-0116, June 10, 2013.

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MWH, 2009a. Supplemental Remedial Investigation Report for the FMC Plant Operable Unit, May 2009.

MWH, 2009b. Groundwater Current Conditions Report for the FMC Plant Operable Unit, June 2009 - Final.

MWH, 2009c. Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit, Final – November 2009.

MWH, 2010a. Supplemental Feasibility Study Report for the FMC Plant Operable Unit, July 2010.

MWH, 2010b. Groundwater Model Report for the FMC Plant Operable Unit, July 2010 (Appendix E of the SFS Report).

MWH, 2010c. Interim CERCLA Groundwater Monitoring Plan for the FMC Operable Unit, July 2010 (Appendix G of the SFS Report).

MWH, 2013a. Remedial Design Work Plan for the FMC OU, December 2013.

MWH, 2013b. Extraction Zone Hydrogeological Work Plan, July 2013.

MWH, 2014a. FMC OU Remedial Design Soil Remedial Action: Remedial Design Report, Revised September 2014.

MWH 2014b. Draft Institutional Controls Implementation and Assurance Plan, March 2014.

MWH 2014c. Hydrogeological Study Report, August 2014.

MWH 2014d. Bench-Scale Treatability Study Work Plan, May 2014.

MWH 2014e. Emergency Response Plan, July 2014.

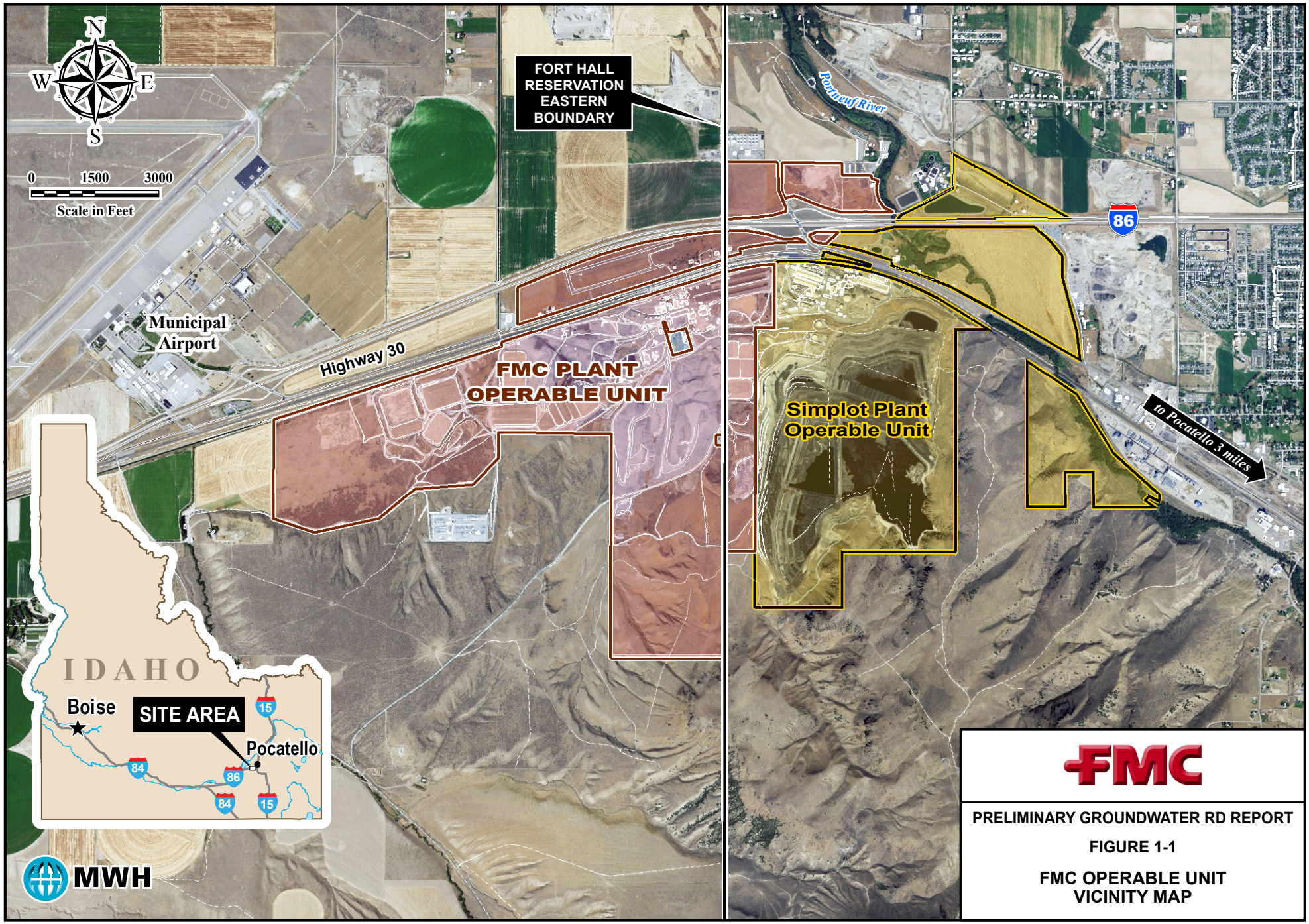
MWH 2014f. Transportation and Off-Site Disposal Plan, July 2014.

Simplot, 2012. 2011 Annual Report Groundwater/Surface Water Remedy, Simplot Operable Unit, Eastern Michaud Flats Superfund Site, Pocatello, Idaho, Prepared by Formation Environmental, March 2012.

Simplot, 2013. 2012 Annual Report Groundwater/Surface Water Remedy, Simplot Operable Unit, Eastern Michaud Flats Superfund Site, Pocatello, Idaho, Prepared by Formation Environmental, May 2013.

# Figures

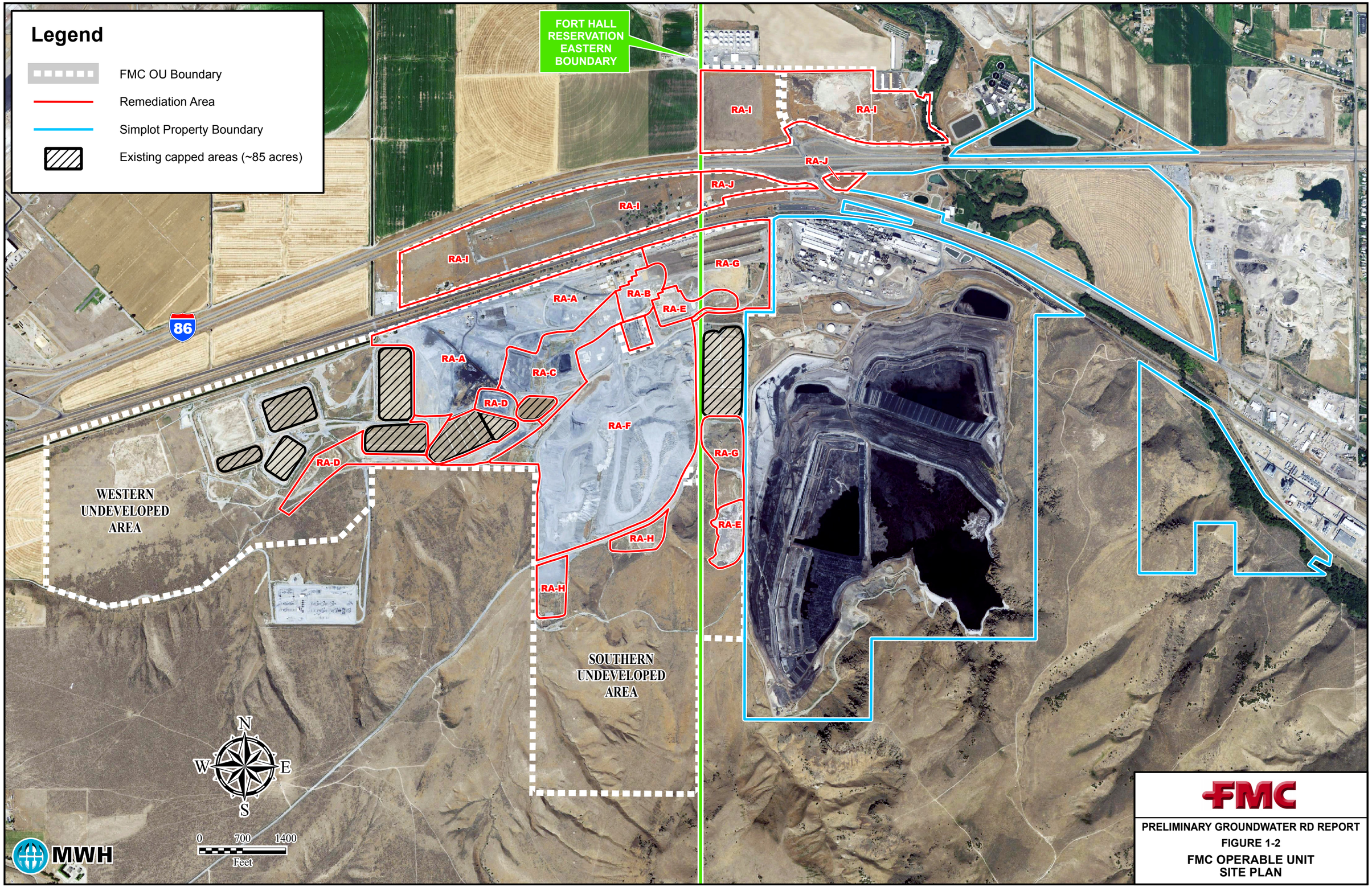
I:\projects\FMCidaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 1-1_FMC_VicinityMap_waerial_Oct2014.mxd 21 Oct 2014 DRAWN BY D. Severson




PRELIMINARY GROUNDWATER RD REPORT

FIGURE 1-1

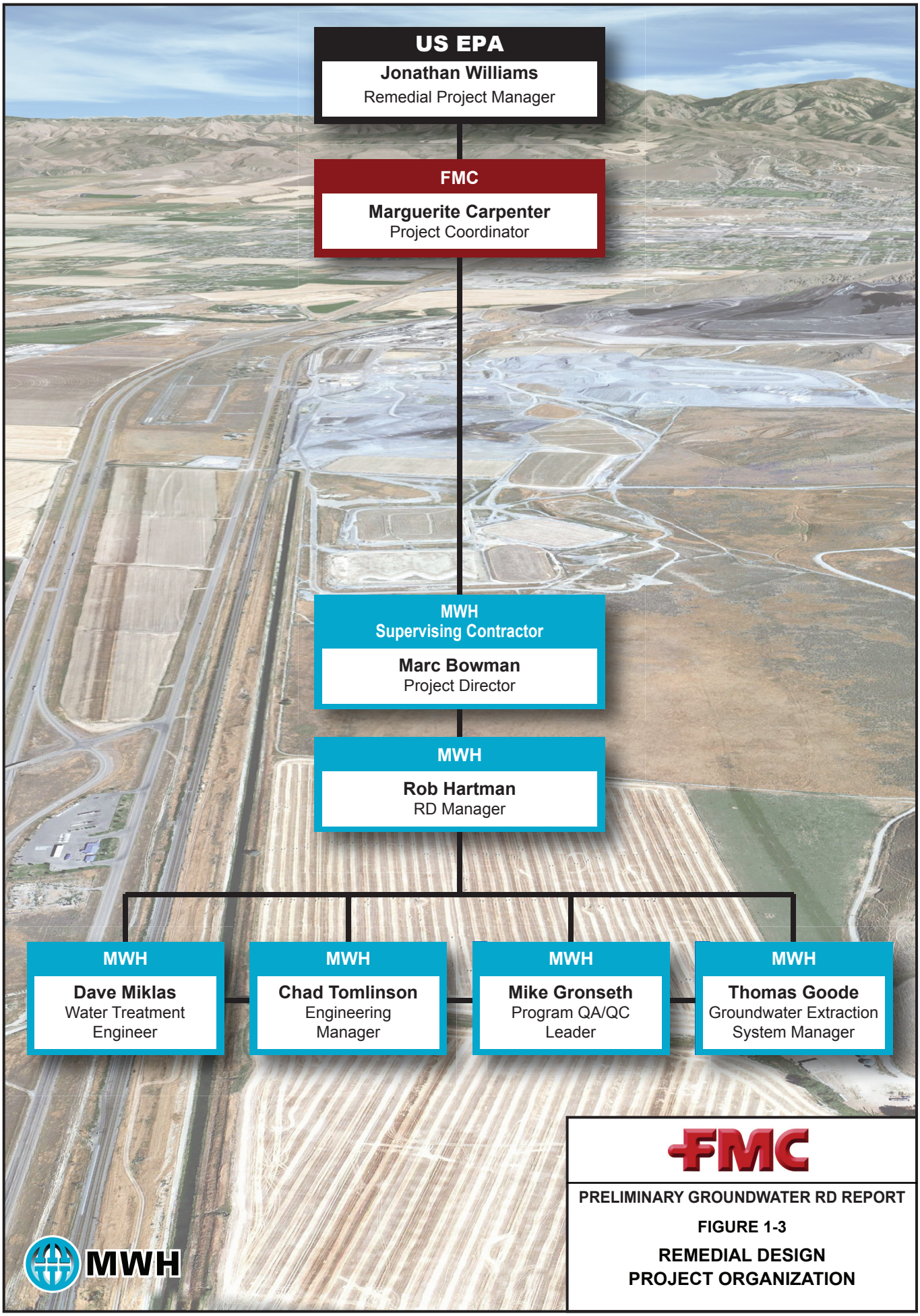
FMC OPERABLE UNIT VICINITY MAP




DRAWN BY D. Severson

23 Oct 2014

I:\projects\FMC\Idaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 1-2_FMC OU Site Plan_Oct2014.mxd




PRELIMINARY GROUNDWATER RD REPORT

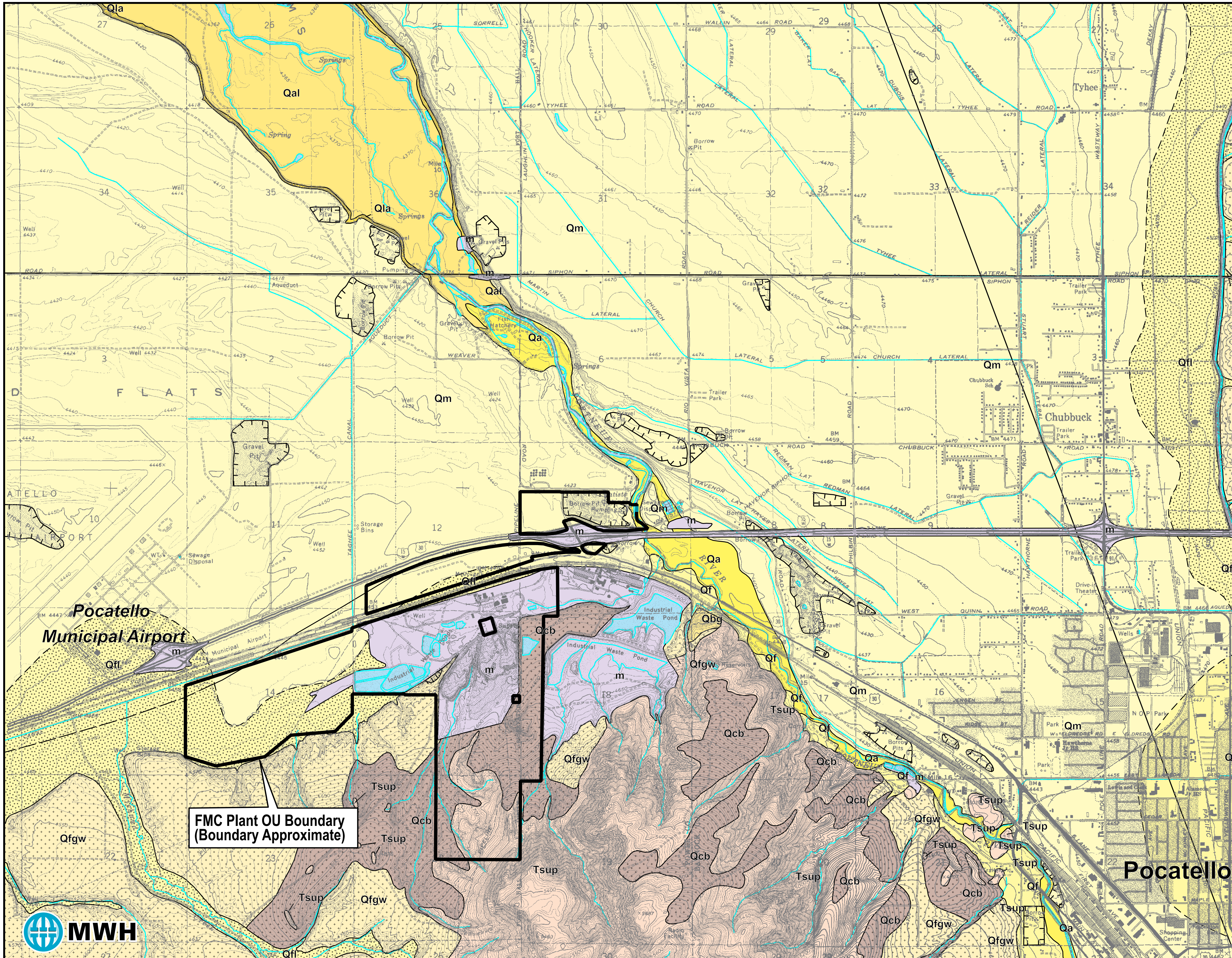
FIGURE 1-3

REMEDIAL DESIGN PROJECT ORGANIZATION

DRAWN BY D. Severson

23 Oct 2014

I:\projects\FMCidaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 1-3_Remedial Design Project Org.ai




# DESCRIPTION OF MAP UNITS

- **m** — Made ground (historical)—Artificial deposits of disturbed, transported, and emplaced construction materials derived from various local sources. Primarily formed in the construction of highways, irrigation ditches, and industrial sites.
- **Qa** — Alluvium of lower Portneuf River and Pocatello Creek (Holocene) — Stratified and interfingering deposits of sand and gravel veneered by silty reworked loess.
- **Qal** — Alluvium and lacustrine deposits of the Portneuf River and Ross Fork delta (Holocene)—Laterally discontinuous beds of sand, silt, clay, muck, and peat.
- **Qf** — Alluvial-fan and debris-flow deposits (Holocene)—Muddy sand and gravel and beds of silty redeposited loess.
- **Qfl** — Alluvial-fan deposits composed mostly of reworked loess (Holocene)—Primarily bedded to massive silt that is redeposited loess.
- **Qm** — Michaud Gravel (late Pleistocene)—Bouldery gravel and sand; more sand in channeled-flow pathways and in distal parts of deposit where grain size decreases.
- **Qbg** — Gravel deposits of the Bonneville Flood, undifferentiated (late Pleistocene) Pebble gravel deposited in eddy bar of Bonneville Flood.
- **Qfgw** — Loess-mantled alluvial-fan gravel of Wisconsin age (late Pleistocene)—Crudely stratified muddy sand and pebble- to boulder-sized gravel mantled with loess.
- **Qfgo** — Loess-mantled alluvial-fan gravel of the ancesteral Pocatello Creek (early Pleistocene?) — Crudely stratified, muddy and sandy pebble-to cobble-sized gravel manteld with loess.
- **Qcb** — Loess-mantled bedrock colluvium (Pleistocene)—Wind-blown and redeposited loess that mantles, interfingers with, or is mixed with stony colluvium derived from local bedrock.
- **Tsup** — Rhyolite porphyry unit—Porphyritic rhyolite,

*Source: Idaho Geological Survey, April 1997*

N E S W

0 3000
Feet

FMC

PRELIMINARY GROUNDWATER RD REPORT

FIGURE 2-1

REGIONAL GEOLOGY AROUND THE FMC OU

DRAWN BY D. Severson

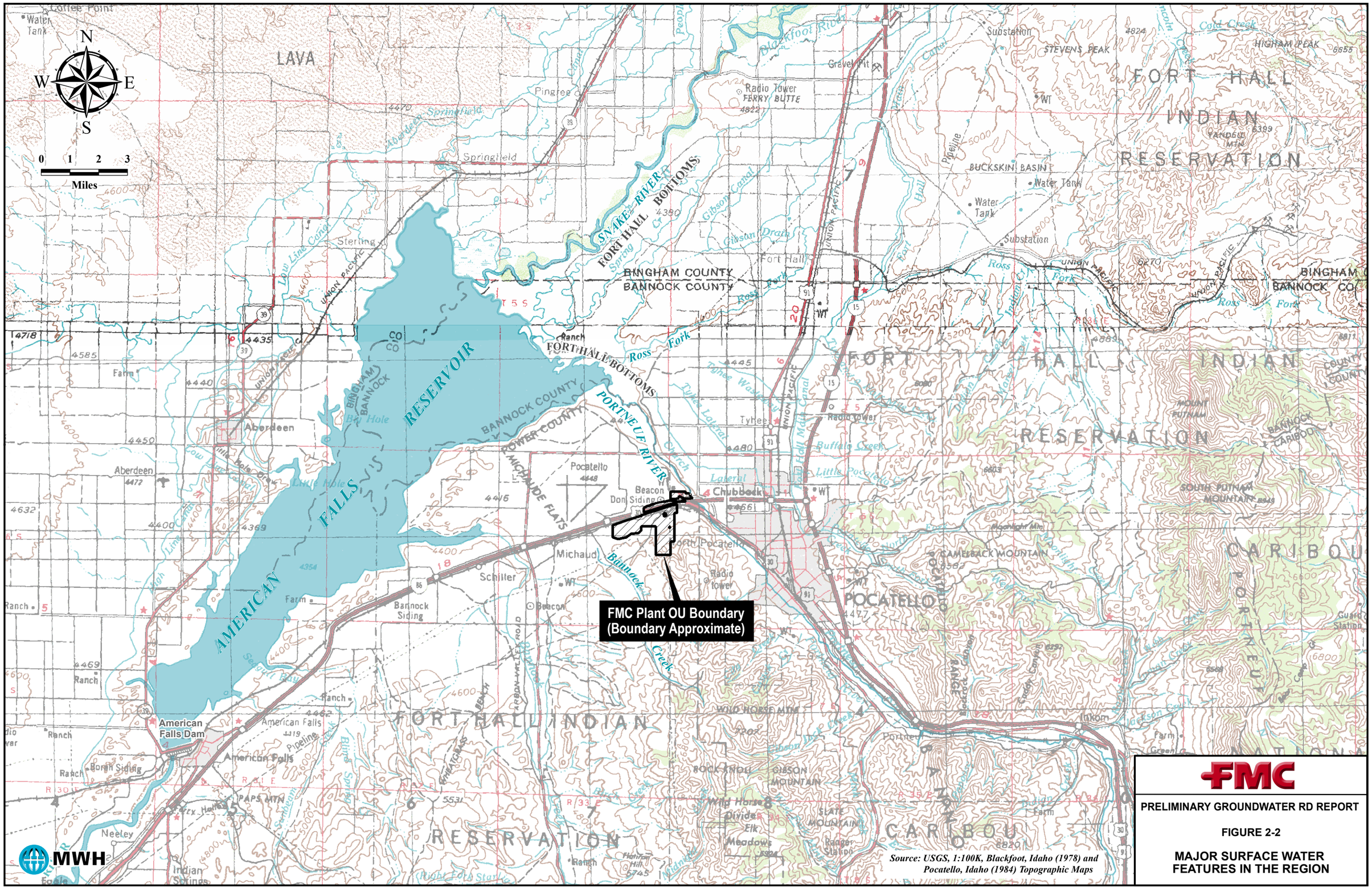
23 Oct 2014

I:\projects\FMC\Idaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 2-1 Regional Geologic map_IGS_April 1997_Oct2014.ai

DRAWN BY D. Severson

24 Oct 2014

I:\projects\FMCidaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 2-2_Major Surface Water Features_Oct2014.mxd




Source: USGS, 1:100K, Blackfoot, Idaho (1978) and Pocatello, Idaho (1984) Topographic Maps

MWH

FMC

PRELIMINARY GROUNDWATER RD REPORT

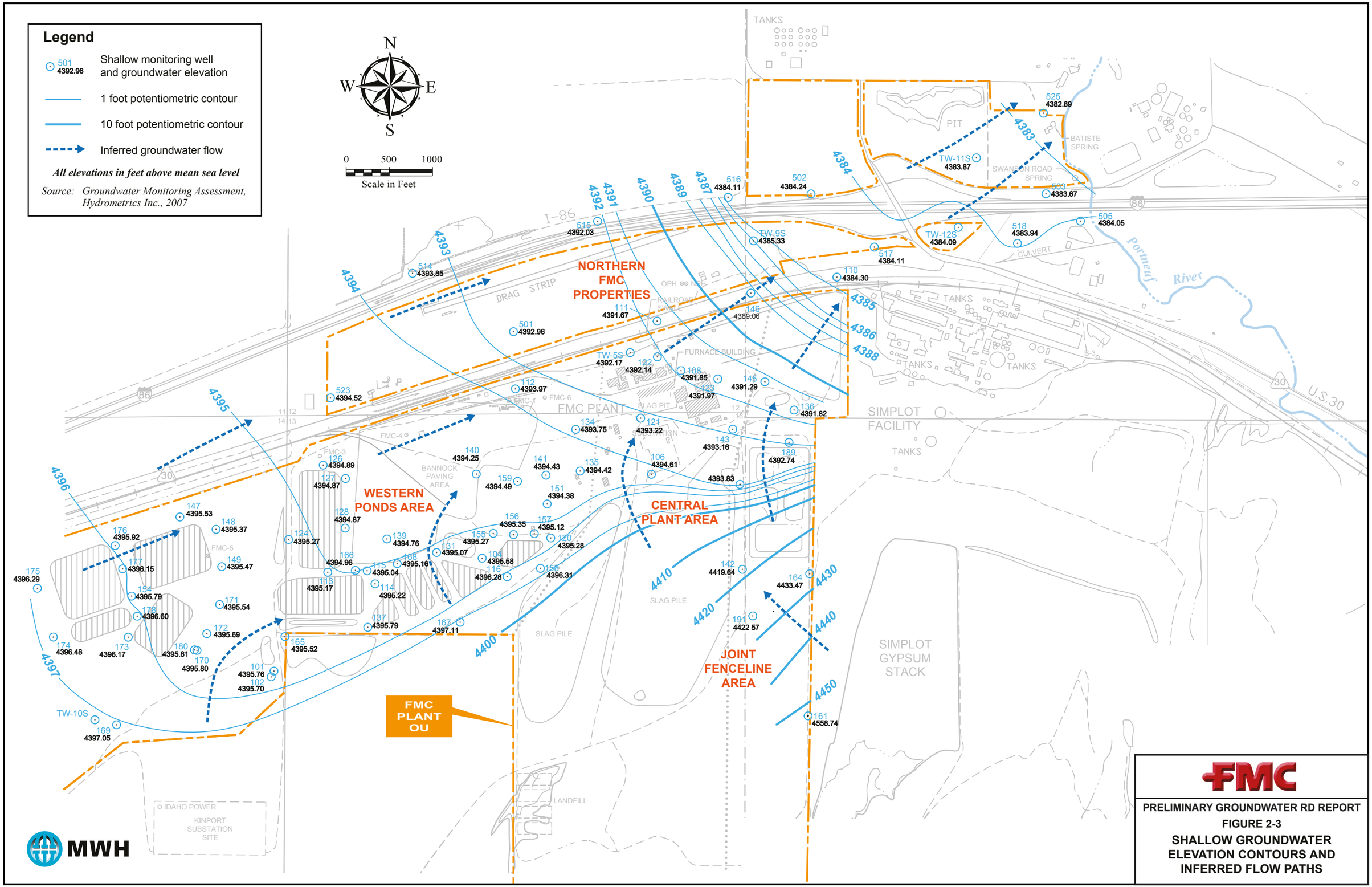
FIGURE 2-2

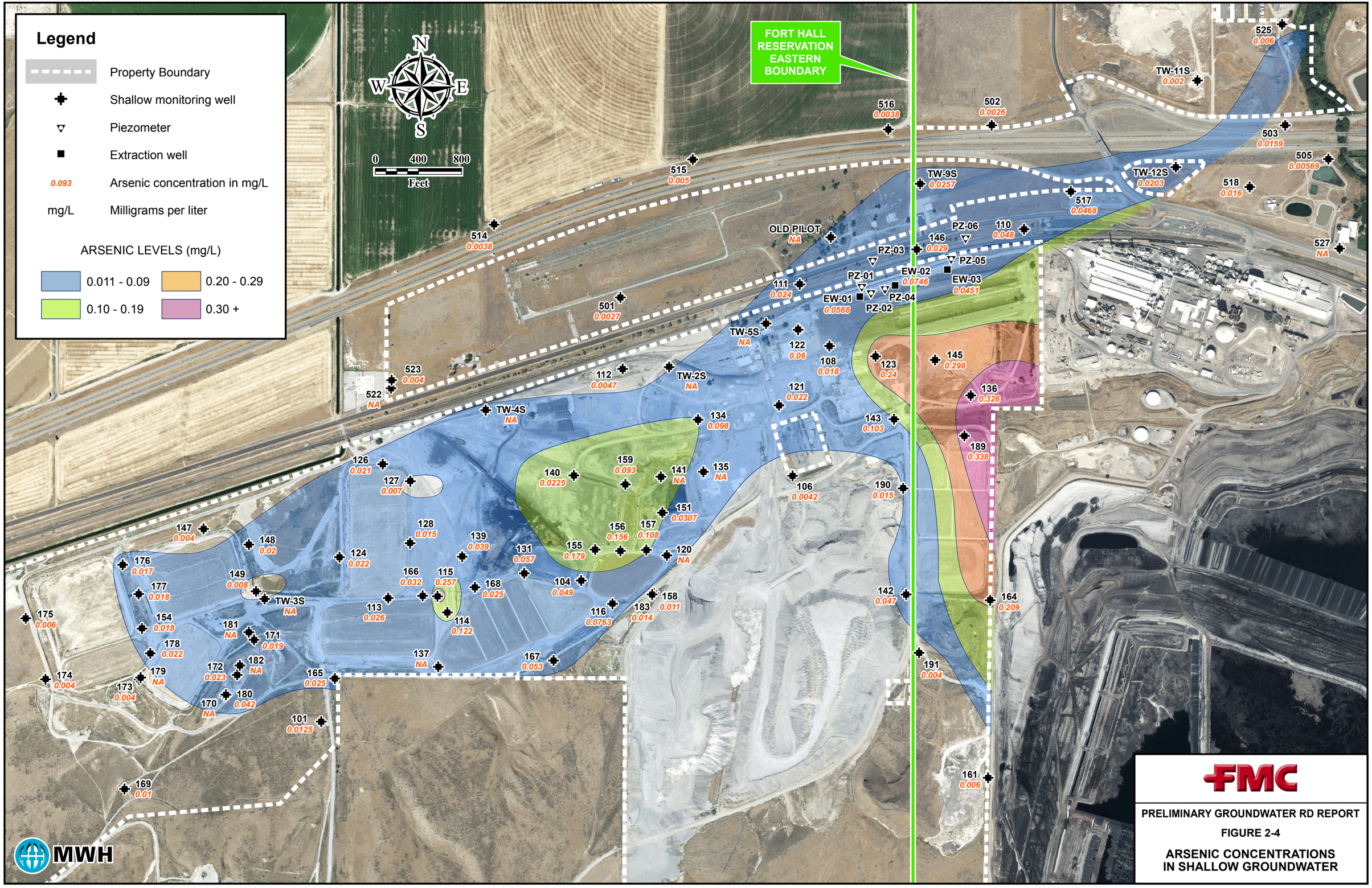
MAJOR SURFACE WATER FEATURES IN THE REGION

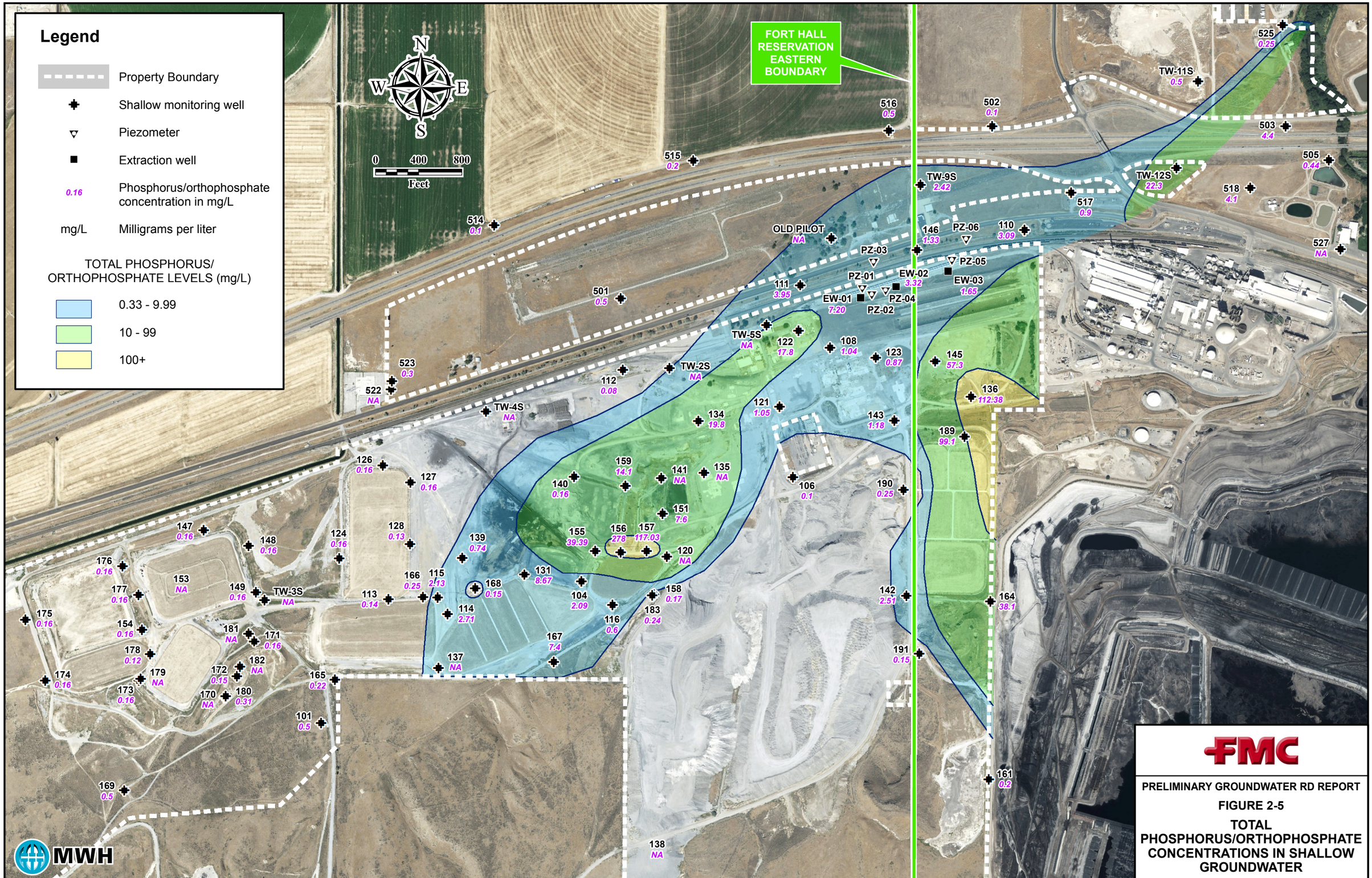
DRAWN BY D. Severson

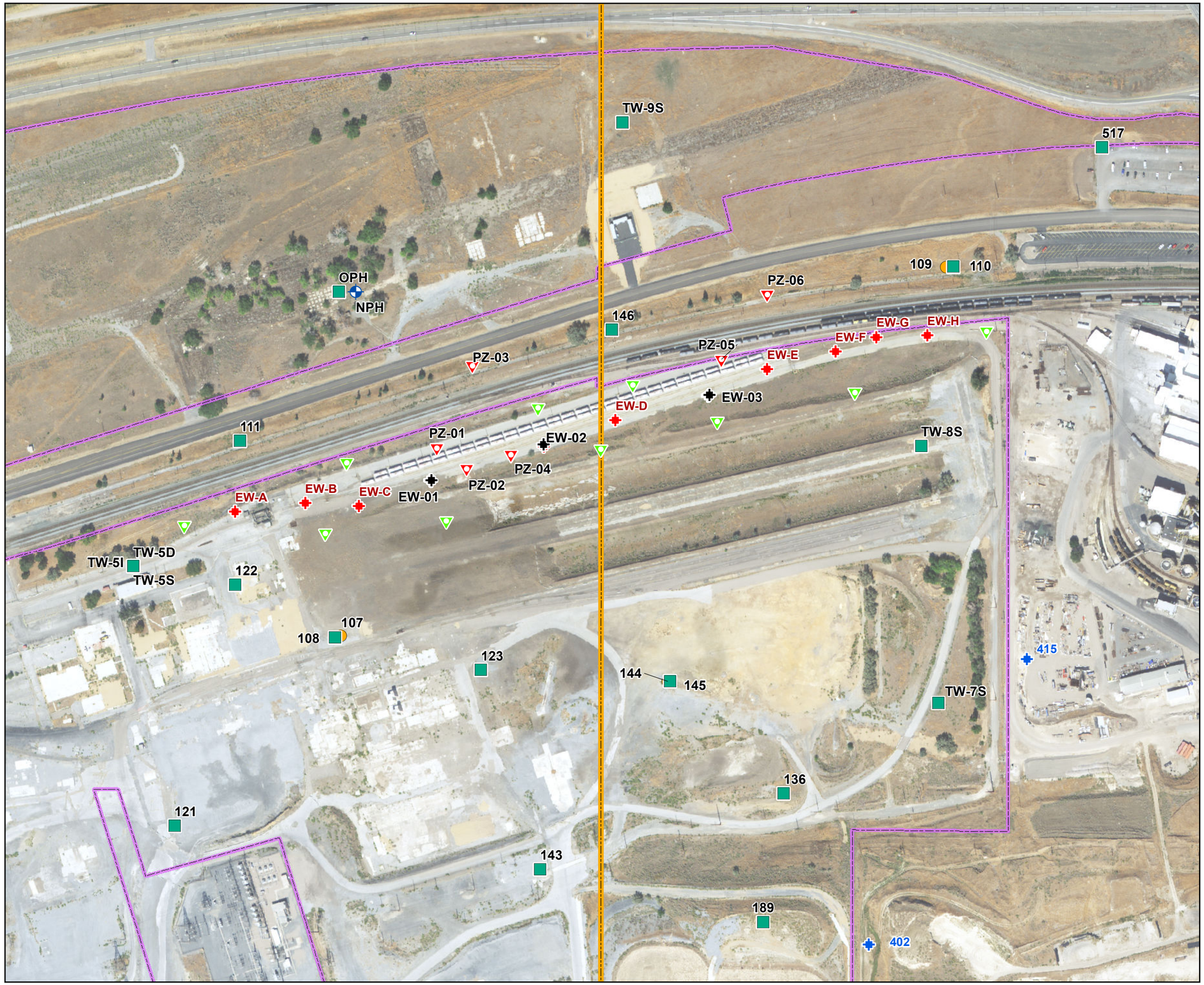
23 Oct 2014

I:\projects\FMC\Idaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 2-3_Shallow GW Elev Cont and Flow Paths.ai




Legend
Property Boundary
Shallow monitoring well
Piezometer
Extraction well
0.093 Arsenic concentration in mg/L
mg/L Milligrams per liter
ARSENIC LEVELS (mg/L)
0.011 - 0.09
0.20 - 0.29
0.10 - 0.19
0.30 +
N
W
E
S
0 400 800
Feet
FORT HALL RESERVATION EASTERN BOUNDARY
525 0.006
TW-11S 0.002
502 0.0026
516 0.0038
503 0.0159
505 0.00569
TW-12S 0.0203
518 0.016
TW-9S 0.0257
517 0.0468
515 0.005
527 NA
OLD PILOT NA
PZ-06
110 0.048
146 0.029
PZ-03
PZ-05
514 0.0038
PZ-01
EW-02 0.0746
EW-03 0.0451
111 0.024
EW-01 0.0568
PZ-04
PZ-02
501 0.0027
TW-5S NA
122 0.06
108 0.018
123 0.24
145 0.298
523 0.004
112 0.0047
TW-2S NA
121 0.022
136 0.326
522 NA
TW-4S NA
134 0.098
143 0.103
189 0.338
126 0.021
159 0.093
140 0.0225
141 NA
135 NA
106 0.0042
190 0.015
127 0.007
151 0.0307
147 0.004
128 0.015
139 0.039
156 0.156
157 0.108
148 0.02
124 0.022
131 0.057
155 0.179
120 NA
176 0.017
166 0.032
115 0.257
168 0.025
104 0.049
149 0.008
177 0.018
TW-3S NA
113 0.026
114 0.122
116 0.0763
183 0.014
158 0.011
142 0.047
164 0.209
175 0.006
154 0.018
181 NA
171 0.019
178 0.022
137 NA
167 0.053
191 0.004
174 0.004
179 NA
172 0.023
182 NA
165 0.025
173 0.004
170 NA
180 0.042
101 0.0125
161 0.006
169 0.01
MWH
FMC
PRELIMINARY GROUNDWATER RD REPORT
FIGURE 2-4
ARSENIC CONCENTRATIONS IN SHALLOW GROUNDWATER
DRAWN BY D. Severson
23 Oct 2014
I:\projects\FMCIdaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 2-4_Arsenic in Shallow GW_Jul2014.mxd


Legend
Property Boundary
Shallow monitoring well
Piezometer
Extraction well
0.16 Phosphorus/orthophosphate concentration in mg/L
mg/L Milligrams per liter
TOTAL PHOSPHORUS/ ORTHOPHOSPHATE LEVELS (mg/L)
0.33 - 9.99
10 - 99
100+
N
W
E
S
0 400 800
Feet
FORT HALL RESERVATION EASTERN BOUNDARY
516 0.5
515 0.2
514 0.1
502 0.1
525 0.25
TW-11S 0.5
503 4.4
505 0.44
TW-12S 22.3
518 4.1
517 0.9
TW-9S 2.42
527 NA
OLD PILOT NA
146 1.33
PZ-06
110 3.09
PZ-03
PZ-05
PZ-01
EW-02 3.32
EW-03 1.65
111 3.95
EW-01 7.20
PZ-04
PZ-02
501 0.5
TW-5S NA
122 17.8
108 1.04
123 0.87
145 57.3
523 0.3
522 NA
112 0.08
TW-2S NA
136 112.38
TW-4S NA
134 19.8
121 1.05
143 1.18
189 99.1
159 14.1
141 NA
135 NA
126 0.16
127 0.16
140 0.16
106 0.1
190 0.25
151 7.6
147 0.16
148 0.16
124 0.16
128 0.13
155 39.39
156 278
157 117.03
120 NA
139 0.74
176 0.16
153 NA
177 0.16
149 0.16
TW-3S NA
166 0.25
115 2.13
168 0.15
131 8.67
104 2.09
158 0.17
142 2.51
164 38.1
175 0.16
113 0.14
114 2.71
116 0.6
183 0.24
154 0.16
181 NA
171 0.16
178 0.12
182 NA
167 7.4
191 0.15
174 0.16
179 NA
172 0.15
137 NA
165 0.22
173 0.16
170 NA
180 0.31
101 0.5
161 0.2
169 0.5
138 NA
MWH
FMC
PRELIMINARY GROUNDWATER RD REPORT
FIGURE 2-5
TOTAL PHOSPHORUS/ORTHOPHOSPHATE CONCENTRATIONS IN SHALLOW GROUNDWATER
DRAWN BY D. Severson
23 Oct 2014
I:\projects\FMCidaho\FMC_GW RD Report_DRAFT\FIGURES\Fig 2-5_Orthophosphate in Shallow GW_Jul2014.mxd




# LEGEND

- Proposed Piezometer
- Modeled FMC Extraction Well
- FMC Extraction Well
- Simplot Extraction/ Production Well
- Piezometer
- Monitoring Well
- Deep Monitoring Well
- FMC Boundary
- Fort Hall Reservation Eastern Boundary

0 200 400 600 Feet

**PRELIMINARY GROUNDWATER RD REPORT**

**Preliminary Extraction Zone Well and Piezometer Network**

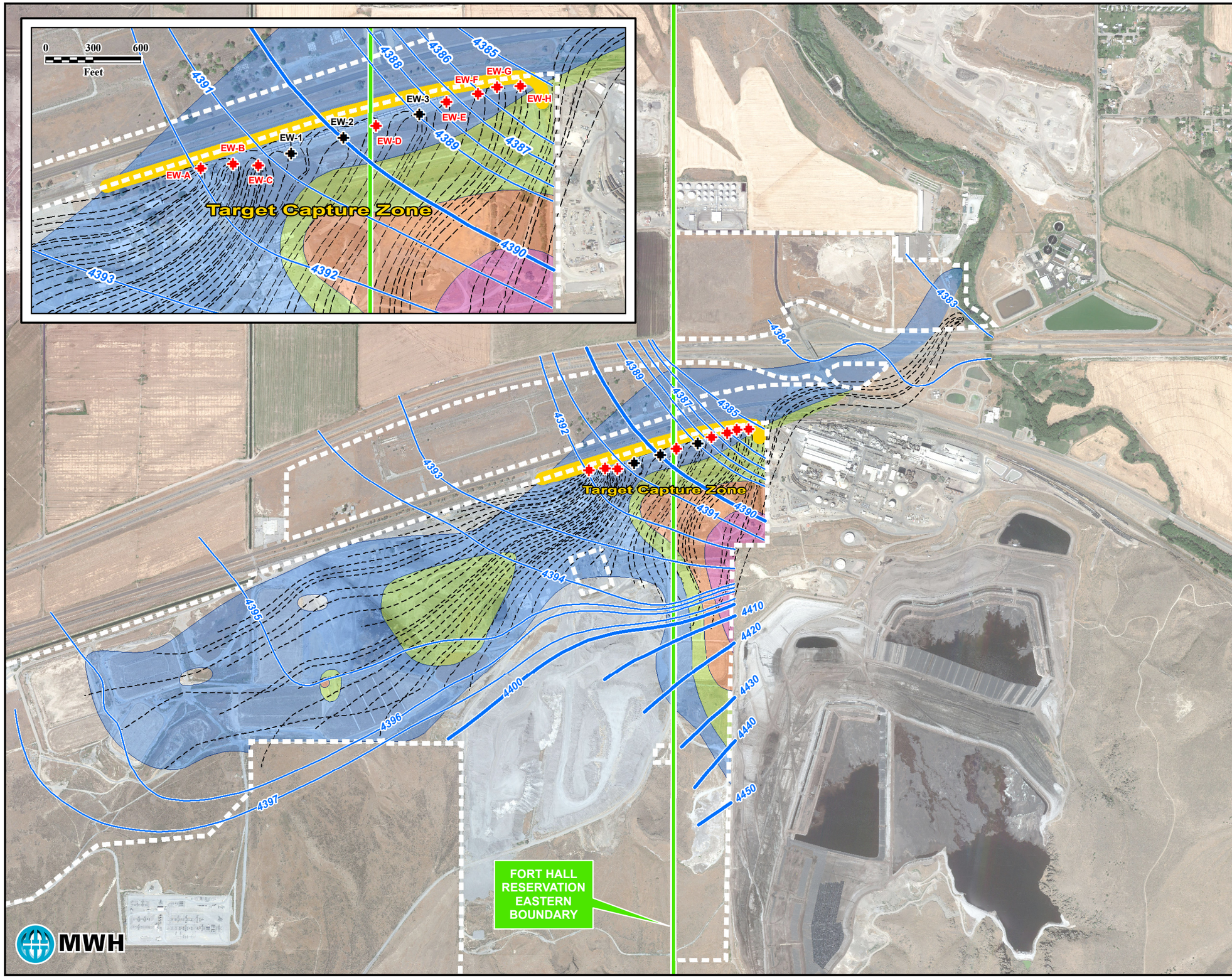
FMC

MWH

FIGURE:

**FIGURE 4-1**

Document Path: J:\Industrial Projects\FMC\GIS_MXDs\ProposedWells_Nov2014\Existing_and_ProposedWells_Nov2014.mxd




## Legend

Property Boundary

Layer 2 particles (Layer 1 and Layer 3 particles have been removed for clarity)

Modeled FMC extraction well

FMC extraction well

ARSENIC LEVELS (mg/L)

- 0.011 - 0.09
- 0.10 - 0.19
- 0.20 - 0.29
- 0.30 +

1 foot potentiometric contour

10 foot potentiometric contour

***All elevations in feet above mean sea level***

*SOURCE: Groundwater Monitoring Assessment, Hydrometrics Inc., 2007*

N W E S

0 600 1200
Feet

FMC

**GW PRELIMINARY RD REPORT**

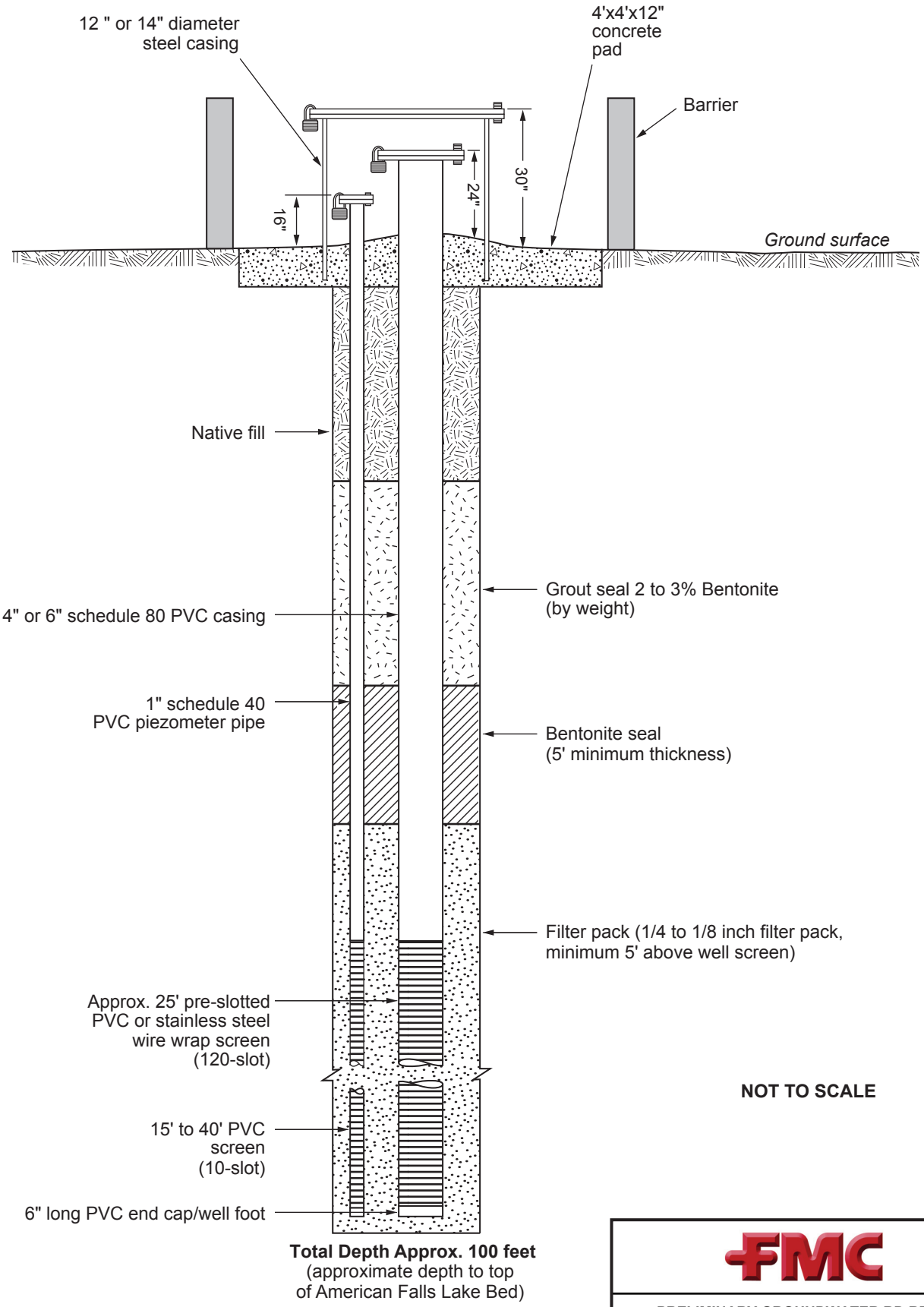
**FIGURE 5-1**

**HYDRAULIC CONTAINMENT TARGET CAPTURE ZONE**

DRAWN BY D. Severson

23 Jan 2015

I:\projects\FMCIdaho\FMC_GW Prelim Design\FIGURES\Fig 5-1_FMC_HC Capture Zone_Shallow GW Cont_Jan2015.mxd




**NOT TO SCALE**

FMC

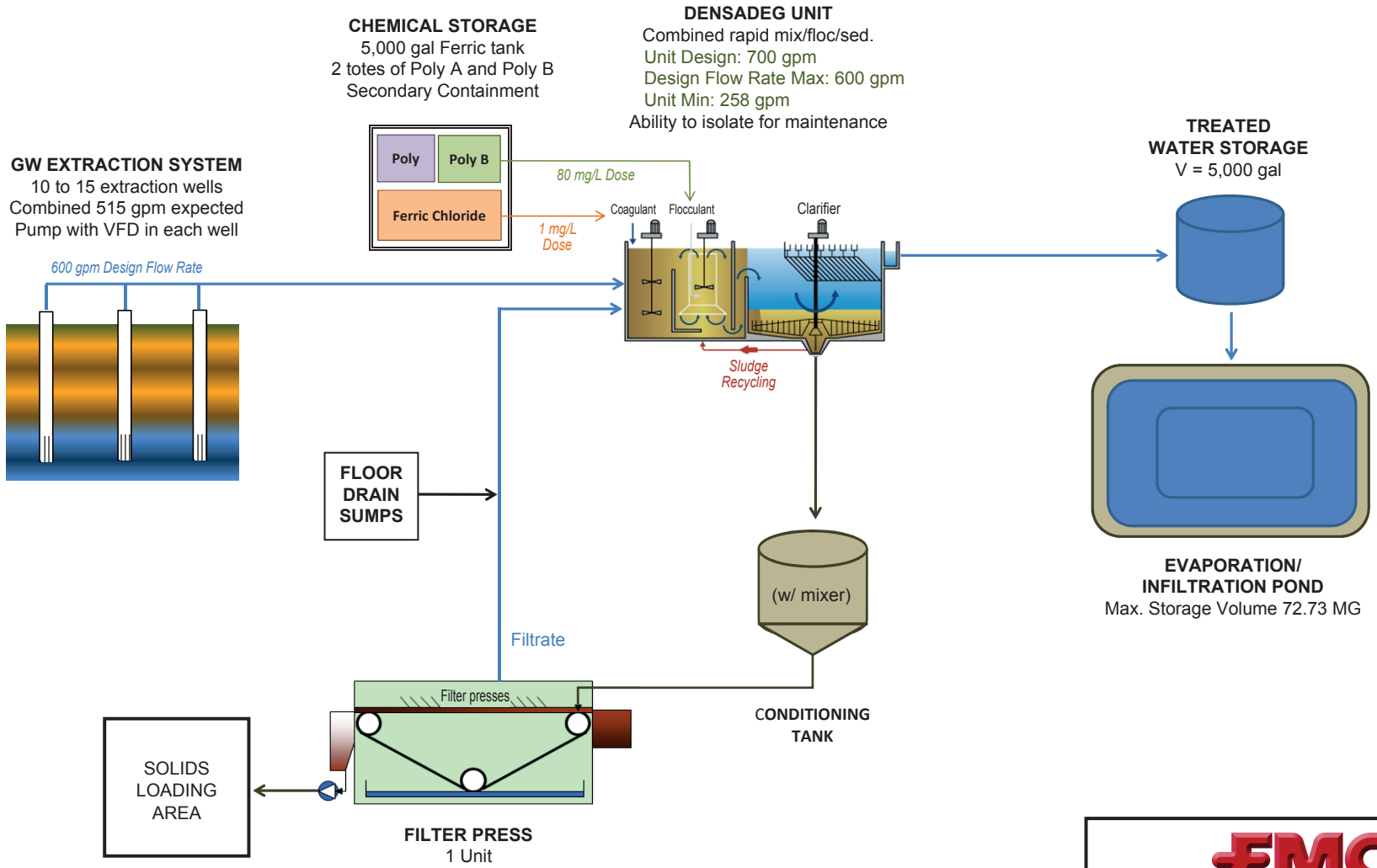
PRELIMINARY GROUNDWATER RD REPORT

**FIGURE 5-2**

**GENERALIZED EXTRACTION WELL DESIGN**

MWH

FILE *Fig 3-2_Generalized Extraction Well Design_mod2.ai* *DATE: 17 Oct 2013*




FMC

PRELIMINARY GROUNDWATER RD REPORT

FIGURE 5-3

GENERALIZED PROCESS FLOW DIAGRAM

MWH

# APPENDIX A

## Design Drawings

# FMC OU PRELIMINARY (30%) GROUNDWATER REMEDIAL DESIGN

JANUARY 2015 ISSUED FOR EPA REVIEW

MWH®
SALT LAKE CITY, UTAH

## LEGEND

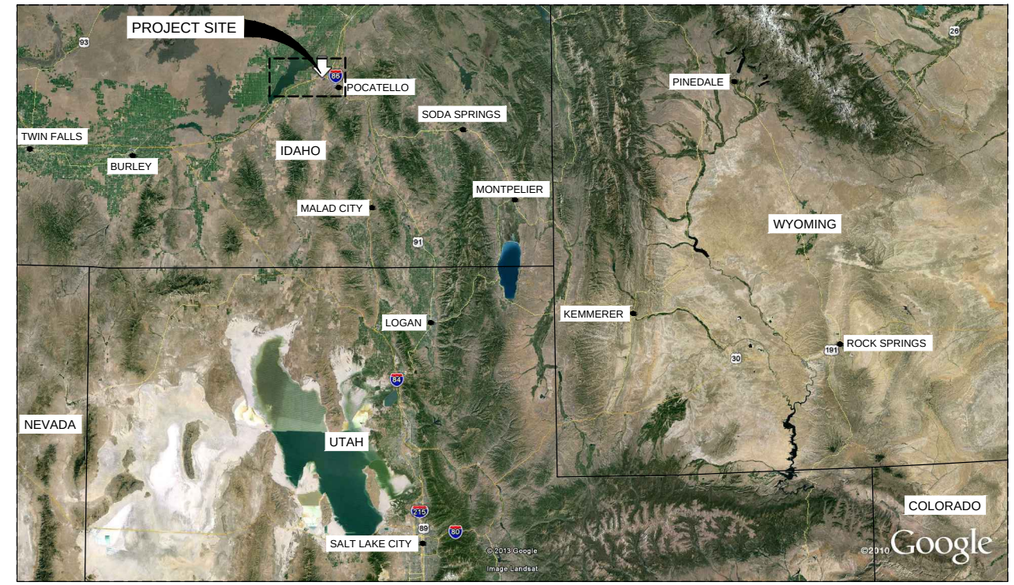
- EXISTING TOPOGRAPHY
- EXISTING RAILROAD TRACK
- EXISTING FENCE
- EXISTING GRAVEL ROAD
- EXISTING ASPHALT ROAD
- EXISTING MISC PAVEMENT
- EXISTING RETAINING WALL
- EXISTING DITCH
- EXISTING PIPELINE
- EXISTING CURB FACE
- EXISTING WATER LEVEL
- EXISTING ELECTRICAL (UG)
- EXISTING FIRE WATER LINE (UG)
- IWW — EXISTING INDUSTRIAL WASTE WATER LINE (UG)
- LDR — EXISTING LDR LINE (UG)
- UND — EXISTING MISCELLANEOUS LINE (UG)
- G — EXISTING NATURAL GAS LINE (UG)
- OIL — EXISTING OIL LINE (UG)
- PHW — EXISTING PHOSSY WATER LINE (UG)
- PLW — EXISTING PLANT WATER LINE (UG)
- SSW — EXISTING SANITARY SEWER (UG)
- SSW(F) — EXISTING SANITARY SEWER-FROZEN (UG)
- SLR — EXISTING SLURRY LINE (UG)
- STRM — EXISTING STORM DRAIN LINE (UG)
- TEL — EXISTING TELEPHONE LINE (UG)
- EXISTING VEGETATION
- EXISTING CULVERT
- EXISTING CONCRETE PAVEMENT
- EXISTING MISC STRUCTURES
- EXISTING POST
- RA BOUNDARY
- EXTRACTION WELLS
- RW — EFFLUENT PIPELINE
- CONCRETE (PLAN VIEW)
- CONCRETE (DETAILS)
- ASPHALT
- FINISHED GROUND

## GENERAL NOTES:

1. EXISTING GROUND TOPOGRAPHY PROVIDED BY FMC.

### INDEX OF DRAWINGS

| DISCIPLINE | DRAWING NUMBER | DRAWING TITLE |
|---|---|---|
| GENERAL | | |
| | G-1 | COVER |
| | G-2 | DRAWING LIST, LEGEND, GENERAL NOTES AND LOCATION MAP |
| | G-3 | SYMBOLS |
| | G-4 | ABBREVIATIONS |
| | G-5 | HYDRAULIC PROFILE |
| | G-6 | PROCESS FLOW DIAGRAMS |
| CIVIL | | |
| | C-1 | EFFLIENT PIPELINE LAYOUT |
| | C-2 | EXTRACTION WELL LAYOUT |
| | C-3 | PLANT LAYOUT |
| | C-4 | INFILTRATION POND LAYOUT |
| | C-5 | DETAILS SHEET 1 |
| | C-6 | DETAILS SHEET 2 |
| | C-7 | DETAILS SHEET 3 |
| INSTRUMENTS | | |
| | GI-1 | INSTRUMENTS NOTES AND SYMBOLS |
| | GI-2 | INSTRUMENTS |
| | I-1 | GROUNDWATER P&ID |
| | I-2 | DENSADEG P&ID |
| | I-3 | TREATED & UTILITY WATER P&ID |
| | I-4 | SLUDGE PUMPS P&ID |
| | I-5 | SLUDGE PROCESSING P&ID |
| | I-6 | CHEMICAL SYSTEMS P&ID |
| ARCHITECTURAL | | |
| | A-1 | LIFE SAFETY PLAN & BUILDING CODE SUMMARY |
| | A-2 | FLOOR PLAN |
| | A-3 | MEZZANINE FLOOR PLAN |
| | A-4 | ROOF PLAN |
| | A-5 | EXTERIOR ELEVATIONS |
| STRUCTURAL | | |
| | S-1 | FLOOR PLAN |
| MECHANICAL | | |
| | M-1 | OVERALL FLOOR PLAN |
| | M-2 | FLOOR - PLAN 1 OF 2 |
| | M-3 | FLOOR - PLAN 2 OF 2 |
| | M-4 | SECTIONS - I |
| | M-5 | SECTIONS - II |
| | M-6 | SECTIONS - III |
| | M-7 | SECTIONS - IV |
| | M-8 | SECTIONS - V |
| | M-9 | SECTIONS - VI |
| | M-10 | SECTIONS - VII |
| | M-11 | SECTIONS - VIII |
| | M-12 | SECTIONS - IX |
| | M-13 | SECTIONS - X |
| | M-14 | SECTIONS - XI |
| | M-15 | MISC PLANS AND SECTIONS |




VICINITY MAP
NTS

LOCATION MAP
NTS

10/29/2014 08:04 AM
WOOLSERN
C:\pwworkdir\dms17425\02 DRAWING LIST LEGEND

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: NTS

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED D. MIKLAS
DRAWN J. VERNER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 01-30-2015

NOT FOR CONSTRUCTION

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MWH.

FMC

PROJECT LOCATION: POCATELLO, IDAHO
GENERAL
FMC OU GROUNDWATER REMEDIAL DESIGN
DRAWING LIST, LEGEND, GENERAL NOTES AND LOCATION MAP

DRAWING G-2

## GENERAL SYMBOLOGY

- NEW CONSTRUCTION
- EXISTING (SCREENED)
- FUTURE (PHANTOM)
- EXISTING TO BE REMOVED OR DEMOLISHED

## MATERIAL SYMBOLOGY

- CONCRETE (PLAN AND SECTION)
- GROUT OR SAND (PLAN AND SECTION)
- BRICK (PLAN AND SECTION)
- CMU (PLAN AND SECTION)
- STEEL/METAL/FRP (SMALL SCALE SECTION)
- CHECKER PLATE OR SOLID FRP GRATING (PLAN)
- CHECKER PLATE (SECTION)
- GRATING (PLAN)
- GRATING OR SOLID FRP GRATING (SECTION)
- SAFETY GRATING (PLAN)
- SAFETY GRATING (SECTION)
- RAILING (PLAN)
- WOOD (PLAN OR ELEVATION)
- LUMBER/FRAMING - NOMINAL
- LUMBER - TRIMMED (BLOCKING OR SHIMS)
- OR — GLULAM (SECTION)
- GLULAM (ELEVATION)
- OR — PLYWOOD (SMALL SCALE)
- FINISHED GRADE
- GRAVEL/DRAINROCK/AGGREGATE BASE

## VALVE AND GATE ACTUATORS

- DIAPHRAGM OPERATOR
- D — D = DIGITAL; E/H = ELECTROHYDRAULIC; P = PNEUMATIC; S = SOLENOID; T = TEMPERATURE
- HAND / MANUAL OPERATOR (ALSO SHOWN AS NO OPERATOR)
- M — MOTOR OPERATOR
- PISTON ACTUATOR
- PRESSURE BALANCED DIAPHRAGM ACTUATOR
- PRESSURE REGULATOR WITH EXTERIOR TAP
- PRESSURE REGULATOR (SELF CONTAINED)
- PRESSURE RELIEF OR SAFETY ACTUATOR
- WEIGHT BALANCED OPERATOR

## VALVES

- 3 WAY MULTI-PORT VALVE
- 4 WAY MULTI-PORT VALVE
- AIR VACUUM, AIR RELEASE, OR AIR VACUUM AND AIR RELEASE ASSEMBLY
- ANGLE VALVE
- BACK-PRESSURE VALVE
- BACKFLOW PREVENTER VALVE
- BACKWATER VALVE
- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- CHECK VALVE - ANGLE
- CHECK VALVE - BALL
- CHECK VALVE - SILENT
- CHECK VALVE - STOP
- CONE VALVE
- DIAPHRAGM VALVE
- FLAP VALVE
- GATE VALVE
- GLOBE VALVE
- HOSE BIBB VALVE FROM TOP, FRONT AND SIDE VIEW
- NEEDLE VALVE
- PINCH VALVE
- PLUG VALVE - ECCENTRIC
- PLUG VALVE - LUBRICATED
- OR — PRESSURE REGULATING VALVE
- PRESSURE RELIEF VALVE
- SLEEVE VALVE
- TELESCOPING VALVE

## GATES

- SLIDE GATE (CAST IRON, ALUMINUM OR STAINLESS STEEL)
- STOP GATE OR SHEAR GATE

## PUMPS & COMPRESSORS

- AIR DRIVEN DIAPHRAGM PUMP
- HORIZONTAL ANSI END SUCTION PUMP
- CENTRIFUGAL PUMP
- CENTRIFUGAL WET PIT PUMP OR TURBINE PUMP
- CHEMICAL METERING PUMP
- CIRCULATING PUMP
- DRUM PUMP
- GEAR PUMP OR ROTARY POSITIVE DISPLACEMENT BLOWER
- HORIZONTAL SPLIT CASED PUMP
- HOSE PUMP
- PISTON PUMP
- PROGRESSIVE CAVITY PUMP
- ROTARY LOBE PUMP
- SAMPLE PUMP
- SUBMERSIBLE PUMP
- SUBMERSIBLE TURBINE PUMP
- VERTICAL TURBINE PUMP
- PISTON DRIVEN COMPRESSOR
- COMPRESSOR

## FLOW MEASUREMENT INSTRUMENTS

- DM — DENSITY FLOWMETER
- DISPLACEMENT FLOWMETER
- FLOW ORIFICE
- FLOW ORIFACE WITH QUICK CHANGE FITTINGS
- FLOW TUBE
- FLOW TURBINE
- FLOW VANE
- FLUME

## FLOW MEASUREMENT INSTRUMENTS (CONTINUED)

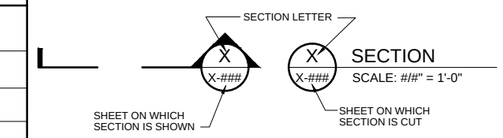
- MM — MAGNETIC FLOWMETER
- PADDLE WHEEL METER
- PITOT TUBE METER (DOUBLE)
- PITOT TUBE METER (SINGLE)
- ROTAMETER / VARIABLE AREA FLOWMETER
- ULTRASONIC FLOWMETER
- VENTURI FLOWMETER
- VORTEX SHEDDING FLOWMETER
- WEIR METER

## PIPING ENDS (SINGLE-LINE)

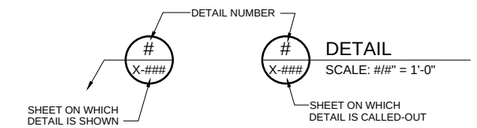
- BLIND FLANGE
- CAP - BREATHER
- CAP - SCREW / THREADED
- CAP - WELDED
- CAP - QUICK DISCONNECT
- EXPANSION JOINT
- FLANGED
- FLANGED COUPLING ADAPTER
- FLANGED COUPLING ADAPTER - RESTRAINED
- OR — FLEXIBLE CONNECTION - BELLOWS TYPE
- GROOVED END COUPLING
- MECHANICAL JOINT
- PIPE MATERIAL CHANGE
- PUSH-ON JOINT - BELL AND SPIGOT
- PUSH-ON JOINT - RESTRAINED
- REDUCER - CONCENTRIC
- REDUCER - ECCENTRIC
- REMOVABLE SPOOL PIECE
- SLEEVE TYPE COUPLING
- SLEEVE TYPE COUPLING - RESTRAINED
- UNION
- WELDED

## REFERENCE SYMBOLS

### SECTION IDENTIFICATION



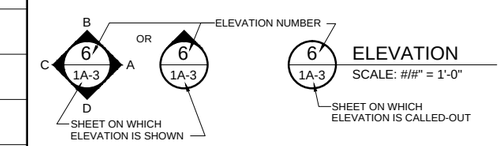

### DETAIL IDENTIFICATION




### STANDARD DETAIL IDENTIFICATION

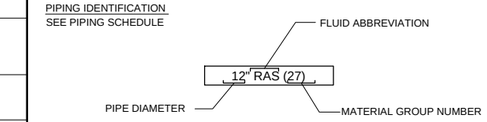
STANDARD DETAILS ARE LOCATED ON DISCIPLINE GENERAL SHEETS, IN NUMERICAL ORDER

### INTERIOR ELEVATION IDENTIFICATION



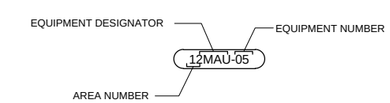

### PIPING IDENTIFICATION

SEE PIPING SCHEDULE




### EQUIPMENT IDENTIFICATION

SEE EQUIPMENT SCHEDULE/SPECIFICATIONS




### MISCELLANEOUS

| | | | |
|---|---|---|---|
| 4-12 | ROOM NUMBER | ### | COORDINATE POINT |
| 2-16 | DOOR NUMBER | Ø | ROUND OR DIAMETER |
| 1-8 | WINDOW NUMBER | @ | AT |
| 13 | ACCESSORY NUMBER | ∠ | ANGLE |
| 4 | WALL TYPE NUMBER | ℄ | CENTERLINE |
| A | SHEET KEY NOTES | | |

DISCIPLINE SPECIFIC SYMBOLS ARE SHOWN ON THE DISCIPLINE GENERAL DRAWINGS.

FOR WELDING SYMBOLS USE AMERICAN WELDING SOCIETY STANDARD SYMBOLS.

REV 040407

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: NTS

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MWH®

FMC

FMC OU PRELIMINARY (30%) GROUNDWATER REMEDIAL DESIGN

FMC OU GROUNDWATER REMEDIAL DESIGN

SYMBOLS

DRAWING G-3

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| | |
|---|---|
| A | AIR / AMPERE |
| A/C | AIR CONDITIONING |
| A/R | AIR RELEASE |
| AASHTO | AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS |
| AB | ANCHOR BOLT |
| ABAN | ABANDON |
| ABND | ABANDONED |
| ABBR | ABBREVIATION |
| ABS | ABSOLUTE TEMPERATURE |
| AC | ACTIVATED CARBON / ASPHALTIC CONCRETE / ALTERNATING CURRENT |
| ACI | AMERICAN CONCRETE INTERNATIONAL |
| ACOUS | ACOUSTIC / ACOUSTICAL |
| ACP | ASBESTOS CEMENT PIPE / ASPHALTIC CONCRETE PAVEMENT |
| ADD | ADDITIONAL |
| ADH | ADHESIVE |
| ADJ | ADJUSTABLE |
| AER | AERATION |
| AFF | ABOVE FINISHED FLOOR |
| AISC | AMERICAN INSTITUTE OF STEEL CONSTRUCTION |
| ALT | ALTERNATE |
| ALUM | ALUMINUM / ALUM |
| AMB | AMBIENT |
| ANSI | AMERICAN NATIONAL STANDARDS INSTITUTE |
| API | AMERICAN PETROLEUM INSTITUTE |
| APPD | APPROVED |
| APPROX | APPROXIMATE |
| APPURTS | APPURTENANCES |
| ARCH | ARCHITECTURE |
| ASME | AMERICAN SOCIETY OF MECHANICAL ENGINEERS |
| ASPH | ASPHALT |
| ASTM | AMERICAN SOCIETY FOR TESTING AND MATERIALS |
| AT | ACOUSTICAL TILE |
| ATM | ATMOSPHERE |
| AV/AR | AIR VACUUM AND AIR RELEASE VALVE |
| AVE | AVENUE |
| AWPA | AMERICAN WOOD PRESERVERS ASSOCIATION |
| AWS | AMERICAN WELDING SOCIETY |
| AWWA | AMERICAN WATER WORKS ASSOCIATION |
| B&S | BELL AND SPIGOT |
| B/W | BACK OF WALL / BACK OF WALK |
| BC | BEGIN CURVE / BOLT CIRCLE / BETWEEN CENTERS / BACK OF CURVE |
| BCR | BEGIN CURB RETURN |
| BD | BOARD |
| BDRY | BOUNDARY |
| BF | BLIND FLANGE / BOTTOM OF FOOTING |
| BFP | BACK FLOW PREVENTER |
| BFV | BUTTERFLY VALVE |
| BHP | BRAKE HORSEPOWER |
| BLDG | BUILDING |
| BLK | BLACK / BLOCK |
| BLKG | BLOCKING |
| BLVD | BOULEVARD |
| BM | BEAM / BENCH MARK |
| BO | BLOW-OFF ASSEMBLY |
| BOD | BIOCHEMICAL OXYGEN DEMAND |
| BOP | BOTTOM OF PIPE |
| BOT | BOTTOM |
| BPV | BACK PRESSURE VALVE |
| BRK | BRICK / BREAK |
| BSMT | BASEMENT |
| BT | BOLT |
| BTU | BRITISH THERMAL UNIT |
| BV | BALL VALVE |
| BVC | BEGIN VERTICAL CURVE |
| BWV | BACK WATER VALVE |
| C | CENTIGRADE / CHANNEL / CEMENT |
| C&G | CURB AND GUTTER |
| CAB | CABINET / CRUSHED AGGREGATE BASE |
| CAP | CAPACITY |
| CATS | CASING TEST STATION |
| CATV | CABLE TELEVISION |
| CB | CATCH BASIN / CHALKBOARD / CURB |
| CC | CLOSED CIRCUIT TV / CENTER TO CENTER |
| CD | CEILING DIFFUSER |
| CEM | CEMENT |
| CF | CURB FACE / CUBIC FOOT |
| CFH | CUBIC FEET PER HOUR |
| CFM | CUBIC FEET PER MINUTE |
| CFS | CUBIC FEET PER SECOND |
| CHEM | CHEMICAL |
| CHG | CHANGE |
| CHKD | CHECKERED |
| CI | CAST IRON |
| CIP | CAST IRON PIPE / CAST IN PLACE |
| CIPP | CAST IN PLACE PIPE |
| CJ | CONSTRUCTION JOINT |
| CL | CHLORINE GAS / CHLORINATOR / CENTERLINE |
| CLF | CHAIN LINK FENCE |
| CLG | CEILING |
| CLOS | CLOSET |
| CLR | CLEAR / CLEARANCE |
| CMB | CRUSHED MISCELLANEOUS BASE |
| CMC | CEMENT MORTAR-COATED |
| CML | CEMENT MORTAR-LINED |
| CML&C | CEMENT MORTAR-LINED AND COATED |
| CMP | CORRUGATED METAL PIPE |
| CMU | CONCRETE MASONRY UNIT |
| CO | CLEANOUT |
| COL | COLUMN |
| COMM | COMMUNICATIONS CABLE |
| COMP | COMPRESSOR |
| CONC | CONCRETE / CONCENTRIC |
| COND | CONDENSER / CONDENSATE |
| CONN | CONNECTION |
| CONST | CONSTRUCT / CONSTRUCTION |
| CONT | CONTINUED / CONTINUOUS |
| CONTR | CONTRACTOR |
| COORD | COORDINATE |
| COR | CORNER |
| COTG | CLEANOUT TO GRADE |
| CPLG | COUPLING |
| CPVC | CHLORINATED POLYVINYL CHLORIDE |
| CS | CAUSTIC SODA / CAST STEEL |
| CSP | CORRUGATED STEEL PIPE |
| CSTS | CURRENT SPAN TEST STATION |
| CT | CERAMIC TILE |
| CTR | CENTER |
| CTS | CORROSION TEST STATION |
| CTSK | COUNTERSUNK |
| CU | COPPER / CUBIC |
| CULV | CULVERT |
| CV | CHECK VALVE |
| CY | CUBIC YARD |
| CYL | CYLINDER |
| d | PENNY |
| DAD | DOUBLE ACTING DOOR |
| DAFT | DISSOLVED AIR FLOTATION THICKENER |
| DB | DIRECT BURY |
| DBL | DOUBLE |
| DC | DIRECT CURRENT |
| DEG | DEGREE |
| DET | DETAIL |
| DF | DRINKING FOUNTAIN / DOUGLAS FIR |
| DG | DOOR GRILL |
| DH | DOUBLE HUNG |
| DI | DUCTILE IRON |
| DIA | DIAMETER |
| DIAG | DIAGONAL |
| DIAPH | DIAPHRAGM |
| DIFF | DIFFUSER / DIFFERENTIAL |
| DIP | DUCTILE IRON PIPE |
| DIR | DIRECTION |
| DISCH | DISCHARGE |
| DISP | DISPENSER |
| DL | DEAD LOAD |
| DMH | DROP MANHOLE |
| DN | DOWN |
| DO | DISSOLVED OXYGEN / DITTO |
| DR | DOOR / DRAIN |
| DS | DRENCH SHOWER AND EYE WASH |
| DT | DRAIN TILE |
| DWG | DRAWING |
| DWLS | DOWELS |
| DWY | DRIVEWAY |
| E | EAST |
| E/O | EAST OF |
| EA | EACH |
| EB | EXPANSION BOLT OR ANCHOR |
| EC | END CURVE |
| ECC | ECCENTRIC |
| ECR | END CURB RETURN |
| EF | EACH FACE / EXHAUST FAN |
| EFF | EFFLUENT |
| EG | EXISTING GRADE / EDGE OF GUTTER / EXHAUST GRILLE |
| EGL | ENERGY GRADE LINE |
| EL | ELEVATION |
| ELEC | ELECTRICAL / ELECTRONIC |
| EN | EDGE NAILING |
| ENCL | ENCLOSURE |
| ENG | ENGINE |
| ENGR | ENGINEER |
| ENT | ENTRANCE |
| EP | EDGE OF PAVEMENT |
| EPT | ETHYLENE PROPYLENE |
| EQ | EQUAL |
| EQUIP | EQUIPMENT |
| ESMT | EASEMENT |
| ETB | EMULSION TREATED BASE |
| ETC | ET CETERA |
| EVAP | EVAPORATOR |
| EVC | END VERTICAL CURVE |
| EW | EACH WAY / EYE WASH |
| EX | EXISTING |
| EXC | EXCAVATION |
| EXH | EXHAUST |
| EX-HY | EXTRA HEAVY |
| EXIST | EXISTING |
| EXP | EXPANSION |
| EXT | EXTERIOR / EXTENSION |
| EXTR | EXTRUDED |
| F | FAHRENHEIT / FINISH |
| F TO F | FACE TO FACE |
| F&C | FRAME AND COVER |
| F&I | FURNISH AND INSTALL |
| FAB | FABRICATE / FABRICATION / FABRICATED |
| FAI | FRESH AIR INTAKE |
| FB | FLAT BAR / FLOOR BEAM / FIELD BOOK |
| FCO | FLOOR CLEANOUT |
| FD | FLOOR DRAIN |
| FDR | FEEDER |
| FE | FIRE EXTINGUISHER / FINAL EFFLUENT |
| FEM | FEMALE (PIPE THREAD) |
| FF | FLAT FACE / FAR FACE / FINISHED FLOOR |
| FG | FINISHED GRADE |
| FH | FIRE HYDRANT / FLAT HEAD |
| FIG | FIGURE |
| FIN | FINISHED |
| FIX | FIXTURE |
| FL | FLOWLINE / FLOOR |
| FLEX | FLEXIBLE |
| FLG | FLANGE / FLOORING |
| FLGD | FLANGED |
| FLOCC | FLOCCULATOR / FLOCCULATION |
| FLR | FLOOR |
| FLSG | FLASHING |
| FM | FACTORY MUTUAL (LAB APPROVED) / FORCE MAIN |
| FMH | FLEXIBLE METAL HOSE |
| FN | FIELD NAILING |
| FND | FOUNDATION |
| FOC | FACE OF CONCRETE / FIBER OPTIC CABLE |
| FOM | FACE OF MASONRY |
| FOS | FACE OF STUDS |
| FOW | FACE OF WALL |
| FPC | FLEXIBLE PIPE COUPLING |
| FPM | FEET PER MINUTE |
| FPS | FEET PER SECOND |
| FPTS | FOREIGN PIPE TEST STATION |
| FR | FRAME |
| FRP | FIBERGLASS REINFORCED PLASTIC |
| FS | FINISHED SURFACE / FAR SIDE / FLOOR SINK / FORGED STEEL |
| FT | FEET / FOOT |
| FTG | FOOTING |
| FUR | FURRING |
| FUT | FUTURE |
| FV | FIELD VERIFY |
| FWD | FORWARD |
| G | GAS |
| GA | GAGE / GAUGE |
| GAL | GALLON |
| GALV | GALVANIZED |
| GANC | GUY ANCHOR |
| GB | GRADE BREAK |
| GEN | GENERAL / GENERATOR |
| GFA | GROOVED FLANGE ADAPTER |
| GI | GALVANIZED IRON |
| GIP | GALVANIZED IRON PIPE |
| GL | GLASS / GROUND LINE / GRADE LINE |
| GLB | GLUE LAMINATED BEAM / GLULAM |
| GLV | GLOBE VALVE |
| GM | GAS METER |
| GP | GUY POLE |
| GPD | GALLONS PER DAY |
| GPH | GALLONS PER HOUR |
| GPM | GALLONS PER MINUTE |
| GR | GRADE |
| GRD | GRADE / GROUND |
| GRTG | GRATING |
| GSP | GALVANIZED STEEL PIPE |
| GV | GATE VALVE |
| GYP | GYPSUM |
| H | HIGH / HEIGHT |
| H&V | HEATING AND VENTILATING |
| H/B | HOSE BIBB |
| HC | HOUSE CONNECTION |
| HDR | HEADER |
| HDW | HARDWARE |
| HDWL | HEADWALL |
| HEX | HEXAGONAL |
| Hg | MERCURY |
| HGL | HYDRAULIC GRADE LINE |
| HGR | HANGER |
| HM | HOLLOW METAL |
| HORZ | HORIZONTAL |
| HP | HIGH POINT / HORSE POWER / HIGH PRESSURE |
| HPG | HIGH PRESSURE GAS |
| HR | HEAT RETURN / HOUR |
| HSL | HORIZONTALLY SLOTTED |
| HSS | HOLLOW STRUCTURAL SECTION |
| HTG | HEATING |
| HTR | HEATER |
| HV | HORIZONTAL AND VERTICAL CONTROL POINT |
| HVAC | HEATING, VENTILATION AND AIR CONDITIONING |
| HW | HOT WATER / HEADWORK |
| HWD | HARDWOOD |
| HWL | HIGH WATER LEVEL |
| HWO | HANDWHEEL OPERATED |
| HYD | HYDRAULIC / HYDRANT |
| I/O | INPUT/OUTPUT |
| I&O | INSIDE AND OUTSIDE |
| IBC | INTERNATIONAL BUILDING CODE |
| ID | INSIDE DIAMETER |
| IF | INSIDE FACE |
| IJTS | INSULATING JOINT TEST STATION |
| IN | INCH |
| INCL | INCLUDE / INCLUDING |
| INFL | INFLUENT |
| INSL | INSULATION / INSULATING / INSULATED |
| INSP | INSPECTION |
| INST | INSTRUMENT |
| INT | INTERIOR |
| INV | INVERT |
| IP | IRON PIPE |
| IPS | IRON PIPE SIZE |
| IRRG | IRRIGATION |
| JAN | JANITOR |
| JC | JUNCTION CHAMBER |
| JCT | JUNCTION |
| JS | JUNCTION STRUCTURE |
| JSTS | JOISTS |
| JT | JOINT |
| k | KILO |
| K | KELVIN / KARAT |
| kg | KILOGRAM |
| km | KILOMETER |
| kV | KILOVOLT |
| KVA | KILOVOLT AMPERE |
| kW | KILOWATT |
| kWh | KILOWATT HOUR |
| L | LITER / LENGTH / ANGLE |
| LAB | LABORATORY |
| LAM | LAMINATED |
| LAT | LATERAL |
| LAV | LAVATORY |
| LB | POUND |
| LCP | LOCAL CONTROL PANEL |
| LCS | LOCAL CONTROL STATION |
| LD | LOCAL DEPRESSION |
| LDG | LANDING |
| LEV | LEVEL |
| LF | LINEAR FOOT |
| LG | LENGTH / LONG |
| LH | LAMP HOLE / LEFT HAND |
| LL | LIVE LOAD |
| LLH | LONG LEG HORIZONTAL |
| LLV | LONG LEG VERTICAL |
| LOC | LOCATION |
| LOL | LAYOUT LINE |
| LONG | LONGITUDINAL |
| LP | LOW POINT / LOW PRESSURE / LAMP POST |
| LPG | LIQUID PETROLEUM GAS |
| LT | LEFT / LIGHT |
| LTS | LIME TREATED SOIL |
| LW | LOW WATER |
| LWL | LOW WATER LEVEL |
| LWR | LOWER |
| m | METER |
| M | MALE (PIPE THREAD) |
| mA | MILLIAMPS |
| MACH | MACHINE |
| MAG | MAGNETIC |
| MAINT | MAINTENANCE |
| MAN | MANUAL |
| MAS | MASONRY |
| MAT | MATERIAL |
| MAX | MAXIMUM |
| MB | MAIL BOX / MACHINE BOLT |
| MCC | MOTOR CONTROL CENTER |
| MCR | MIDDLE OF CURB RETURN |
| MEAS | MEASURE |
| MECH | MECHANICAL |
| MED | MEDIUM |
| MEMB | MEMBER |
| MFR | MANUFACTURER |
| MFRD | MANUFACTURED |
| MGD | MILLION GALLONS PER DAY |
| MH | MANHOLE / MAINTENANCE HOLE |
| MHT | MEAN HIGH TIDE |
| MHW | MEAN HIGH WATER |
| MI | MALLEABLE IRON / MILE |
| MICRON | 1/1,000,000 METER |
| MIL | MILITARY / 1/1,000TH INCH |
| MIN | MINIMUM / MINUTE |
| MIR | MIRROR |
| MISC | MISCELLANEOUS |
| MK | MARK |
| MLW | MEAN LOW WATER |
| mm | MILLIMETER |
| MO | MOTOR OPERATED / MASONRY OPENING |
| MOD | MODEL |
| MON | MONUMENT |
| MOR | MORTAR |
| MS | MOP SINK |
| MSL | MEAN SEA LEVEL |
| MTC | MECHANICAL-TYPE COUPLING |
| MTD | MOUNTED |
| MTG | MOUNTING |
| MTL | METAL |
| MTR | MOTOR |
| N | NORTH |
| NaOCL | SODIUM HYPOCHLORITE |
| NaOH | SODIUM HYDROXIDE (CAUSTIC SODA) |
| NC | NORMALLY CLOSED |
| NEC | NATIONAL ELECTRICAL CODE |
| NEMA | NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION |
| NF | NEAR FACE |
| NFPA | NATIONAL FIRE PROTECTION ASSOCIATION |
| NG | NATURAL GRADE / NATURAL GAS |
| NIC | NOT IN CONTRACT |
| NO | NUMBER / NORMALLY OPEN |
| NOM | NOMINAL |
| NPS | NOMINAL PIPE SIZE |
| NPT | NATIONAL PIPE THREAD |
| NRCP | NON-REINFORCED CONCRETE PIPE |
| NRS | NON-RISING STEM |
| NS | NEAR SIDE |
| NTS | NOT TO SCALE |
| OBJ | OBJECT |
| OC | ON CENTER / OVER-CROSSING |
| OD | OUTSIDE DIAMETER / OVERALL DIMENSION |
| OE | OUTER EDGE |
| OF | OVERFLOW / OUTSIDE FACE |
| OFD | OVERFLOW DRAIN |
| OFF | OFFICE |
| OH | OVER HEAD |
| OHW | OVERHEAD WIRES |
| OPER | OPERATOR / OPERATING |
| OPNG | OPENING |
| OPP | OPPOSITE |
| ORIG | ORIGINAL |
| OS&Y | OUTSIDE SCREW AND YOKE |
| OSA | OUTSIDE AIR |
| OSHA | OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION |
| OWG | OIL, WATER, GAS |
| OZ | OUNCE |
| P | POLE / PAGE / PIPE |
| P/S | POLE AND SHELF |
| PA | PLANTING AREA |
| PART | PARTITION |
| PAVMT | PAVEMENT |
| PB | POLYBUTYLENE / PULL BOX |
| PC | POINT OF CURVATURE / PRIMARY CLARIFIER / PORTLAND CEMENT |
| PCC | PORTLAND CEMENT CONCRETE / POINT OF COMPOUND CURVE |
| PCOTG | PRESSURE CLEANOUT TO GRADE |
| PCVC | POINT OF COMPOUND VERTICAL CURVE |
| PE | PLANT EFFLUENT / POLYETHYLENE / POLYELECTROLYTE POLYMER |
| PG | PRESSURE GAGE |
| pH | RECIPROCAL LOG OF HYDROGEN ION CONCENTRATION |
| PI | PLANT INFLUENT / POINT OF INTERSECTION |
| PK | PARKING |
| PL | PLATE / PROPERTY LINE / PLACE |
| PLAS | PLASTER / PLASTIC |
| PLT | PLANT |
| PLWD | PLYWOOD |
| PM | PRESSED METAL |
| PNEU | PNEUMATIC |
| PNL | PANEL |
| POB | POINT OF BEGINNING |
| POC | POINT OF CONNECTION |
| POT | POINT OF TANGENT |
| PP | POWER POLE / POLYPROPYLENE |
| PPD | POUNDS PER DAY |
| PPH | POUNDS PER HOUR |
| PPM | POUNDS PER MINUTE |
| PR | PAIR |
| PRC | POINT OF REVERSE CURVE |
| PRCT | PRECAST |
| PREFAB | PREFABRICATED |
| PRESS | PRESSURE |
| PROF | PROFILE |
| PRV | PRESSURE REGULATING, RELIEF OR REDUCING VALVE |
| PRVC | POINT OF REVERSE VERTICAL CURVE |
| PS | PRESSURE SWITCH |
| PSF | POUNDS PER SQUARE FOOT |
| PSI | POUNDS PER SQUARE INCH |
| PSIA | POUNDS PER SQUARE INCH ABSOLUTE |
| PSIG | POUNDS PER SQUARE INCH GAUGE |
| PT | POINT OF TANGENCY / PAINT / PRESSURE |
| PTFE | POLYTETRAFLUOROETHYLENE (TEFLON) |
| PV | PLUG VALVE |
| PVC | POLYVINYL CHLORIDE |
| PVDF | POLYVINYLIDENE FLUORIDE (KYNAR) |
| PW | POTABLE WATER |
| QT | QUARRY TILE |
| QTY | QUANTITY |
| QUAD | QUADRANGLE / QUADRANT |
| R | RADIUS / RISER / RATE OF SLOPE |
| R&O | ROCK AND OIL |
| R/W | RIGHT OF WAY |
| RAC | RECYCLED ASPHALT CONCRETE |
| RAG | RETURN AIR GRILLE |
| RAP | RECLAIMED ASPHALT PAVEMENT |
| RAS | RETURN ACTIVATED SLUDGE |
| RC | REINFORCED CONCRETE |
| RCP | REINFORCED CONCRETE PIPE |
| RD | ROAD / ROOF DRAIN / ROUND |
| RED | REDUCER / REDUCING |
| REF | REFERENCE / REFER / REFRIGERATOR |
| REG | REGULATING |
| REINF | REINFORCE / REINFORCED |
| REQD | REQUIRED |
| RESIL | RESILIENT |
| RET | RETAINING / RETURN |
| REV | REVISION |
| REW | RECLAIMED WATER |
| RF | ROOF / RAISED FOUNDATION / ROUGH FACE |
| RFG | ROOFING |
| RGE | REGISTERED GEOTECHNICAL ENGINEER |
| RH | REDHEAD / RIGHT HAND |
| RM | ROOM |
| RO | ROUGH OPENING |
| RPM | REVOLUTIONS PER MINUTE |
| RR | RAILROAD |
| RS | RISING STEM |
| RSL | RAW SLUDGE |
| RT | RIGHT |
| RTP | REINFORCED THERMOSETTING PLASTIC |
| RTU | REMOTE TERMINAL UNIT |
| RW | REDWOOD |
| RWL | RAINWATER LEADER |
| S | SOUTH / SCUM / SINK / SECOND / SLOPE / |
| S/O | SOUTH OF |
| SA | SAMPLE |
| SAN | SANITARY |
| SBR | STYRENE BUTADIENE (RUBBER) |
| SC | SPARE CHEMICAL / SECONDARY CLARIFIER |
| SCCP | STEEL CYLINDER CONCRETE PIPE |
| SCD | SCREWED |
| SCFM | STANDARD CUBIC FEET PER MINUTE |
| SCH | SCHEDULE |
| SD | SANITARY DRAIN & VENT / SMOKE DETECTOR |
| SDR | STANDARD THERMOPLASTIC PIPE DIMENSION RATIO / STORM DRAIN |
| SEC | SECONDARY / SECTION |
| SER | SERIES |
| SETT | SETTING |
| SF | SQUARE FOOT |
| SH | SHOWER |
| SHELV | SHELVING |
| SHT | SHEET |
| SHTG | SHEATHING |
| SIM | SIMILAR |
| SL | SLUDGE |
| SLDG | SLIDING |
| SLG | SLUICE GATE |
| SOG | SLAB ON GRADE |
| SOLN | SOLUTION |
| SP | STATIC PRESSURE |
| SPEC | SPECIFICATION |
| SPK | SPIKE |
| SQ | SQUARE |
| SS | STAINLESS STEEL / SANITARY SEWER / SERVICE SINK |
| SSB | SELECT SUB-BASE |
| SSPWC | STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION |
| SSU | SECONDS SAYBOLT UNIVERSAL |
| ST | STREET / STATE |
| STA | STATION |
| STC | SLEEVE-TYPE COUPLING |
| STD | STANDARD |
| STK | STAKE |
| STL | STEEL |
| STM | STEAM |
| STR | STRAIGHT / STRUCTURAL |
| SU | STEAM LINE |
| SUCT | SUCTION |
| SV | SOLENOID VALVE |
| SW | SIDEWALK |
| SWD | SIDEWALK DRAIN |
| SWGR | SWITCHGEAR |
| SWR | SIDEWALL REGISTER |
| SY | SQUARE YARD |
| SYM | SYMMETRICAL / SYMBOL |
| SYS | SYSTEM |
| T | THERMOSTAT / TREAD OF STAIR / TANGENT |
| T&B | TOP AND BOTTOM |
| T&G | TONGUE AND GROOVE |
| TAN | TANGENT |
| TB | TACK BOARD |
| TBE | THREAD BOTH ENDS |
| TBM | TEMPORARY BENCH MARK |
| TC | TOP OF CURB |
| TCV | TEMPERATURE CONTROL VALVE |
| TEL | TELEPHONE |
| TEMP | TEMPERATURE / TEMPORARY |
| TF | TOP OF FOOTING |
| TH | TEST HOLE |
| THK | THICK / THICKNESS |
| THR | THRESHOLD |
| THR'D | THREADED |
| TK | TANK / TACK |
| TL | TRAVERSE LINE |
| TOC | TOP OF CONCRETE |
| TOE | THREAD ONE END |
| TOL | TOILET |
| TOM | TOP OF MASONRY |
| TOP | TOP OF PIPE |
| TOPO | TOPOGRAPHIC |
| TOS | TOP OF STEEL |
| TOW | TOP OF WALL |
| TP | TELEPHONE POLE |
| TR | TRACT |
| TRANS | TRANSMITTER / TRANSITION /TRANSMISSION |
| TS | TRAFFIC SIGNAL |
| TSB | TOP SET BASE |
| TSC | TRAFFIC SIGNAL CONDUIT |
| TV | THERMOSTATIC VALVE / TELEVISION |
| TW | THERMOMETER WELL /TRAVELED WAY |
| TYP | TYPICAL |
| UB | UNION BONNET |
| UBC | UNIFORM BUILDING CODE |
| UC | UNDER-CROSSING |
| UG | UNDERGROUND |
| UGC | UNDERGROUND CONDUIT |
| UH | UNIT HEATER |
| UL | UNDERWRITERS LABORATORIES |
| UNID | UNIDENTIFIED |
| UNO | UNLESS NOTED OTHERWISE |
| UOI | UNLESS OTHERWISE INDICATED |
| UPS | UNINTERRUPTABLE POWER SUPPLY |
| UR | URINAL |
| USA | UNDERGROUND SERVICE ALERT |
| USGS | UNITED STATES GEOLOGICAL SURVEY |
| UV | ULTRAVIOLET |
| UW | UTILITY WATER |
| V | VALVE / VERTICAL / VENT / VOLT / VOLUME |
| VAC | VACUUM |
| VAR | VARIES / VARIABLE |
| VB | VALVE BOX |
| VC | VERTICAL CURVE |
| VCP | VITRIFIED CLAY PIPE |
| VERT | VERTICAL |
| VOL | VOLUME |
| VPI | VERTICAL POINT OF INTERSECTION |
| VSL | VERTICALLY SLOTTED |
| VTC | VENT TO CEILING |
| VTR | VENT THROUGH ROOF |
| VWC | VINYL WALL COVERING |
| VWM | VERIFY WITH MANUFACTURE |
| W | WEST / WASTE / WIDTH / WIDE FLANGE / WATER |
| W/ | WITH |
| W/O | WEST OF / WITHOUT |
| WC | WATER COLUMN / WATER CLOSET |
| WCO | WALL CLEANOUT |
| WD | WOOD |
| WDW | WINDOW |
| WH | WATER HEATER |
| WI | WROUGHT IRON |
| WM | WATER METER |
| WOG | WATER, OIL, OR GAS |
| WP | WATERPROOFING / WORKING PRESSURE / WORK POINT |
| WPJ | WEAKEN PLANE JOINT |
| WS | WATER SURFACE |
| WSTP | WATERSTOP |
| WT | WEIGHT |
| WWF | WELDED WIRE FABRIC |
| WWP | WATER WORKING PRESSURE |
| XCONN | CROSS CONNECTION |
| XS | EXTRA STRONG |
| XSEC | CROSS SECTION |
| XXS | DOUBLE EXTRA STRONG |
| YD | YARD |
| YR | YEAR |
| Z | ZERO / ZONE |
| ZN | ZINC |
| # | POUND |
| & | AND |
| @ | AT |

FOR ADDITIONAL ABBREVIATIONS SEE:

CIVIL - GENERAL CIVIL SHEETS
PIPING - PIPING SCHEDULE
ELECTRICAL - GENERAL ELECTRICAL SHEETS
INSTRUMENTATION - GENERAL INSTRUMENTATION SHEETS

OTHER ABBREVIATIONS CONFORM TO ANSI STANDARD ABBREVIATIONS Z32.2.3

REV 121109

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: NTS

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED D. MIKLAS
DRAWN J. VERNER
CHECKED C. TOMLINSON

PRELIMINARY DESIGN PHASE - 01-30-2015

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MWH.

FMC

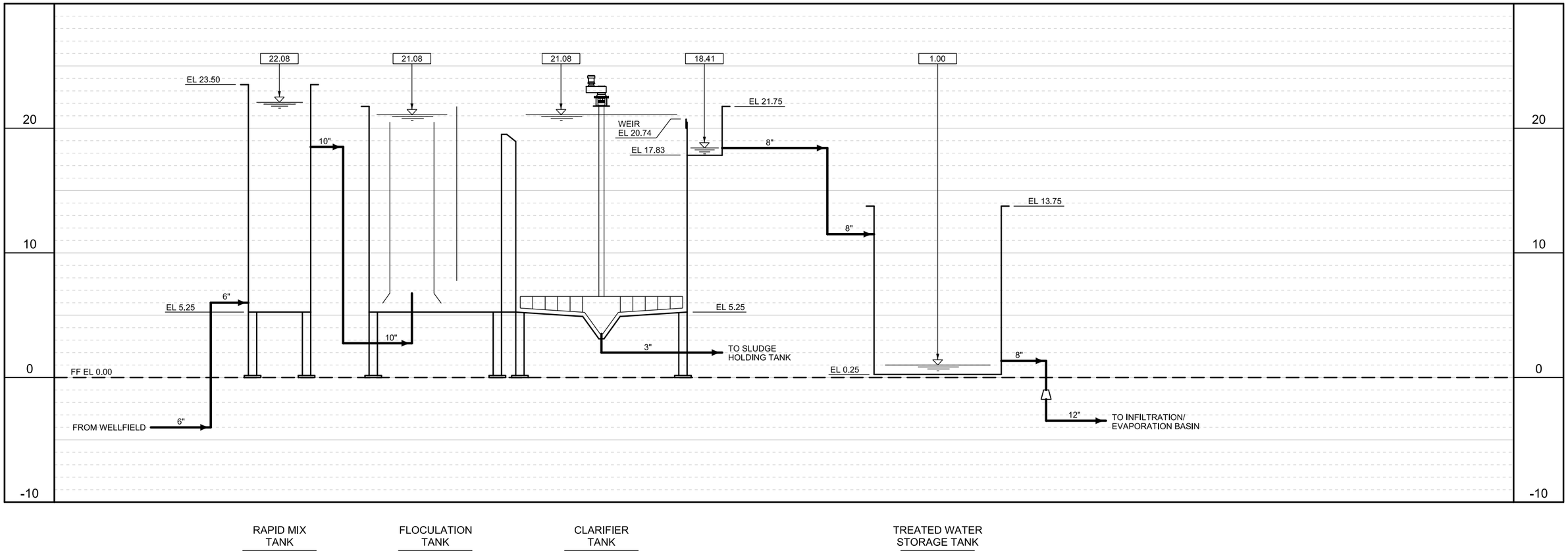
PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
ABBREVIATIONS

DRAWING G-4

C:\pwworkdir\dms17425\10505612_g04

## LEGEND

XXX.XX WATER SURFACE ELEVATION




| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: 1" = 4' VERTICAL

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J DIXON
DRAWN P UDE
CHECKED D MIKLAS

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FMC

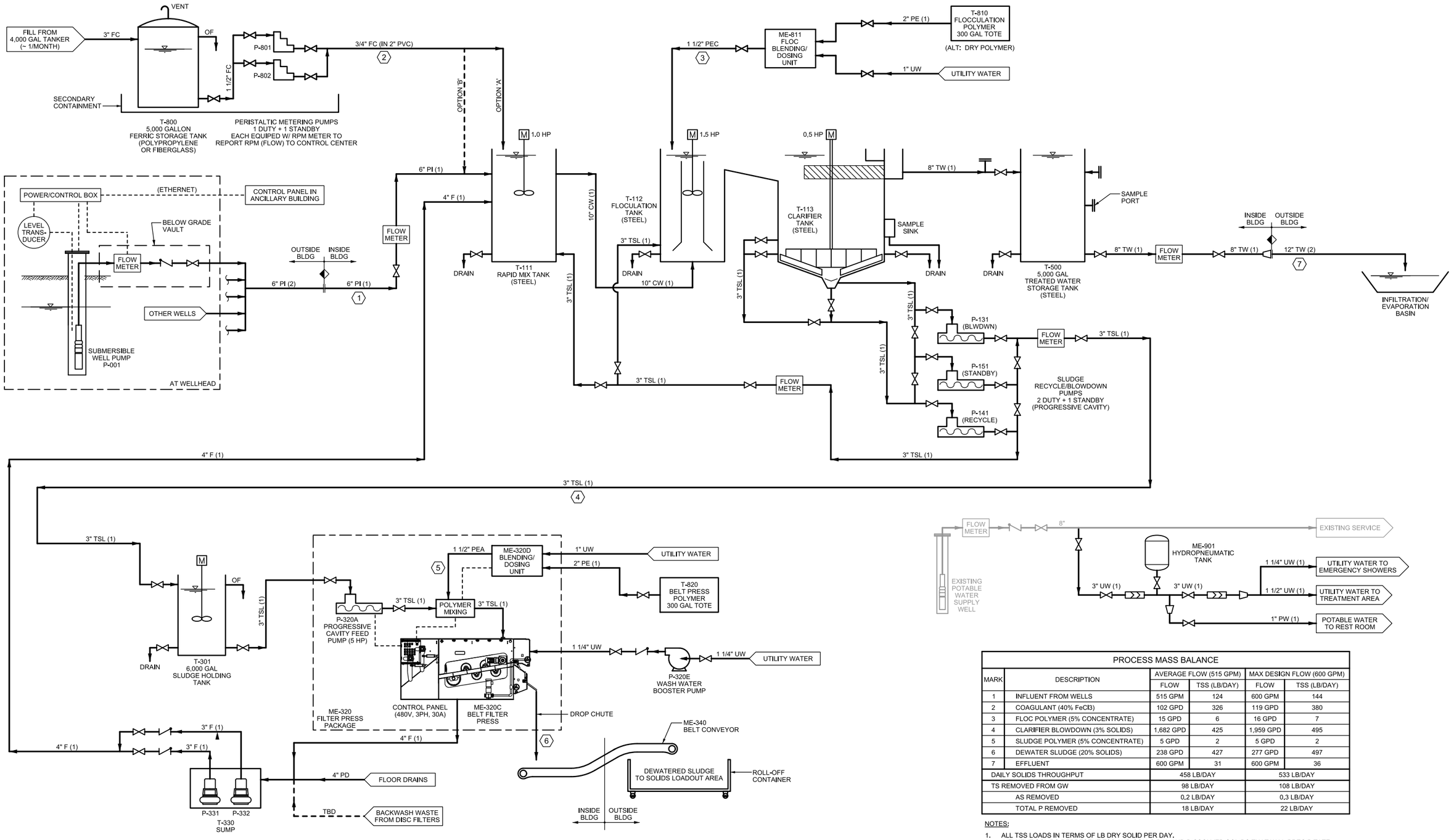
PROJECT LOCATION: POCATELLO, IDAHO

GENERAL

FMC OU GROUNDWATER REMEDIAL DESIGN
HYDRAULIC PROFILE

DRAWING G-5

File: FMC G05.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 22-JAN-2015 16:52




| PROCESS MASS BALANCE | | | | | |
|---|---|---|---|---|---|
| MARK | DESCRIPTION | AVERAGE FLOW (515 GPM) | | MAX DESIGN FLOW (600 GPM) | |
| | | FLOW | TSS (LB/DAY) | FLOW | TSS (LB/DAY) |
| 1 | INFLUENT FROM WELLS | 515 GPM | 124 | 600 GPM | 144 |
| 2 | COAGULANT (40% FeCl3) | 102 GPD | 326 | 119 GPD | 380 |
| 3 | FLOC POLYMER (5% CONCENTRATE) | 15 GPD | 6 | 16 GPD | 7 |
| 4 | CLARIFIER BLOWDOWN (3% SOLIDS) | 1,682 GPD | 425 | 1,959 GPD | 495 |
| 5 | SLUDGE POLYMER (5% CONCENTRATE) | 5 GPD | 2 | 5 GPD | 2 |
| 6 | DEWATER SLUDGE (20% SOLIDS) | 238 GPD | 427 | 277 GPD | 497 |
| 7 | EFFLUENT | 600 GPM | 31 | 600 GPM | 36 |
| DAILY SOLIDS THROUGHPUT | | 458 LB/DAY | | 533 LB/DAY | |
| TS REMOVED FROM GW | | 98 LB/DAY | | 108 LB/DAY | |
| AS REMOVED | | 0.2 LB/DAY | | 0.3 LB/DAY | |
| TOTAL P REMOVED | | 18 LB/DAY | | 22 LB/DAY | |

NOTES:

1. ALL TSS LOADS IN TERMS OF LB DRY SOLID PER DAY.
2. INFLUENT SOLIDS REPRESENT TSS AND COLLOIDAL AND DISSOLVED SOLIDS THAT WILL PRECIPITATE OR ABSORB TO SOLIDS IN TREATMENT PROCESS.
3. MASS OF DISSOLVED SOLIDS INTO AND OUT OF THE TREATMENT PLANT, INCLUDING DISSOLVED SOLIDS IN INFLUENT AND CHLORIDE LOAD FROM COAGULANT, NOT SHOWN.
4. GPM = GALLONS PER MINUTE; GPD = GALLONS PER DAY, TSS = TOTAL SUSPENDED SOLIDS, TS = TOTAL SOLIDS

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: NO SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED B SICK
DRAWN P UDE
CHECKED D MIKLAS

PRELIMINARY DESIGN PHASE - 01-30-2015

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FMC

PROJECT LOCATION: POCATELLO, IDAHO

GENERAL

FMC OU GROUNDWATER REMEDIAL DESIGN
PROCESS FLOW DIAGRAMS

DRAWING G-6

File: FMC G06.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 22-JAN-2015 16:58

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE
1" = 500'

WARNING
0 ½ 1
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DESIGNED J. DIXON
DRAWN J. VERNER
CHECKED D. MIKLAS

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FMC

PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
EFFLUENT PIPELINE LAYOUT

DRAWING
C-1

10/27/2014 2:05 PM
WOOLSERN
C:\pwworkdir\dms20811\EFFLUENT PIPELINE LAYOUT

## ELEVATIONS

| WELL ID | NORTHING | EASTING | TOP OF SEAL | TOP OF FILTER PACK | TOP OF SCREEN | BOTTOM OF SCREEN | BOTTOM OF SUMP | BOTTOM OF HOLE | FINAL ELEVATION |
|---|---|---|---|---|---|---|---|---|---|
| EW-A | 452682.80 | 556282.77 | 4409.40 | 4404.40 | 4398.40 | 4373.40 | 4371.40 | 4363.40 | 4469.40 |
| EW-B | 452630.45 | 556503.66 | 4412.09 | 4407.09 | 4401.09 | 4376.09 | 4374.09 | 4366.09 | 4472.09 |
| EW-C | 452664.09 | 556654.53 | 4412.09 | 4407.09 | 4401.09 | 4376.09 | 4374.09 | 4366.09 | 4472.09 |
| EW-01 | 452775.45 | 556853.76 | 4408.12 | 4402.62 | 4396.62 | 4371.62 | 4369.62 | 4361.62 | 4467.62 |
| EW-02 | 452873.99 | 557183.44 | 4401.42 | 4396.42 | 4390.42 | 4367.42 | 4365.42 | 4358.42 | 4463.42 |
| EW-D | 452887.14 | 557394.99 | 4403.38 | 4398.38 | 4392.38 | 4367.38 | 4365.38 | 4357.38 | 4463.38 |
| EW-03 | 453021.53 | 557664.18 | 4399.75 | 4394.75 | 4388.75 | 4363.75 | 4361.75 | 4352.75 | 4458.78 |
| EW-E | 453024.33 | 557835.02 | 4399.25 | 4394.25 | 4388.25 | 4363.25 | 4361.25 | 4353.25 | 4459.25 |
| EW-F | 453078.69 | 558034.90 | 4396.31 | 4391.31 | 4385.31 | 4360.31 | 4358.31 | 4350.31 | 4456.31 |
| EW-G | 453107.22 | 558153.98 | 4395.04 | 4390.04 | 4384.04 | 4359.04 | 4357.04 | 4349.04 | 4455.04 |
| EW-H | 453134.95 | 558303.51 | 4393.50 | 4388.50 | 4382.50 | 4357.50 | 4355.50 | 4347.50 | 4453.50 |

0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 5 FOOT

NOTE:

1. REFER TO DRAWING G-2 FOR LEGEND, AND GENERAL NOTES.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: 1" = 100'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. DIXON
DRAWN J. VERNER
CHECKED D. MIKLAS

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FMC

PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
EXTRACTION WELL LAYOUT

DRAWING C-2

10/29/2014 3:06 PM
WOOLSERN
C:\pwworkdir\dms20811\EXTRACTION WELL LAYOUT

10/29/2014 2:07 PM

WOOLSERN

0 30 60
SCALE IN FEET
CONTOUR INTERVAL = 5 FOOT

NOTE:

1. REFER TO DRAWING G-2 FOR LEGEND, AND GENERAL NOTES.

C:\pwworkdir\dms20811\PLANT LAYOUT

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: 1" = 30'

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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FMC

PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
PLANT LAYOUT

DRAWING C-3

0 100 200
SCALE IN FEET
CONTOUR INTERVAL = 5 FOOT

NOTE:

1. REFER TO DRAWING G-2 FOR LEGEND, AND GENERAL NOTES.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE
1" = 100'

WARNING
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J.DIXON
DRAWN J. VERNER
CHECKED D. MIKLAS

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FMC

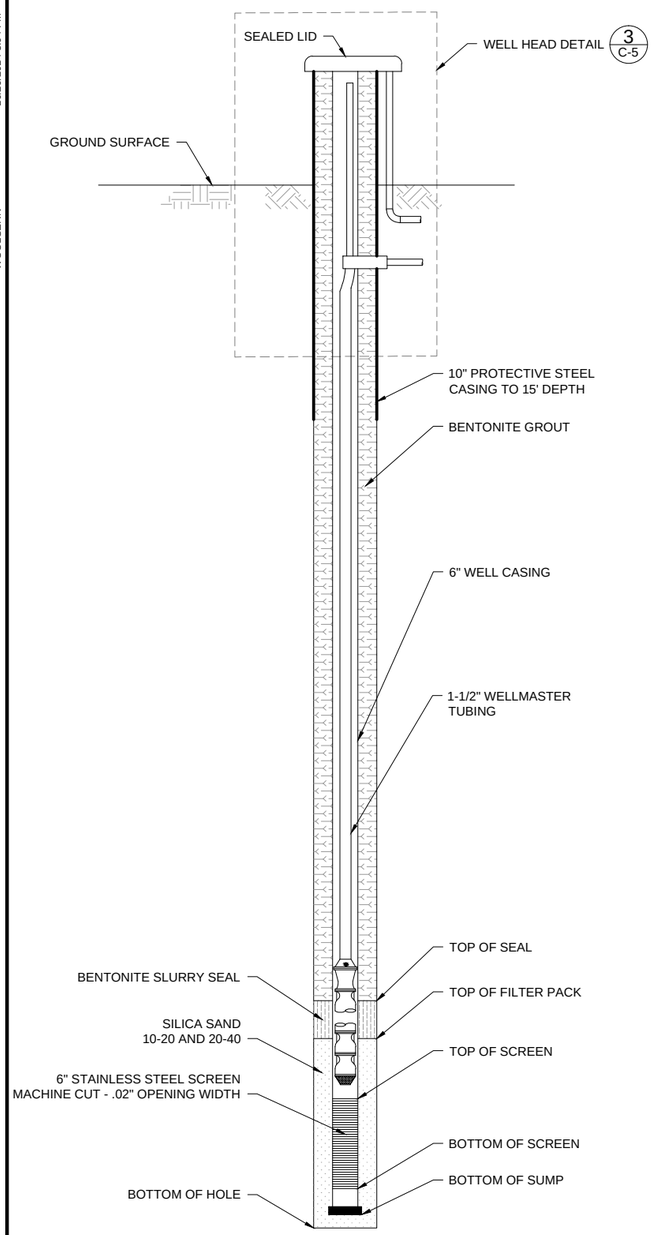
PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
INFILTRATION POND LAYOUT

DRAWING
C-4

10/27/2014 2:15 PM
WOOLSERN
C:\pwworkdir\dms20811\INFILTRATION POND LAYOUT

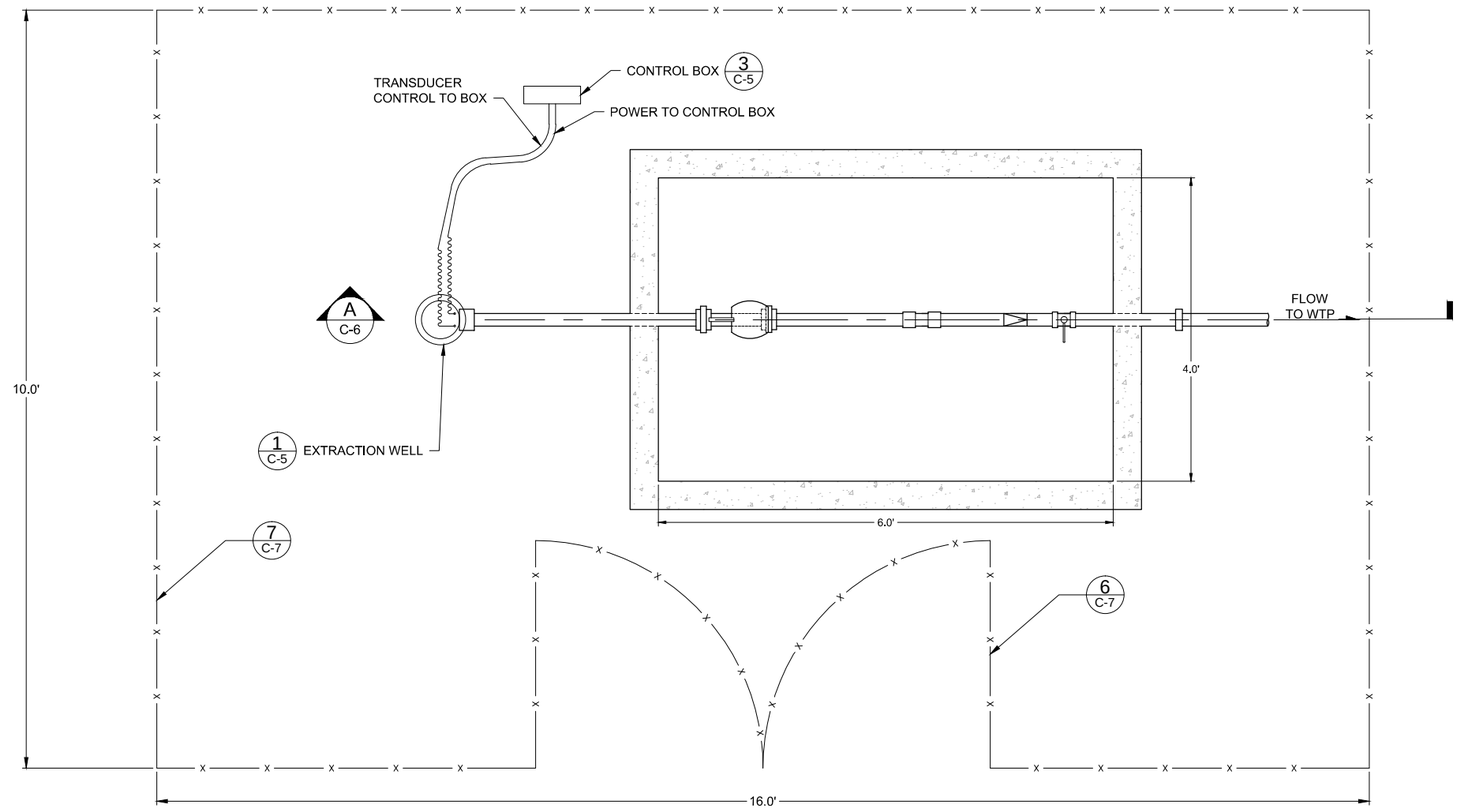
NOTES

1. REFER TO ELEVATION TABLE ON DRAWING C-2 FOR DEPTHS.

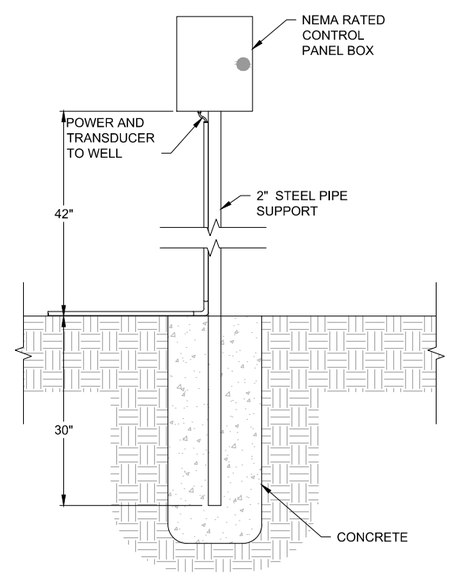



1 - TYPICAL EXTRACTION WELL DETAIL
SCALE: NTS

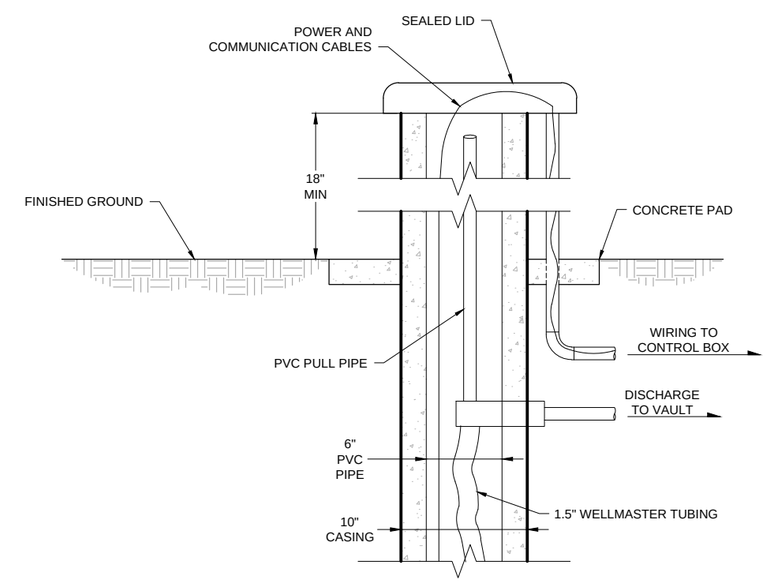
ELEVATIONS APPEAR ON SHEET G-08




2 - TYPICAL EXTRACTION WELL VAULT DETAIL
SCALE: NTS




3 - CONTROL BOX DETAIL
SCALE: NTS




4 - WELLHEAD DETAIL
SCALE: NTS

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. DIXON
DRAWN J. VERNER
CHECKED D. MIKLAS

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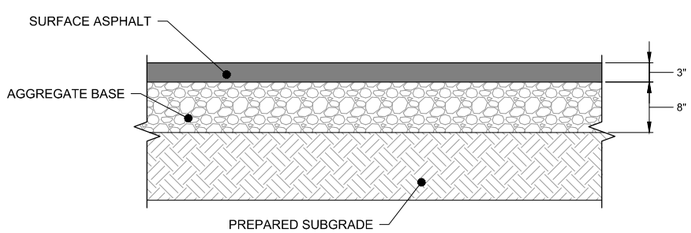
FMC

PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
DETAILS SHEET 1

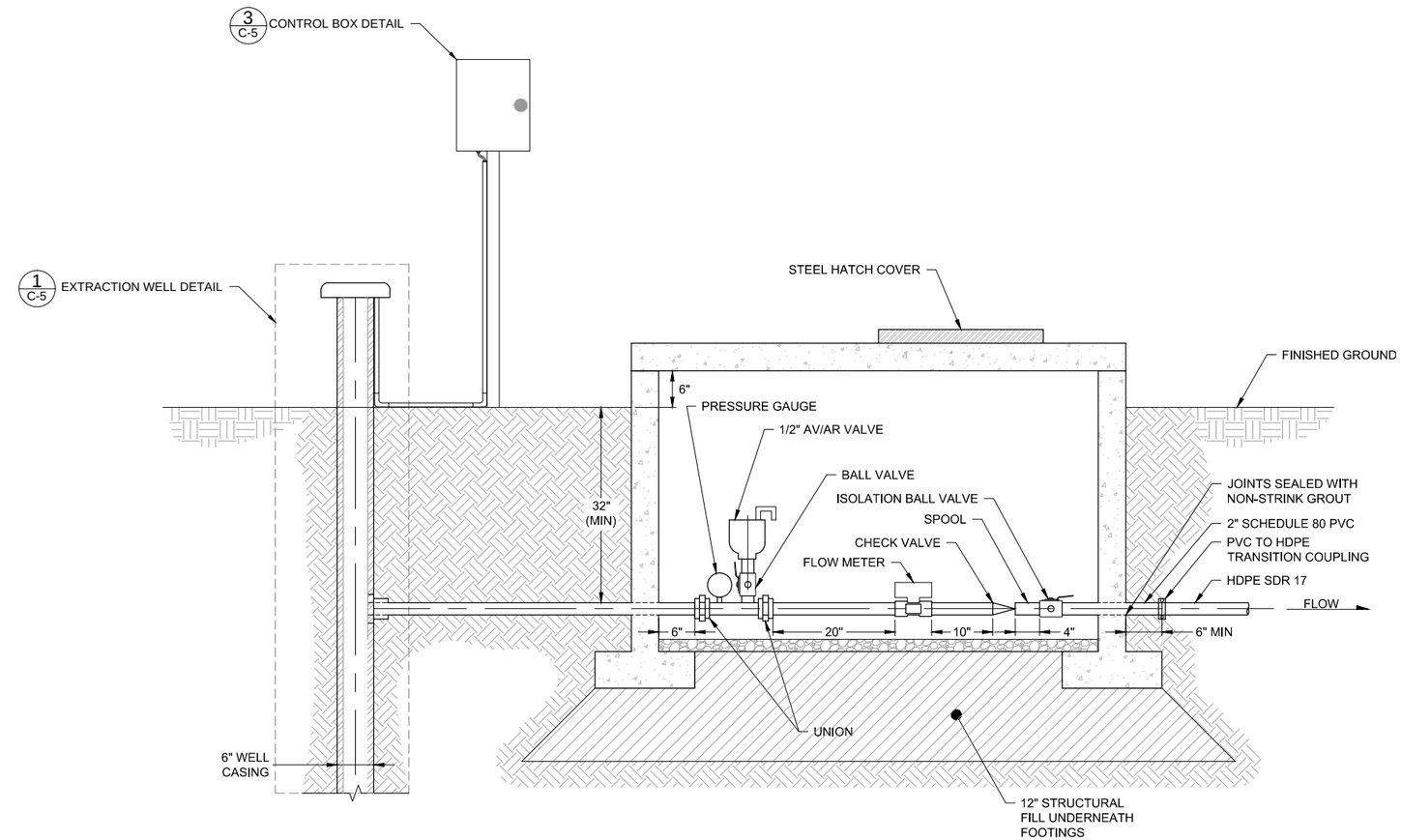
DRAWING C-5

10/29/2014 3:04 PM
WOOLSERN
C:\pwworkdir\dms20811\DETAILS

10/29/2014 1:56 PM
WOOLSERN




5 / - LIGHT TRAFFIC PAVING DETAIL
SCALE: NTS




A / C-5 TYPICAL EXTRACTION WELL VAULT SECTION
SCALE: NTS

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. DIXON
DRAWN J. VERNER
CHECKED D. MIKLAS

PRELIMINARY DESIGN PHASE - 01-30-2015

NOT FOR CONSTRUCTION

This document is an interim document and not suitable for construction. As an interim document, it may contain data that is potentially inaccurate or incomplete and is not to be relied upon without the express written consent of the preparer.

MWH®

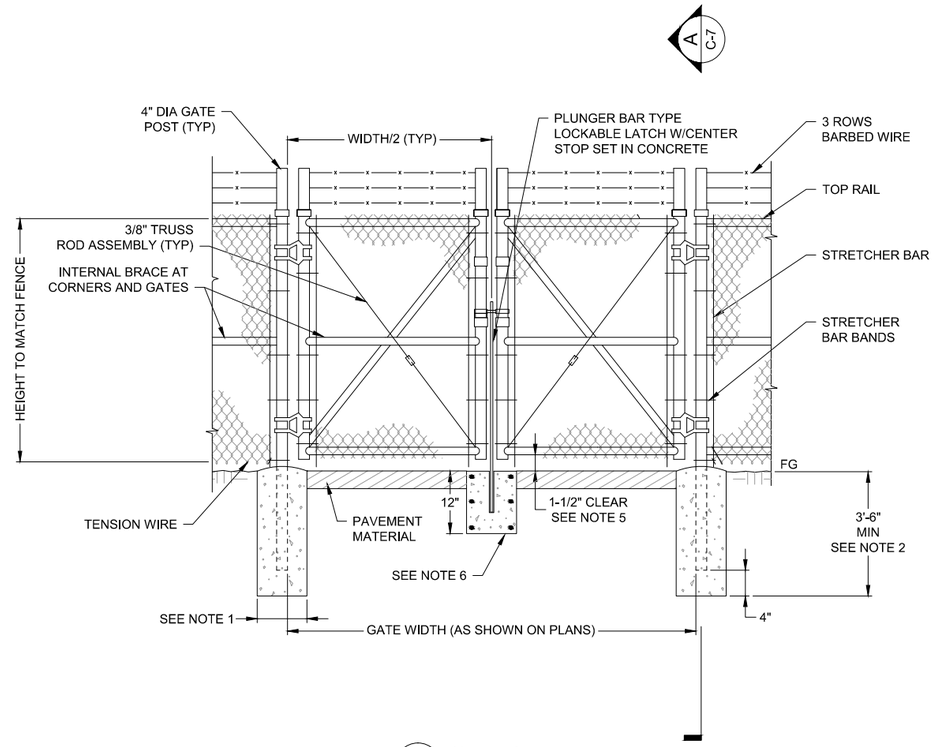
FMC

PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
DETAILS SHEET 2

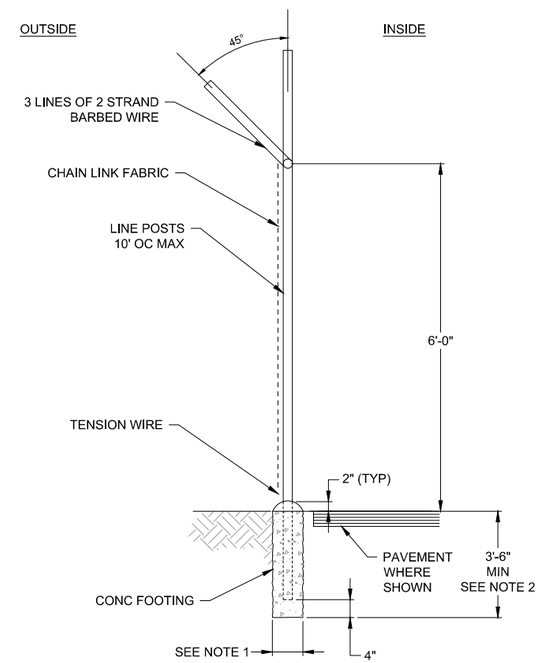
DRAWING C-6

C:\pwworkdir\dms20811\DETAILS

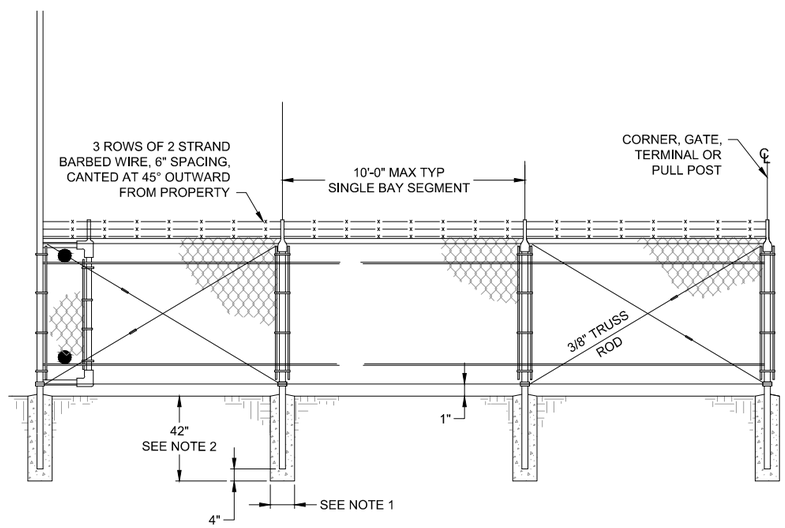
10/30/2014 11:18 AM
WOOLSERN




6 - GATE DETAIL
SCALE: NTS




A - CHAIN LINK FENCE
SCALE: NTS




7 - FENCE DETAIL
SCALE: NTS

NOTES

1. GATE AND CORNER POSTS SHALL BE DESIGNED BY AN ENGINEER. OTHERS SHALL BE 12" OR 5X POST DIAMETER WHICHEVER IS GREATER.
2. BOTTOM OF CONCRETE FOOTING TO BE SET BELOW FROST LINE.
3. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
4. EXTENSION ARM MAY BE TURNED IN AT OPTION OF OWNER.
5. SEE SPECIFICATIONS FOR CLEARANCES IN SNOW REGIONS.
6. 12" DIAMETER X 18" DEEP CONCRETE STOP WITH 20 GAUGE STEEL PLUNGER SLEEVE. DIA = ROD OD +1/2".

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| C | 01-30-2015 | RNW | 30% DESIGN |
| B | 12-12-2014 | JTV | 30% DESIGN |
| A | 11-07-2014 | KB | ISSUED FOR CLIENT REVIEW |

SCALE: AS SHOWN

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DESIGNED J. DIXON
DRAWN J. VERNER
CHECKED D. MIKLAS

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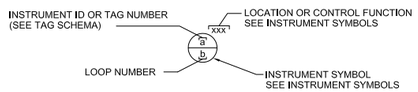
FMC

PROJECT LOCATION: POCATELLO, IDAHO
CIVIL
FMC OU GROUNDWATER REMEDIAL DESIGN
DETAILS SHEET 3

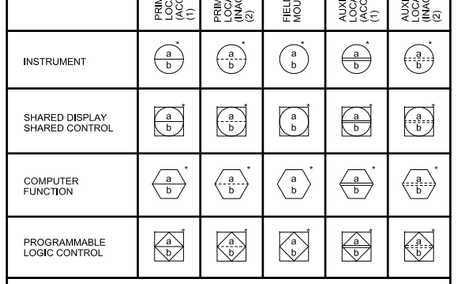
DRAWING C-7

C:\pwworkdir\dms20811\DETAILS

## INSTRUMENTATION CALL-OUT




## INSTRUMENT SYMBOLS




(1) NORMALLY ACCESSIBLE TO OPERATOR

(2) NORMALLY INACCESSIBLE TO OPERATOR (BEHIND-THE-PANEL)

* LOCATION OR CONTROL FUNCTION - SEE BELOW

A INSTRUMENT IDENTIFICATION/TAG NUMBER (SEE TAG DESIGNATION FOR MORE INFO) INSTRUMENT LOOP NUMBER

B

SINGLE INSTRUMENT OR OTHER COMPONENT HAVING MULTIPLE FUNCTIONS

RELAY INTERLOCK LOGIC - SEE SCHEMATICS OR SPECIFICATIONS FOR MORE INFORMATION

INDICATING LIGHT - FIELD MOUNTED, MAY BE LOCATED ON A CONTROL PANEL

INDICATING LIGHT - PANEL MOUNTED

CR CONTROL RELAY

LIGHTNING SURGE ARRESTOR

CONTROL FUNCTION DESIGNATIONS

XXX DESIGNATIONS SUCH AS 100 (LOCAL CONTROL PANEL NO 100), 200 (LOCAL CONTROL PANEL NO 200), ETC., ARE USED WHEN NECESSARY TO SPECIFY INSTRUMENT OR FUNCTION LOCATION.

| | | | |
|---|---|---|---|
| A/H/C | AUTO/HOLD/CLOSE | O/O | ON/OFF |
| A/M | AUTO/MANUAL | O/S/C | OPEN/STOP/CLOSE |
| AS | AIR SUPPLY | PID | PROPORTIONAL/INTEGRAL/ DERIVATIVE |
| DEV | DEVIATION | POT | POTENTIOMETER |
| H/M/L | HIGH/MID/LOW | R/L | RAISE/LOWER |
| H/O/A | HAND/OFF/AUTO | R/S/L | RAISE/STOP/LOWER |
| H/O/R | HAND/OFF/REMOTE | SD | SHUTDOWN |
| L/O/R | LOCAL/OFF/REMOTE | SEL | SELECT |
| LOS | LOCKOUT STOP | SP | SET POINT |
| L/R | LOCAL/REMOTE | S/R | START/RESET |
| M/O/A | MANUAL/OFF/AUTO | S/S | START/STOP |
| O/C | OPEN/CLOSE | ST | START |
| O/C/A | OPEN/CLOSE/AUTO | ST/R | STOP/RESET |
| O/L/H | OFF/LOW/HIGH | | |

## INSTRUMENT SYMBOLS - CONTINUED

COMPUTING OR CONVERTING FUNCTIONS

COMPUTING

| | | |
|---|---|---|
| SUMMING | DERIVATIVE | EXPONENTIAL |
| ADDITION | AVERAGING | BIAS |
| SUBTRACTION | RATIO | HIGH LIMITING |
| MULTIPLYING | DIFFERENCE | LOW LIMITING |
| DIVIDING | HIGH SELECTING | LINEARIZER |
| SQ ROOT EXTRACTION | LOW SELECTING | |
| PROPORTIONAL | INTEGRAL | |

CONVERTING

| | | |
|---|---|---|
| E VOLTAGE | R RESISTANCE (ELECT) | A ANALOG |
| I CURRENT | D DIGITAL | B BINARY |
| P PNEUMATIC | O ELECTROMAGNETIC, SONIC | H HYDRAULIC |

PLC / REMOTE I/O POINTS

| | | |
|---|---|---|
| ANALOG INPUT | DISCRETE INPUT | DATA SIGNAL INPUT* |
| ANALOG OUTPUT | DISCRETE OUTPUT | DATA SIGNAL OUTPUT* |

* 2-WIRE NETWORK INTERFACE. SEE SPECIFICATION FOR MORE INFORMATION

## INSTRUMENTATION LINE SYMBOLOGY

NEW WORK (UNSCREENED)

EXISTING (SCREENED)

EXISTING TO BE DEMOLISHED

FUTURE EQUIPMENT (LONG DASH, SHORT DASH)

INSTRUMENT LINES

CAPILLARY

DATA LINK

ELECTRIC (PULSE SIGNAL)

ELECTRICAL SIGNAL

ULTRASONIC SIGNAL

HYDRAULIC SIGNAL

MECHANICAL LINK

PNEUMATIC SIGNAL

PROCESS

D DEVICENET

M MODBUS

PB PROFIBUS

E ETHERNET

C CONTROLNET

OTHER INSTRUMENTATION SYMBOLS AND SYMBOLOGY

24 VDC POWER SUPPLY (SIZE AS NOTED)

AS AIR SUPPLY

PRIMARY ELECTRICAL POWER (120V/60HZ UNLESS INDICATED OTHERWISE)

INDICATES VENDOR FURNISHED EQUIPMENT

CABLE (MULTICONDUCTOR OR COAXIAL) FURNISHED WITH EQUIPMENT

(E) EXISTING EQUIPMENT

(F) FUTURE EQUIPMENT

(R) RELOCATED EQUIPMENT

(TD) TIME DELAY(ED)

## TAG SCHEMA

TYPICAL TAG FORMAT

TIC-01 — — INSTRUMENT TAG NUMBER
TIC — — — FUNCTIONAL IDENTIFICATION
T — — — — FIRST LETTER
IC — — — SUCCEEDING LETTER(S)
01 — — LOOP NUMBER

EXPANDED TAG FORMAT

10-PAH-01A — — INSTRUMENT TAG NUMBER
10 — — — — — — AREA / BUILDING NUMBER
PAH — — — — FUNCTIONAL IDENTIFICATION
P — — — — — FIRST LETTER
AH — — — — SUCCEEDING LETTER(S)
01 — — — LOOP NUMBER
A — — OPTIONAL SUFFIX

RUN INDICATION SHALL BE GREEN, OFF INDICATION SHALL BE RED

| | FIRST LETTER | | SUCCEEDING LETTER(S) | | |
|---|---|---|---|---|---|
| | MEASURED OR INITIATING VARIABLE | MODIFIER | READOUT OR PASSIVE FUNCTION | OUTPUT FUNCTION | MODIFIER |
| A | ANALYSIS | | ALARM | | |
| B | BURNER, COMBUSTION | | | | |
| C | CONDUCTIVITY | | | CONTROL | CLOSED |
| D | DENSITY | DIFFERENTIAL | | | |
| E | VOLTAGE | | SENSOR (PRIMARY ELEMENT) | | |
| F | FLOW RATE | RATIO (FRACTION) | | | |
| G | GAGE | | GLASS, VIEWING DEVICE | | |
| H | HAND | | | | HIGH |
| I | CURRENT (ELECTRICAL) | | INDICATE | | |
| J | POWER | SCAN | | | |
| K | TIME, TIME SCHEDULE | TIME RATE OF CHANGE | | CONTROL STATION | |
| L | LEVEL | | LIGHT | | LOW |
| M | MOTOR | MOMENTARY | | | MIDDLE, INTERMEDIATE |
| N | TORQUE | | ISOLATE | ISOLATOR | |
| O | | | ORIFICE, RESTRICTION | | OPEN |
| P | PRESSURE, VACUUM | | POINT (TEST) CONNECTION | | |
| Q | QUANTITY | INTEGRATE, TOTALIZE | | | |
| R | RADIATION | | RECORD | | |
| S | SPEED, FREQUENCY | SAFETY | | SWITCH | |
| T | TEMPERATURE | | | TRANSMIT | |
| U | MULTIVARIABLE | | MULTIFUNCTION | MULTIFUNCTION | MULTIFUNCTION |
| V | VIBRATION, MECHANICAL ANALYSIS | | | VALVE, DAMPER, LOUVER | |
| W | WEIGHT, FORCE | | WELL | | |
| X | INTRUSION | X AXIS | | | |
| Y | EVENT, STATE, OR PRESENCE | Y AXIS | | COMPUTER, CONVERT | |
| Z | POSITION, DIMENSION | Z AXIS | | DRIVER, ACTUATOR, FINAL CONTROL ELEMENT | |

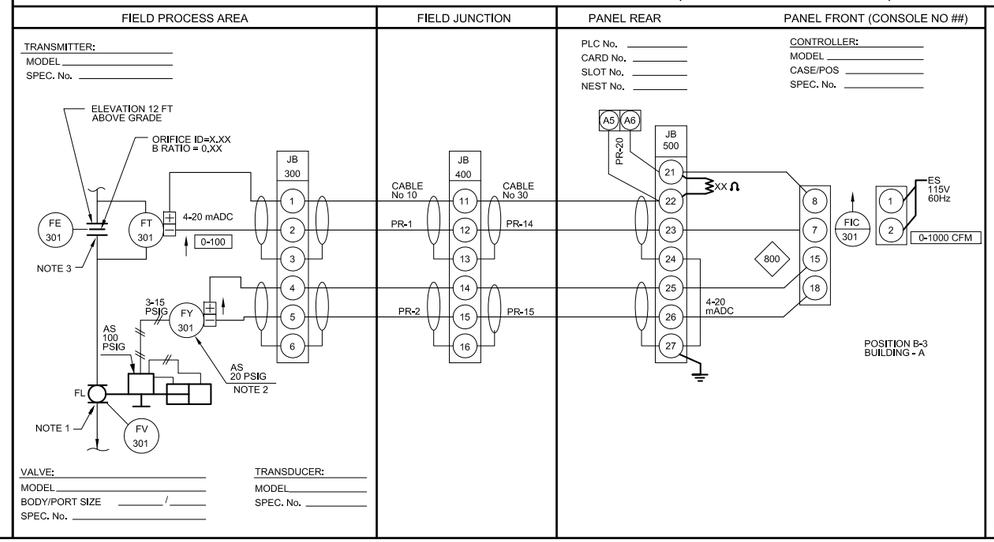
## ABBREVIATIONS

| | | | |
|---|---|---|---|
| FOC | FIBER OPTIC CABLE | PC | PERSONAL COMPUTER |
| FOR | FIBER OPTIC REPEATER | PLC | PROGRAMMABLE LOGIC CONTROLLER |
| FOT | FIBER OPTIC TRANSCEIVER | RIO | REMOTE I/O |
| HMI | HUMAN MACHINE INTERFACE | RVSS | REDUCED VOLTAGE SOLID-STATE STARTER |
| LCP | LOCAL CONTROL PANEL | RTU | REMOTE TERMINAL UNIT |
| LCS | LOCAL CONTROL STATION | SW | SEAL WATER |
| MCC | MOTOR CONTROL CENTER | TC | THERMOCOUPLE |
| MCP | MAIN CONTROL PANEL | TSH | TEMPERATURE SWITCH, HIGH |
| MOV | MOTOR OPERATED VALVE | TSP | TWISTED SHIELD PAIR |
| MS | MOTOR STARTER | UPS | UNINTERRUPTIBLE POWER SUPPLY |
| MWH | MOTOR WINDING HEATER | VCP | VENDOR SUPPLIED PANEL |
| N.C. | NORMALLY CLOSED | VFD | VARIABLE FREQUENCY DRIVE |
| N.O. | NORMALLY OPEN | VSD | VARIABLE SPEED DRIVE |
| OF | OVERFLOW | | |
| OI | OPERATOR INTERFACE | | |

## GENERAL INSTRUMENTATION NOTES

1. ADDITIONAL INSTRUMENTATION AND CONTROL SYMBOLS MAY BE USED AS REQUIRED. SYMBOLS AND NOMENCLATURE ARE BASED ON ISA STANDARD 5.1-INSTRUMENTATION SYMBOLS AND IDENTIFICATION.
2. SEE ELECTRICAL AND GENERAL SHEETS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
3. SEE SPECIFICATION SECTION 409100 FOR COMPLETE DETAILS OF LOOP DRAWING SUBMITTAL REQUIREMENTS.
4. POWER SUPPLIES FOR INSTRUMENT LOOPS OR SYSTEMS SHALL BE FURNISHED BY THE INSTRUMENTATION SUPPLIER TO MEET THE VOLTAGE AND CURRENT REQUIREMENTS OF THE COMPONENTS IN EACH LOOP OR SYSTEM.
5. FIELD SWITCHES FOR ELECTRIC MOTOR OPERATION SHALL BE SUPPLIED BY THE ELECTRICAL CONTRACTOR. EXCEPTIONS ARE SWITCHES THAT ARE PART OF VENDOR PACKAGES.
6. VALVE ACTUATORS SHALL BE SUPPLIED WITH THE VALVE BY THE VALVE SUPPLIER, UNLESS OTHERWISE NOTED.

## SAMPLE LOOP DIAGRAM (ISA EXPANDED FORMAT)




NOTES:

1. FV-301 FULLY OPEN AT 15 PSIG AND FULLY CLOSED AT 3 PSIG.
2. STAND MOUNT NEAR, BUT NOT ON THE CONTROL VALVE.
3. FE-301 REQUIRES 10 PIPE DIAMETERS UPSTREAM AND 5 PIPE DIAMETERS DOWNSTREAM OF STRAIGHT PIPE.
4. DETAIL SURGE ARRESTOR INSTALLATION AND GROUNDING AS APPLICABLE

0-XXXX INSTRUMENT RANGE

XXX INSTRUMENT SET POINT

DIRECT ACTING OUTPUT SIGNAL

REVERSE ACTING OUTPUT SIGNAL

REV 01102013

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

SCALE

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED J. DEERKOP
DRAWN J. DEERKOP
CHECKED D. MIKLAS

MWH®

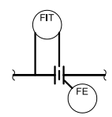
FMC

INSTRUMENTATION
FMC OU GROUNDWATER REMEDIAL DESIGN
INSTRUMENTS NOTES AND SYMBOLS

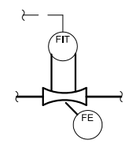
DRAWING GI-1

10/29/2014 08:04 AM
DIXONJ
C:\pwworkdir\dms21081\1105056\2_\00_NEW

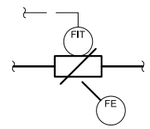
## FLOW INSTRUMENTS



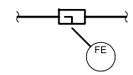
ORIFICE PLATE WITH VENA CONTRACTA, RADIUS, OR PIPE TAPS CONNECTED TO DIFFERENTIAL-PRESSURE -TYPE FLOW TRANSMITTER



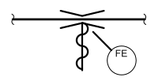
VENTURI TUBE WITH (DIFFERENTIAL PRESSURE) FLOW TRANSMITTER



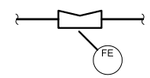
SONIC FLOWMETER (DOPPLER OR TRANSIT TIME)



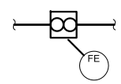
SINGLE PORT PITOT TUBE OR PITOT-VENTURI TUBE



FLUME WITH ULTRASONIC FLOW TRANSMITTER

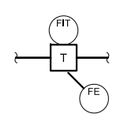


WEIR

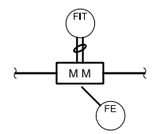


POSITIVE-DISPLACEMENT TYPE FLOW METER

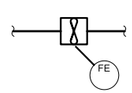
VARIABLE AREA FLOW INDICATOR (ROTA METER)



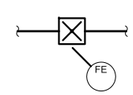
THERMAL MASS FLOW METER



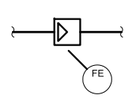
MAGNETIC FLOWMETER WITH REMOTE FLOW TRANSMITTER



TURBINE OR PROPELLER TYPE FLOW METER

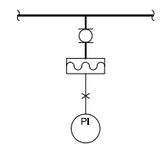


PADDLE WHEEL FLOW METER

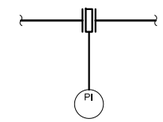


VORTEX FLOW METER

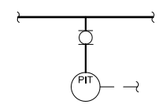
## PRESSURE OR VACUUM INSTRUMENTS



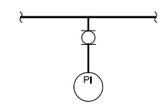
PROCESS LINE WITH DIAPHRAM SEAL WITH FILLED SYSTEM



PROCESS LINE WITH ANNULAR SEAL WITH FILLED SYSTEM

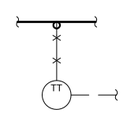


PRESSURE ELEMENT STRAIN-GAUGE TYPE, CONNECTED TO PRESSURE INDICATING TRANSMITTER

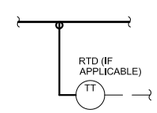


PRESSURE INDICATOR DIRECT - CONNECTED

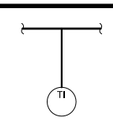
## TEMPERATURE INSTRUMENTS



FILLED -SYSTEM TYPE TEMPERATURE TRANSMITTER WITH THERMOWELL

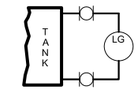


THERMOCOUPLE, RESISTANCE BULB (RTD) OR THERMISTOR (TH) TEMPERATURE TRANSMITTER WITH THERMOWELL

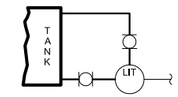


BIMETALLIC TYPE THERMOMETER, GLASS THERMOMETER, OR OTHER LOCAL UNCLASSIFIED TEMPERATURE INDICATOR

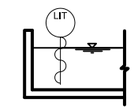
## LEVEL INSTRUMENTS



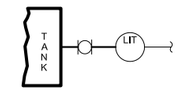
GAUGE GLASS (EXTERNALLY CONNECTED)



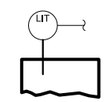
LEVEL TRANSMITTER, DIFFERENTIAL PRESSURE TYPE, (MOUNTED ON TANK)



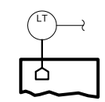
ULTRASONIC LEVEL TRANSMITTER



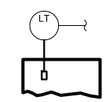
PRESSURE ACTUATED LEVEL TRANSMITTER



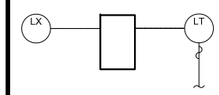
CAPACITANCE OR DIELECTRIC TYPE LEVEL TRANSMITTER



LEVEL TRANSMITTER FLOAT ACTUATED TYPE

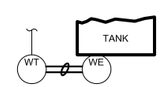


HYDROSTATIC TYPE LEVEL TRANSMITTER

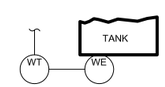


RADIOACTIVE OR SONIC TYPE LEVEL TRANSMITTER WITH INTEGRAL SENSOR

## WEIGHT INSTRUMENTS

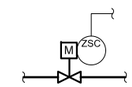


STRAIN GAUGE CONNECTED TO SEPARATE WEIGHT TRANSMITTER (TAG STRAIN GAUGE WE)

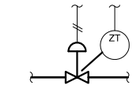


HYDRAULIC ACTUATED WEIGHT TRANSMITTER

## POSITION INSTRUMENTS

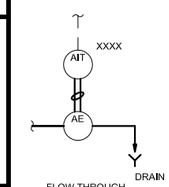


LIMIT SWITCH ON MOTORIZED VALVE INDICATING CLOSED POSITION



VALVE POSITION TRANSMITTER ON PNEUMATIC ACTUATED VALVE

## ANALYTICAL INSTRUMENTS



FLOW THROUGH ANALYZING ELEMENT WITH TRANSMITTER

| | |
|---|---|
| ALK | ALKALINITY |
| $CL_2$ | CHLORINE CONCENTRATION |
| COMB | COMBUSTIBLE GAS |
| CON | CONDUCTIVITY |
| DO | DISSOLVED OXYGEN |
| $H_2S$ | HYDROGEN SULFIDE |
| LEL | LOWER EXPLOSIVE LIMIT |
| $O_2$ | OXYGEN CONCENTRATION |
| $O_3$ | OZONE |
| ORP | OXIDATION/REDUCTION POTENTIAL |
| PC | PARTICLE COUNTER |
| PH | HYDROGEN ION CONCENTRATION |
| $SO_2$ | SULFUR DIOXIDE |
| TH | TOTAL HARDNESS |
| TURB | TURBIDITY |
| UV | ULTRA VIOLET |

REV 01102013

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

SCALE

WARNING
0 ½ 1
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DRAWN J. DEERKOP
CHECKED D. MIKLAS

MWH.

FMC

INSTRUMENTATION
FMC OU GROUNDWATER REMEDIAL DESIGN
INSTRUMENTS

DRAWING
GI-2

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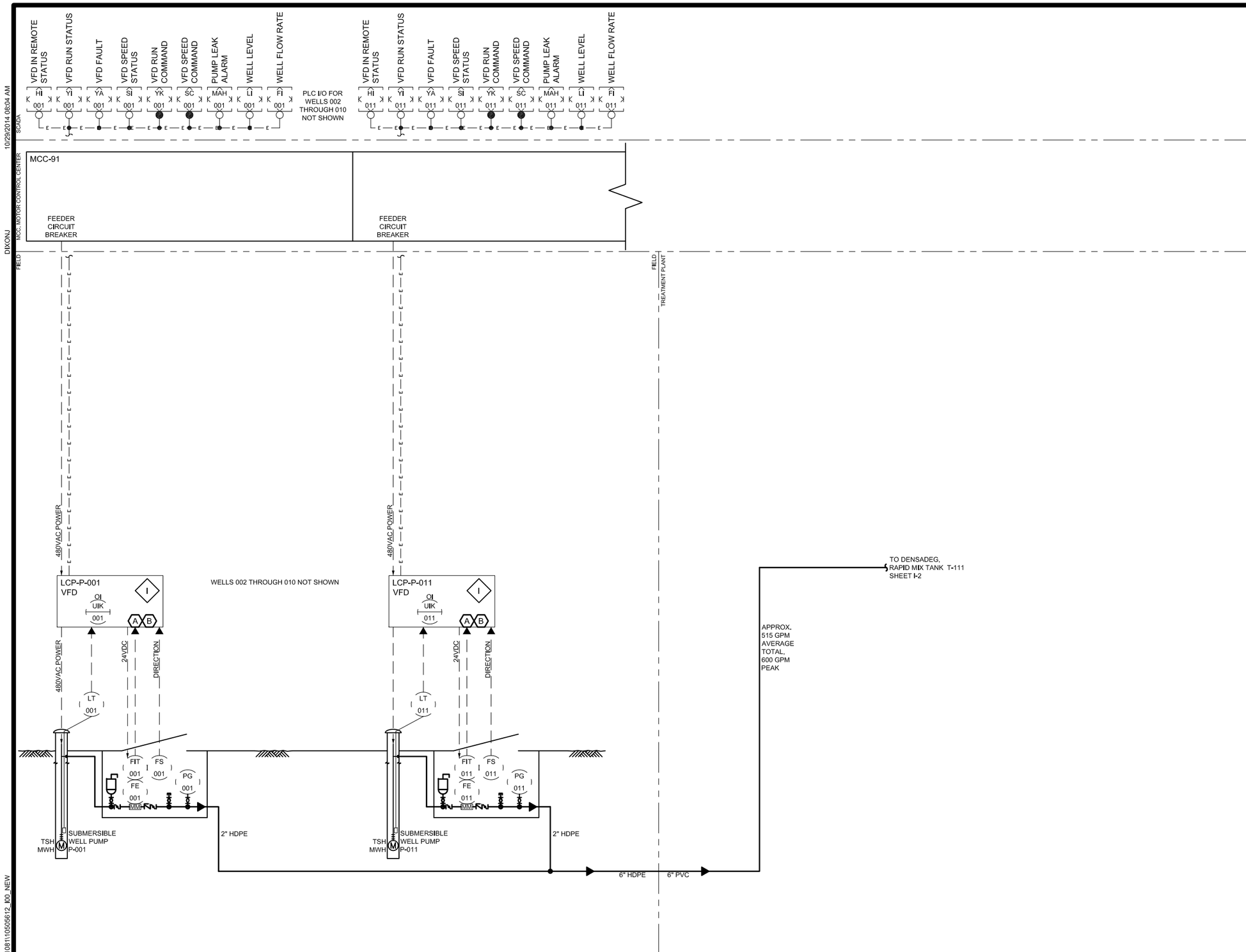


## GENERAL SHEET NOTES

1. WELLS 2 THROUGH 10 ARE NOT SHOWN FOR CLARITY. LOOP NUMBER FOR THOSE WELLS ARE 002 THROUGH 010.

## SHEET KEYNOTES

A. WELL WATER LEVEL TRANSDUCER INPUT TO VFD PROVIDES LOW LEVEL SHUT OFF PROTECTION FOR WELL PUMP.

B. PLC STOPS ALL WELL PUMPS, STOPPING INFLOW TO THE PLANT, IF ANY OF THE TREATMENT TANKS REACHES ITS HIGH LEVEL ALARM SETPOINT FOR LONGER THAN ITS TIME DELAY SETPOINT.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

SCALE

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DRAWN J. DEERKOP
CHECKED D. MIKLAS

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INSTRUMENTATION
FMC OU GROUNDWATER REMEDIAL DESIGN
GROUNDWATER P&ID

DRAWING
I-1

10/29/2014 08:04 AM
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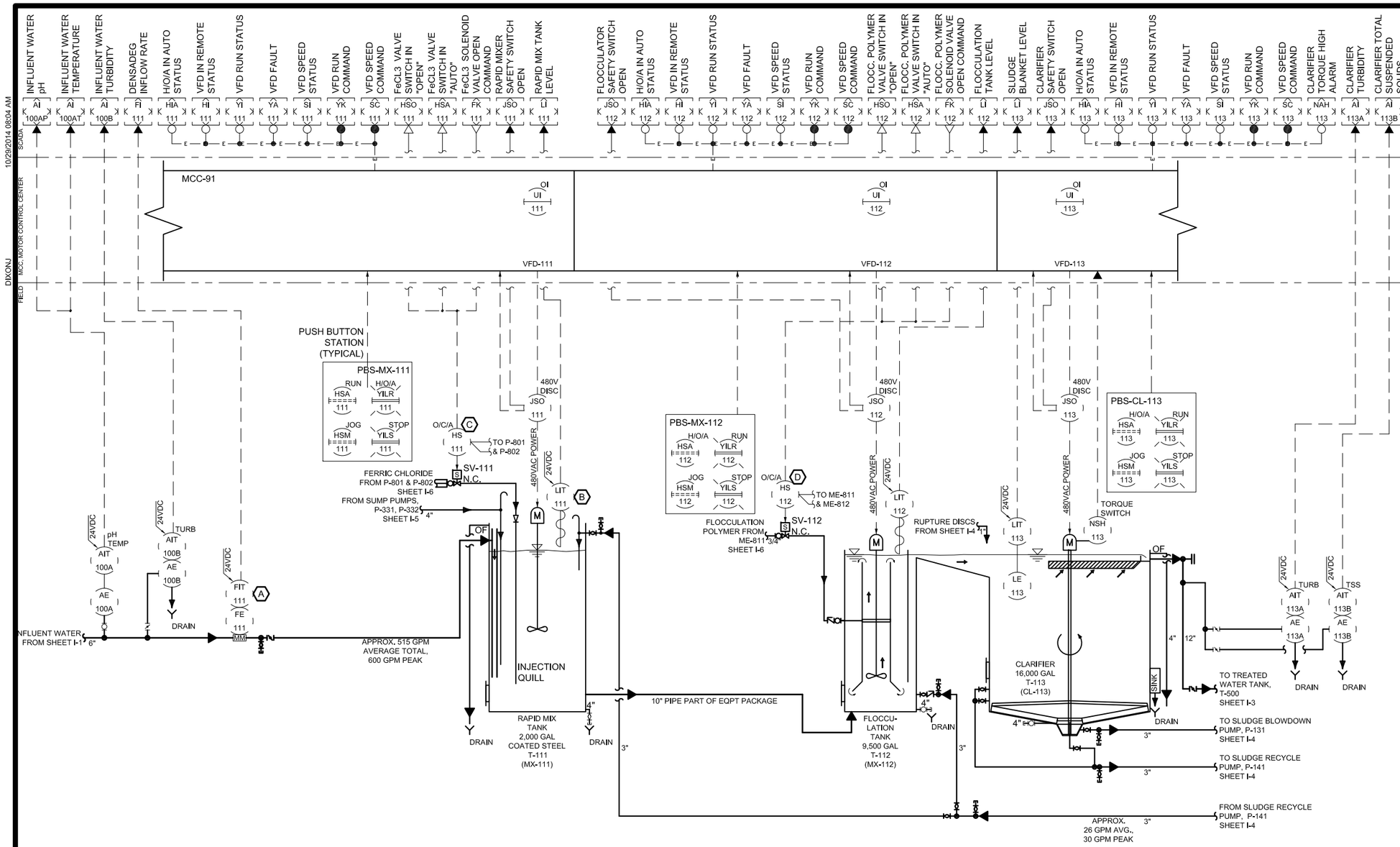


## SHEET KEYNOTES

A. FERRIC CHLORIDE DOSAGE IS FLOW PACED TO PLANT INFLUENT FLOW RATE INTO THE RAPID MIX TANK, T-111.

B. PLC STOPS FERRIC CHLORIDE SOLENOID VALVE AND METERING PUMP IF THE RAPID MIX TANK, T-111, HAS A HIGH LEVEL ALARM (TIME DELAYED).

C. PUMP P-801 IS INTERLOCKED TO NOT RUN IF FERRIC CHLORIDE SOLENOID VALVE SWITCH HS-111 IS NOT IN THE "OPEN" OR "AUTO" POSITION.

D. POLYMER BLENDING UNIT ME-811 IS INTERLOCKED TO NOT RUN IF POLYMER SOLENOID VALVE SWITCH HS-112 IS NOT IN THE "OPEN" OR "AUTO" POSITION.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

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DENSADEG P&ID

DRAWING I-2

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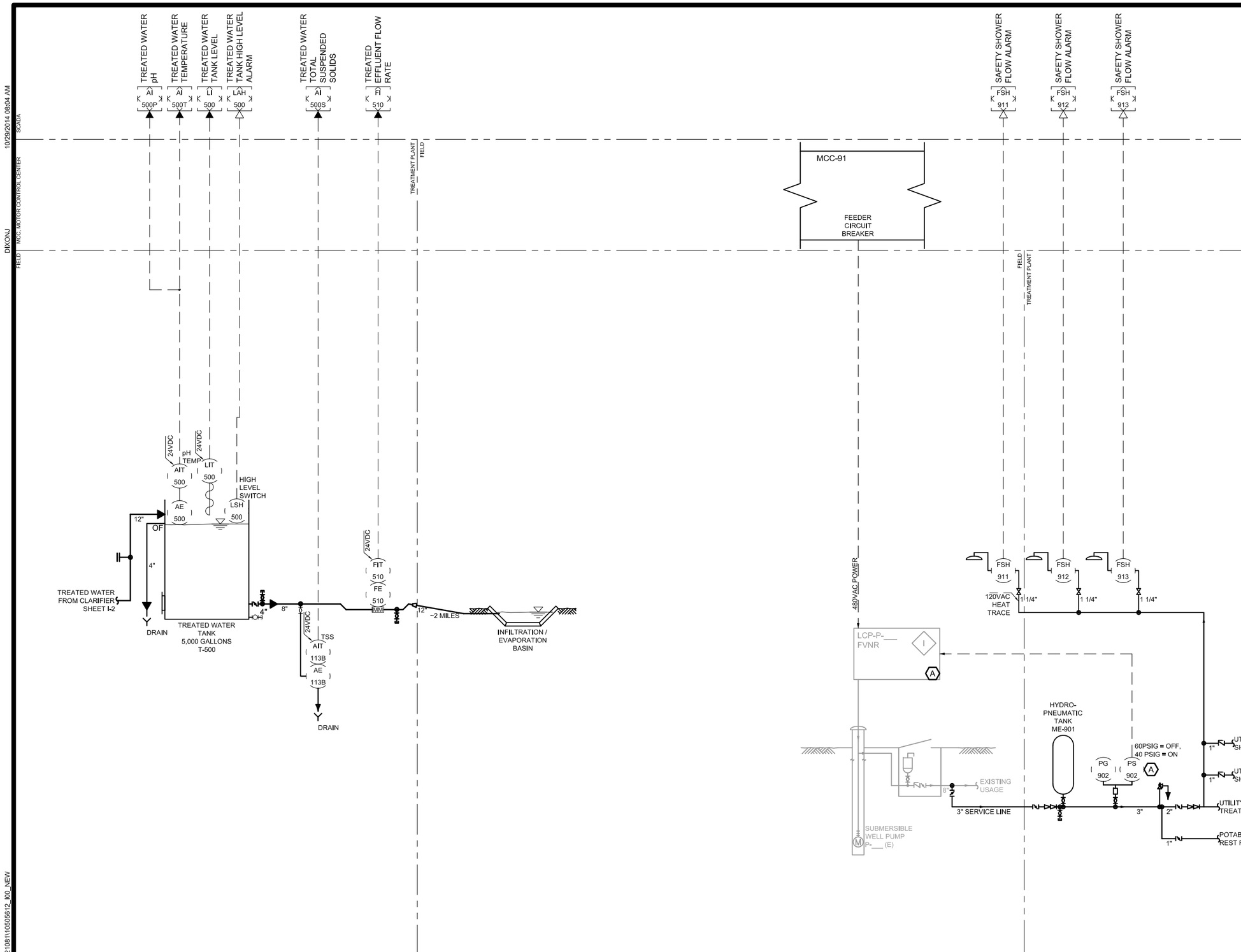


## SHEET KEYNOTES

A. CONNECT NEW PRESSURE SWITCH INTO EXISTING WELL PUMP CONTROLS TO START AND STOP THE PUMP AT THE PRESSURES SHOWN.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

SCALE

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FMC OU GROUNDWATER REMEDIAL DESIGN
TREATED & UTILITY WATER P&ID

DRAWING I-3

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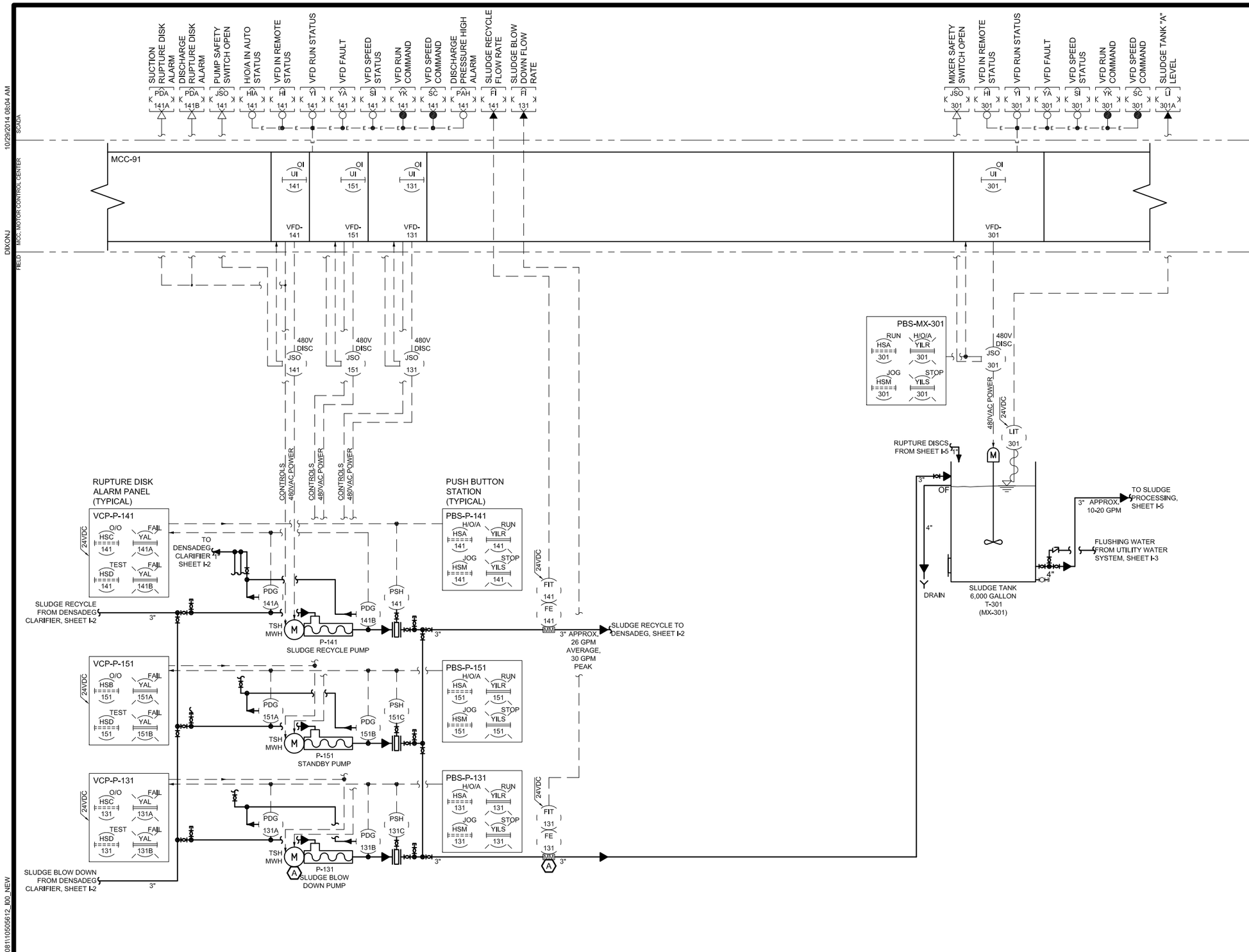


## GENERAL SHEET NOTES

1. PLC I/O FOR SLUDGE PUMPS P-131 AND P-151 ARE NOT SHOWN FOR CLARITY.
2. HIGH DISCHARGE PRESSURE SWITCHES SHALL BE TIME DELAYED TO PREVENT NUISANCE TRIPPING DURING STARTUP, ETC.
3. RUPTURE DISK FAILURE ALARM SHALL IMMEDIATELY SHUT DOWN THE AFFECTED PUMP.

## SHEET KEYNOTES

A. SLUDGE BLOWDOWN PUMP RUNS ON REPEATING CYCLE TIMER LOGIC WITH HMI ADJUSTABLE SETPOINTS. INITIAL TIMING IS 8 MINUTES OF RUN WITH 60 MINUTES BETWEEN STARTS AT A FLOW RATE OF 10 GPM.

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|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

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SLUDGE PUMPS P&ID

DRAWING I-4

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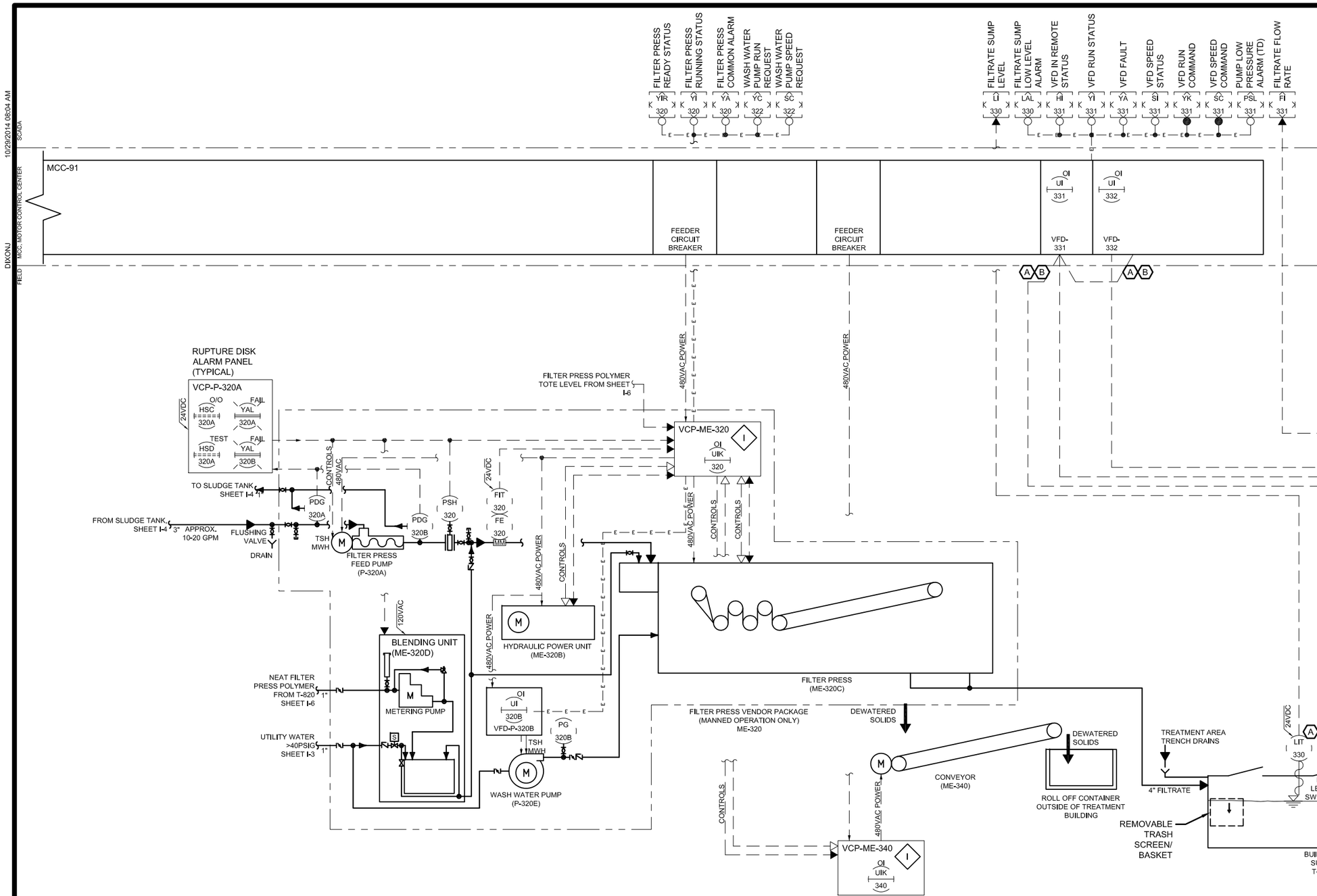


## GENERAL SHEET NOTES

1. PLC I/O FOR SUMP PUMP P-332 ARE NOT SHOWN FOR CLARITY.

## SHEET KEYNOTES

A. THE PLC SHALL GENERATE ALARMS FOR HIGH HIGH SUMP PUMP FLOW RATE (TIME DELAYED), HIGH HIGH BUILDING SUMP LEVEL (TIME DELAYED), AND IF THE SUMP PUMP IS RUNNING AT HIGH HIGH SPEED (TIME DELAYED). THESE WILL ALERT THE OPERATOR TO EXCESSIVE DRAINAGE INTO THE SUMP FROM THE TREATMENT AREA.

B. THE PLC RUNS SUMP PUMPS P-331 & P-332 TO MAINTAIN THE SUMP LEVEL WITHIN AN ADJUSTABLE DEADBAND BY SLOWLY VARYING THE FLOW RATE TO THE BLENDING TANK TO MINIMIZE CHANGES TO THE BLENDED WATER CHEMISTRY. IF LIT-330 FAILS THE PLC SHALL RUN THE PUMPS STARTING AT THE LAST AVERAGE FLOW RATE AND SLOWLY INCREASING UNTIL IT TRIPS THE THE LOW LEVEL FLOAT SWITCH AND THE DECREASE THE SPEED SO THE SUMP LEVEL DITHERS ABOUT THE FLOAT SWITCH LEVEL. THE LOW LEVEL SWITCH, LSL-330, SHUT DOWN OF THE SUMP PUMPS SHALL HAVE AN ADJUSTABLE TIME DELAY AND AUTOMATICALLY RESET WHEN THE FLOAT IS NO LONGER TRIPPED.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

SCALE

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FMC OU GROUNDWATER REMEDIAL DESIGN
SLUDGE PROCESSING P&ID

DRAWING
I-5

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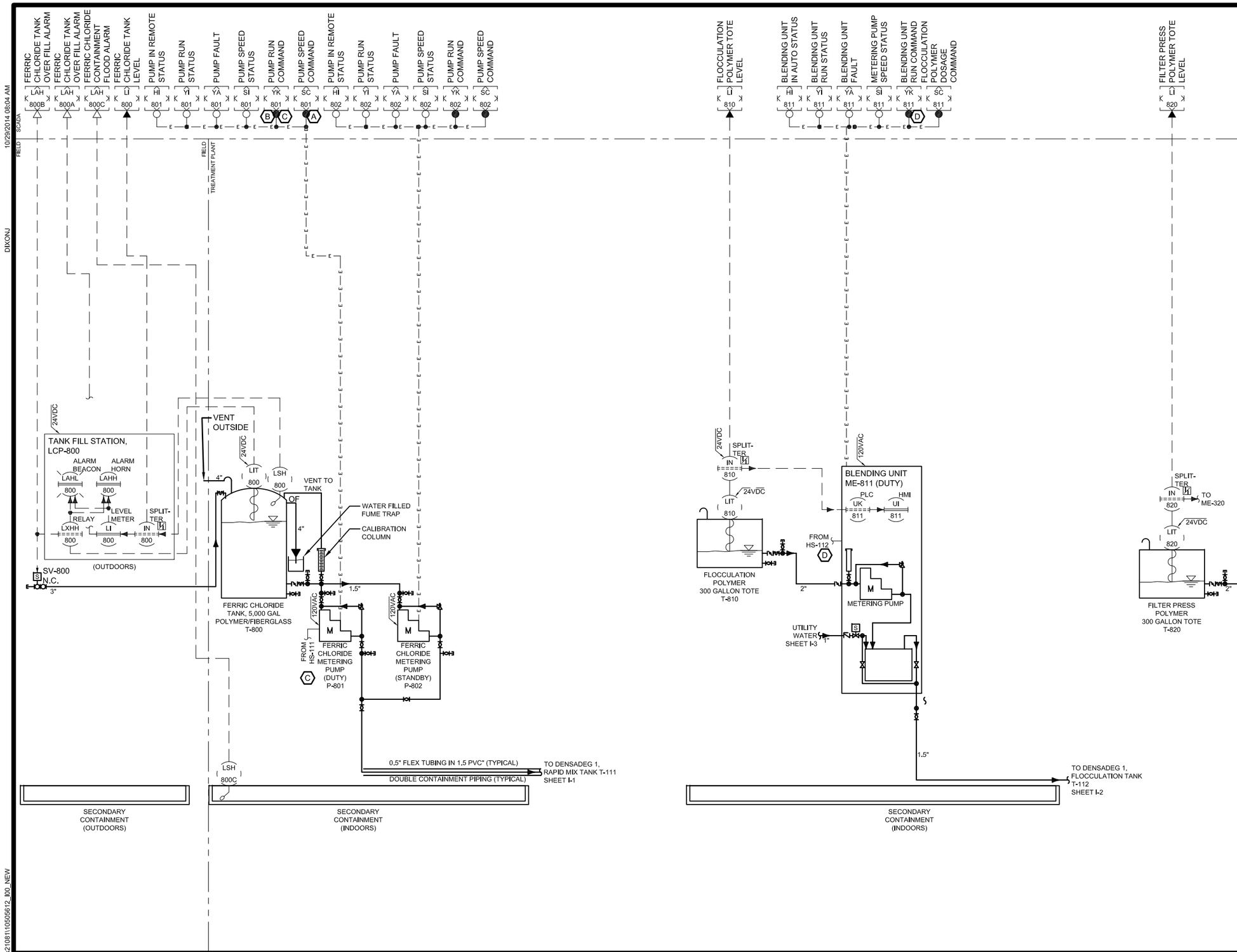


## GENERAL SHEET NOTES

1. PLC I/O FOR NON-PROCESS EQUIPMENT SUCH AS THE STANDBY DIESEL GENERATOR, AUTOMATIC TRANSFER SWITCH, POWER MONITOR, ETC. ARE NOT SHOWN.

## SHEET KEYNOTES

A. FERRIC CHLORIDE DOSAGE IS FLOW PACED TO PLANT INFLUENT FLOW RATE INTO THE RAPID MIX TANK, T-111.

B. PLC STOPS FERRIC CHLORIDE SOLENOID VALVE AND METERING PUMP IF THE RAPID MIX TANK, T-111, HAS A HIGH LEVEL ALARM (TIME DELAYED).

C. PUMP P-801 IS INTERLOCKED TO NOT RUN IF FERRIC CHLORIDE SOLENOID VALVE SWITCH HS-111 IS NOT IN THE "OPEN" OR "AUTO" POSITION.

D. POLYMER BLENDING UNIT ME-811 IS INTERLOCKED TO NOT RUN IF POLYMER SOLENOID VALVE SWITCH HS-112 IS NOT IN THE "OPEN" OR "AUTO" POSITION.

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | JCD | 30% DESIGN SUBMITTAL |

SCALE

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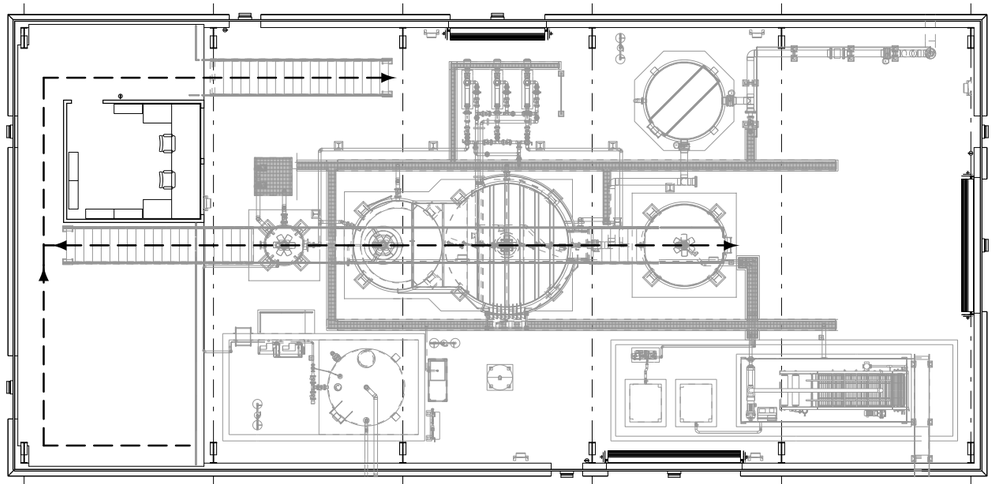
INSTRUMENTATION
FMC OU GROUNDWATER REMEDIAL DESIGN
CHEMICAL SYSTEMS P&ID

DRAWING I-6



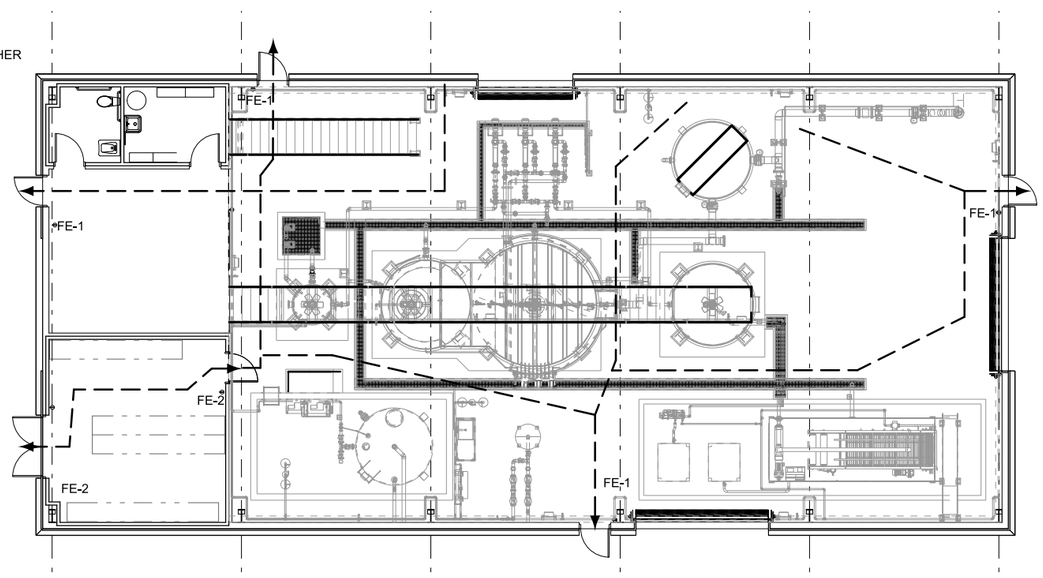
## MEZZANINE LEVEL LIFE SAFETY PLAN

SCALE: 1/16" = 1'-0"

◄ EXIT

- - - EXIT ACCESS

•FE-1 FIRE EXTINGUISHER




## GROUND LEVEL LIFE SAFETY PLAN

SCALE: 1/16" = 1'-0"

# BUILDING CODE SUMMARY

| | | | |
|---|---|---|---|
| OWNER: | FMC | DATE: | OCTOBER 2, 2014 |
| PROJECT NAME: | FMC OU REMEDIAL DESIGN | PROJECT NO.: | 10505612.010102 |
| PROJECT LOCATION: | PROJECT LOCATION | ARCHITECT: | CHARLES YOUNG |
| AREA/BUILDING : | ADMINISTRATION/WATER TREATMENT BUILDING | LICENSE NO.: | AR-984784 |

GOVERNING CODES

| | |
|---|---|
| BUILDING CODE: 2012 INTERNATIONAL BUILDING CODE (IBC) | ENERGY CODE: |
| FIRE CODE: 2012 INTERNATIONAL FIRE CODE (IFC) | |
| ACCESIBLITIY CODE: | ELEVATOR CODE: NA |

HAZARDOUS MATERIALS (1)

| CHEMICAL | CAS NO | QUANTITY | NFPA 704 RATING | | | | HAZARD PROPERTIES | | OCCUPANCY GROUP WHEN MAX ALLOW QUANT EXCEEDS (2) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | HEALTH | FLAMMABILITY | REACTIVITY | SPECIAL | PHYSICAL | HEALTH | | |
| FERRIC CHLORIDE | 7705-08-0 | 5000 | 3 | 0 | 0 | 0 | - | IRR/OHH | NA | NON-HAZARD |
| | | | | | | | | | | |

USE AND OCCUPANCY CLASSIFICATION/ALLOWABLE AREA AND HEIGHT (3)

| OCCUPANCY GROUP AND DESCRIPTION | CONSTRUCTION TYPE | ALLOWABLE HEIGHT | ALLOWABLE AREA | AUTOMATIC SPRINKLER INCREASE | ACTUAL AREA | ACTUAL AREA/ ALLOWABLE AREA RATIO | AREA MODIFICATION FRONTAGE INCREASE |
|---|---|---|---|---|---|---|---|
| GROUP B: ADMINISTRATION FACILITIES | II-B | 55 | 23,000 | NA | 924 | .04 | NA |
| GROUP F-1: PROCESS FACILITIES | II-B | 55 | 15,500 | NA | 1578 | .26 | NA |
| GROUP F-1: HVAC MEZZANINE | II-B | 55 | 15,500 | NA | (924) | N/A | NA |
| TOTAL | | | | | | .30<1.00 | |

OCCUPANCY SEPARATION (4) / FIRE RESISTANCE RATING OF STRUCTURAL ELEMENTS (6)(7)

| OCCUPANCIES | ASSEMBLY RATING | OPENING RATING | INCIDENTAL USE (5) | | STRUCTURAL FRAME | BEARING WALLS EXTERIOR | BEARING WALLS INTERIOR | FLOOR CONSTRUCTION | ROOF CONSTRUCTION | EXT WALLS BASED ON SEPARATION DISTANCE (7) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | ROOM OR AREA | SEPARATION/ PROTECTION | | | | | | SEPARATION DISTANCE | RATING |
| B/F-1 | NR | NR | N/A | - | 0 | 0 | 0 | 0 | 0 | X>30' | 0 |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

FIRE PROTECTION SYSTEMS (8)

| FIRE EXTIGUISHERS: 75' MAX DISTANCE | AUTOMATIC FIRE PROTECTION SYSTEM: NOT REQUIRED |
|---|---|

MEANS OF EGRESS (9)

| ROOM OR AREA NAME | FUNCTION OF SPACE | MAX FLOOR AREA PER OCCUPANT | TOTAL OCCUPANT LOAD | COMMON PATH OF TRAVEL DISTANCE | EXITS REQ'D | EXITS PROVIDED | EXIT ACCESS TRAVEL DIST | CORRIDOR FIRE-RESIST RATING | STAIRWAYS FIRE-RESIST RATED | OPEN STAIRWAYS |
|---|---|---|---|---|---|---|---|---|---|---|
| RESTROOM/STOR | BUSINESS | 100 | 2 | - | 1 | 1 | 20 | 0 | NA | NA |
| ELECTRICAL ROOM | INDUSTRIAL | 100 | 4 | - | 2 | 2 | 60 | 0 | NA | NA |
| PROCESS AREA | INDUSTRIAL | 100 | 16 | 30 | 2 | 3 | 75 | 0 | NA | NA |
| CONTROL ROOM | BUSINESS | 100 | 2 | 70 | 1 | 1 | 80 | 0 | NA | NA |
| | | | | | | | | | | |

(1) HMEX: THE HAZARDOUS MATERIAL EXPERT ASSISTANT, VERSION 6 - FLUER, INC

(2) IBC TABLE 307.1 - MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS

(3) IBC CHAPTER 3 - USE AND OCCUPANCY CLASSIFICATION, IBC CHAPTER 5 - GENERAL BUILDING HEIGHTS AND AREAS, TABLE 503 - ALLOWABLE HEIGHT AND BUILDING AREAS

(4) IBC CHAPTER 5, TABLE 508.4 - REQUIRED SPEARATION OF OCCUPANCIES

(5) IBC CHAPTER 5, TABLE 509 - INCIDENTAL USE AREAS

(6) IBC CHAPTER 6 - TYPES OF CONSTRUCTION, TABLE 601 - FIRE-RESISTANCE REQUIREMENTS FOR BUILDING ELEMENTS

(7) IBC CHAPTER 6 - TYPES OF CONSTRUCTION, TABLE 602 - FIRE RESISTANCE RATING FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

(8) IBC CHAPTER 9 - FIRE PROTECTION SYSTEMS

(9) IBC CHAPTER 10 - MEANS OF EGRESS

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-215 | CY | 30% DESIGN |

SCALE: 1/16" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C YOUNG
DRAWN C YOUNG
CHECKED D MIKLAS

PRELIMINARY DESIGN PHASE - 12-12-2014

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FMC

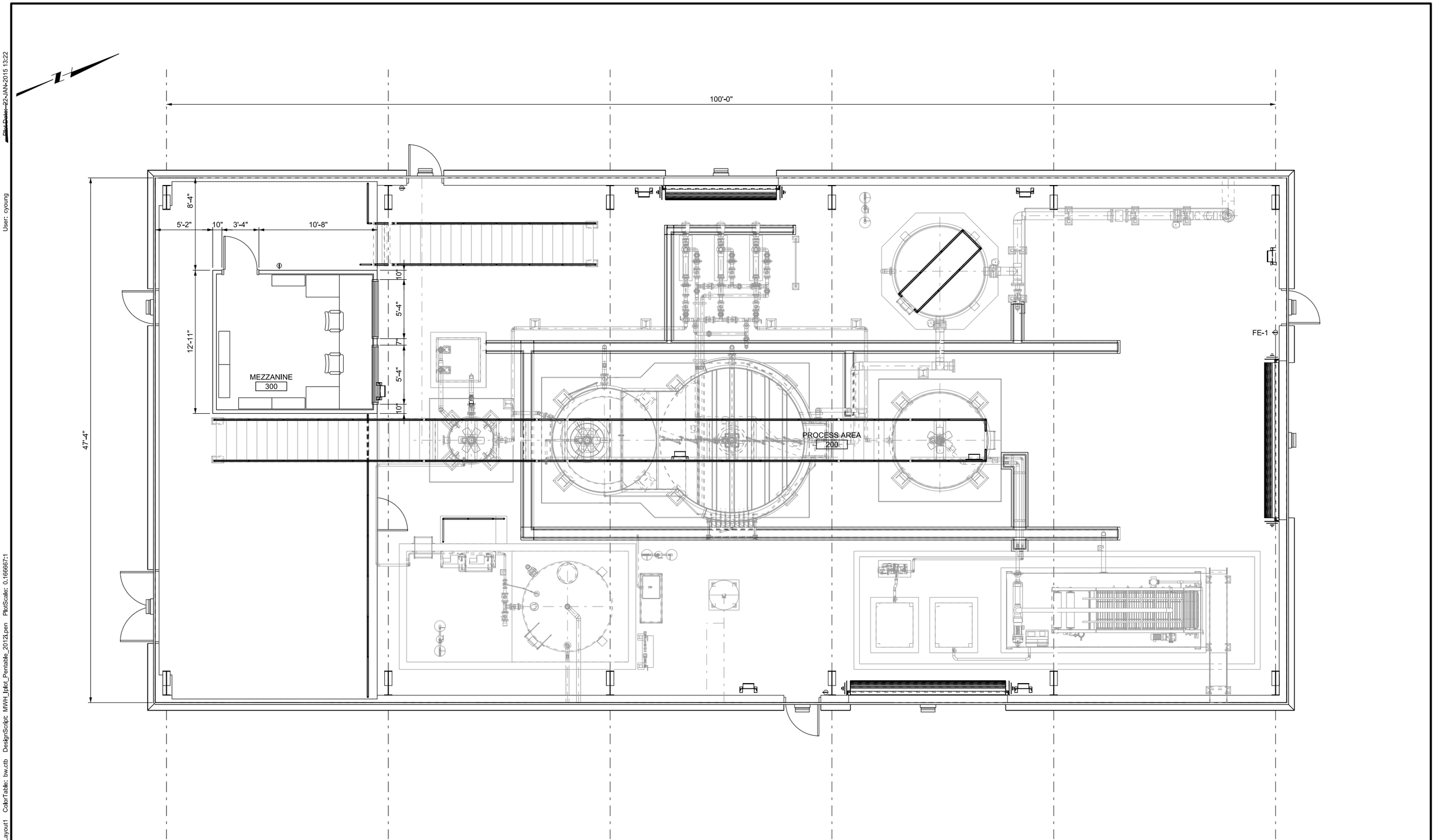
PROJECT LOCATION: POCATELLO, IDAHO

ARCHITECTURAL

FMC OU GROUNDWATER REMEDIAL DESIGN
LIFE SAFTY PLAN & BUILDING CODE SUMMARY

DRAWING A-1

File: FMC A01.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_2012i.pen PlotScale: 2:1 Plot Date: 22-JAN-2015 13:16 User: cyoung




| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | CY | 30% DESIGN |

SCALE: 1/4" = 1'-0"

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PROJECT LOCATION: POCATELLO, IDAHO

ARCHITECTURAL

FMC OU GROUNDWATER REMEDIAL DESIGN

MEZZANINE FLOOR PLAN

DRAWING A-3

File: FMC A03.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_2012.pen PlotScale: 0.166667:1 User: cyoung Plot Date: 22-JAN-2015 13:22

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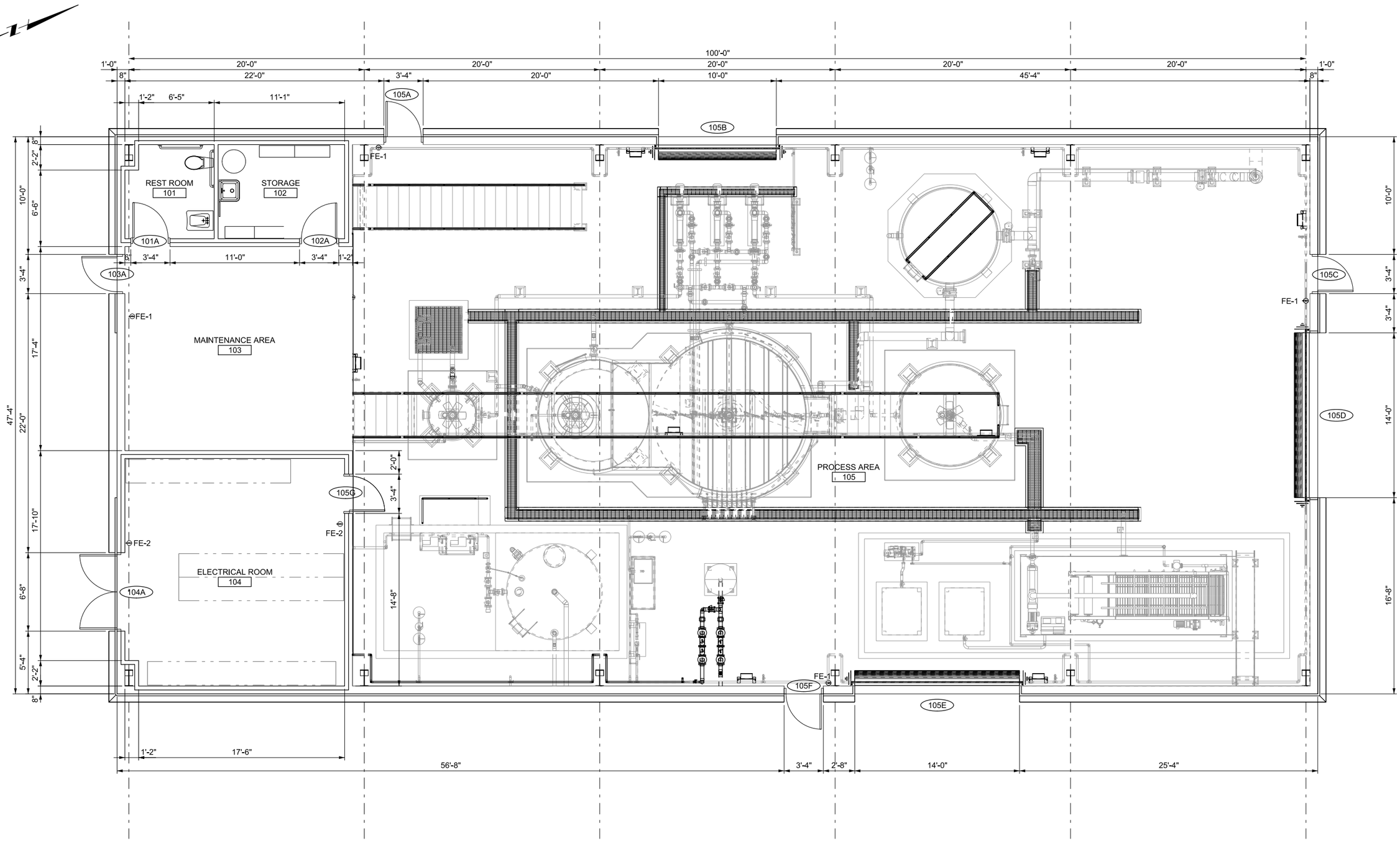


| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-15 | CY | 30% DESIGN |

SCALE: 1/4" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED C YOUNG
DRAWN C YOUNG
CHECKED D MIKLAS

PRELIMINARY DESIGN PHASE - 12-12-2014

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FMC

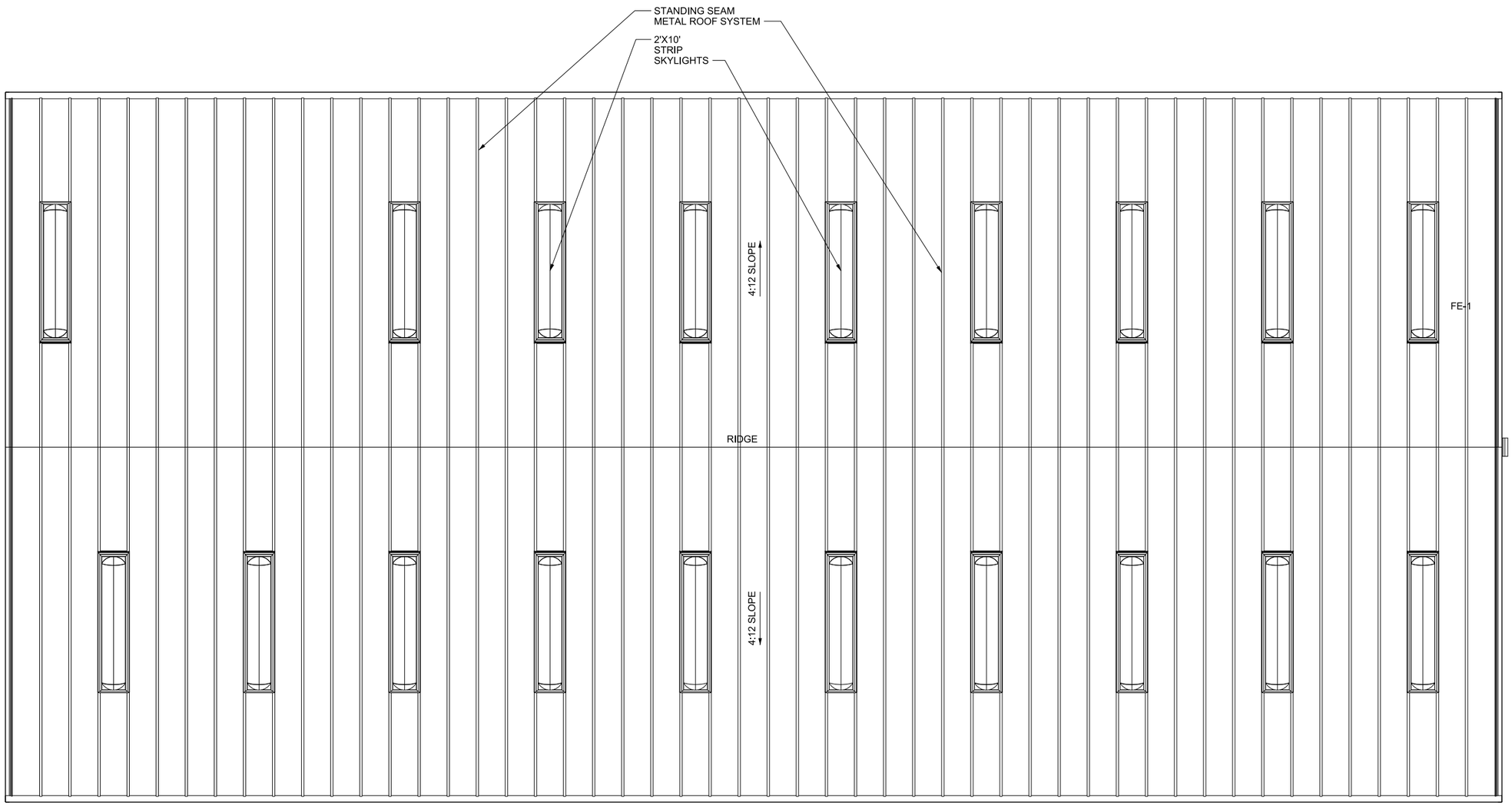
PROJECT LOCATION: POCATELLO, IDAHO

ARCHITECTURAL

FMC OU GROUNDWATER REMEDIAL DESIGN

FLOOR PLAN

DRAWING A-2




| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-15 | CY | 30% DESIGN |

SCALE
1/4" = 1'-0"

WARNING
0 ½ 1
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DESIGNED C YOUNG
DRAWN C YOUNG
CHECKED D MIKLAS

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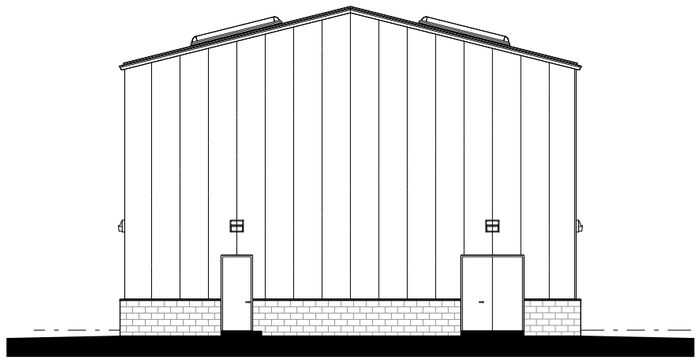
PROJECT LOCATION: POCATELLO, IDAHO
ARCHITECTURAL
FMC OU GROUNDWATER REMEDIAL DESIGN
ROOF PLAN

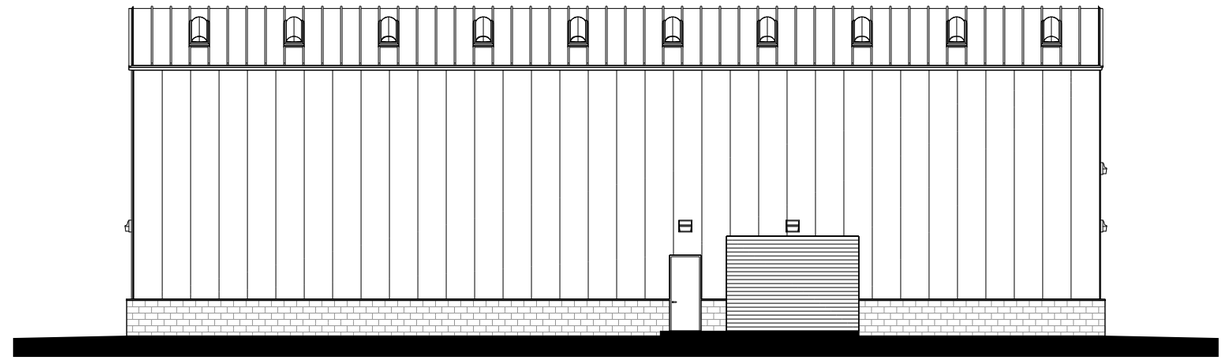
DRAWING
A-4

File: FMC A04.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_2012i.pen PlotScale: 0.166667:1
User: cyoung Plot Date: 22-JAN-2015 14:18

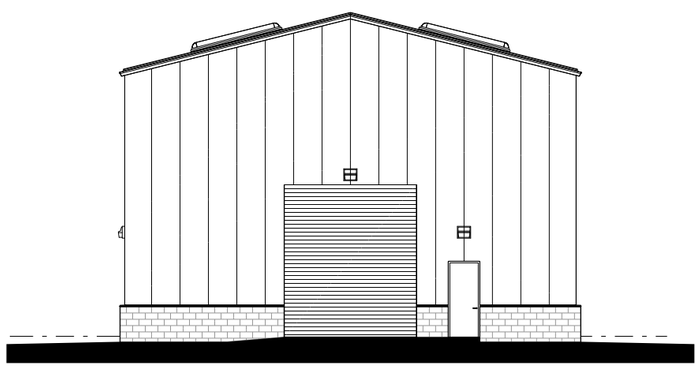
File: FMC A05.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_2012i.pen PlotScale: 0.166667:1
User: cyoung Plot Date: 22-JAN-2015 13:31



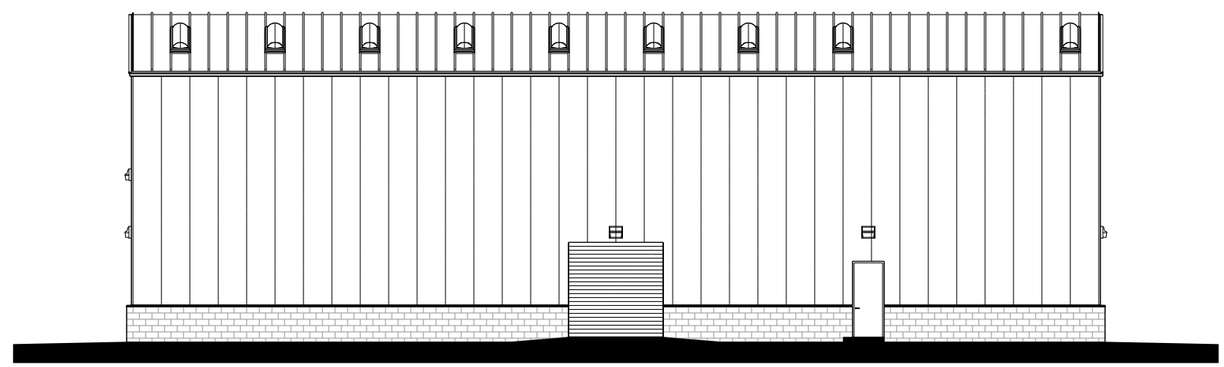
WEST ELEVATION



NORTH ELEVATION



EAST ELEVATION



SOUTH ELEVATION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | CY | 30% DESIGN |

SCALE
1/8" = 1'-0"

WARNING
0 ½ 1
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DESIGNED C YOUNG
DRAWN C YOUNG
CHECKED D MIKLAS

PRELIMINARY DESIGN PHASE - 12-12-2014

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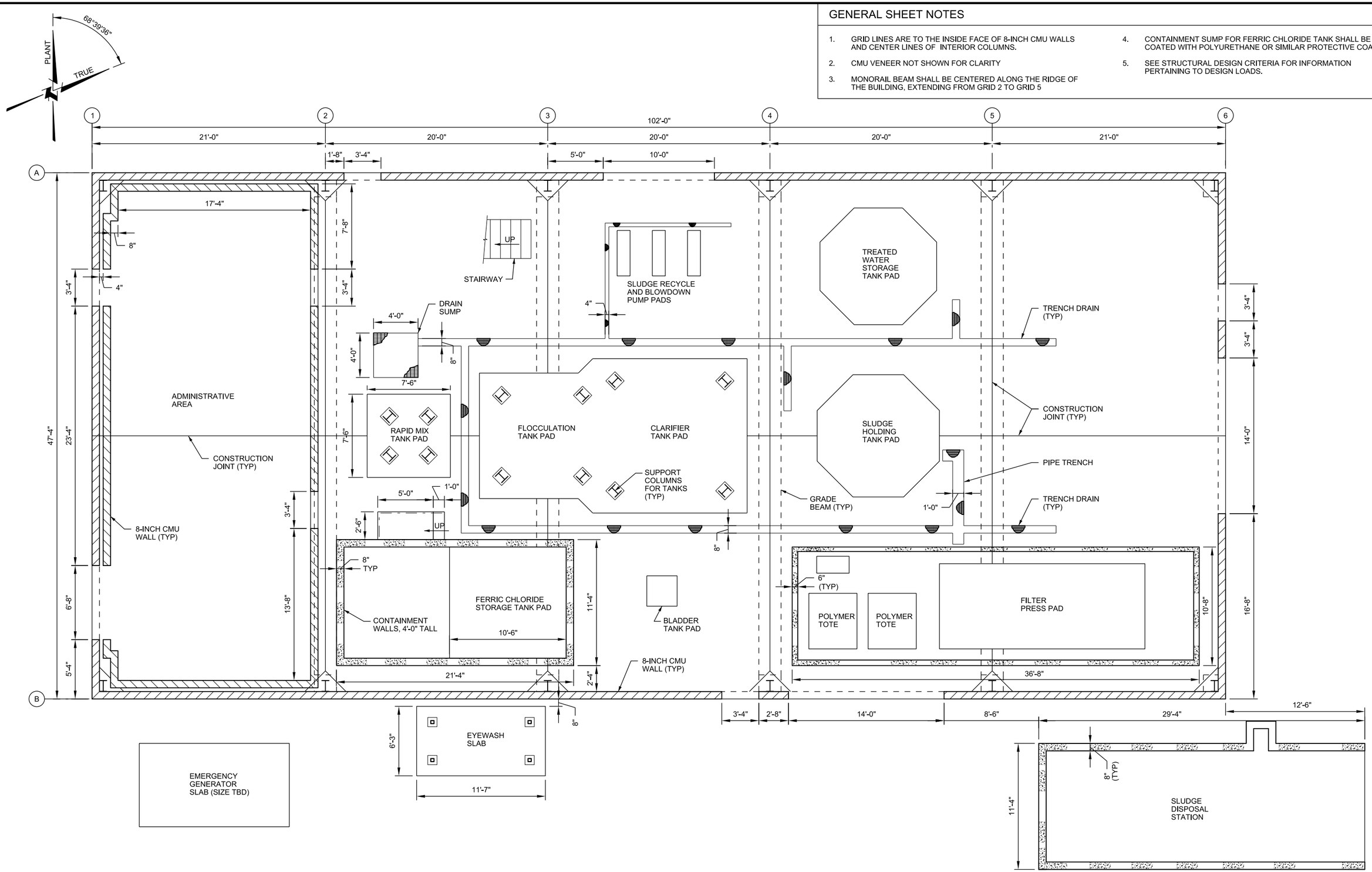
PROJECT LOCATION: POCATELLO, IDAHO
ARCHITECTURAL
FMC OU GROUNDWATER REMEDIAL DESIGN
EXTERIOR ELEVATIONS

DRAWING
A-5

## GENERAL SHEET NOTES

1. GRID LINES ARE TO THE INSIDE FACE OF 8-INCH CMU WALLS AND CENTER LINES OF INTERIOR COLUMNS.
2. CMU VENEER NOT SHOWN FOR CLARITY
3. MONORAIL BEAM SHALL BE CENTERED ALONG THE RIDGE OF THE BUILDING, EXTENDING FROM GRID 2 TO GRID 5
4. CONTAINMENT SUMP FOR FERRIC CHLORIDE TANK SHALL BE COATED WITH POLYURETHANE OR SIMILAR PROTECTIVE COATING
5. SEE STRUCTURAL DESIGN CRITERIA FOR INFORMATION PERTAINING TO DESIGN LOADS.




| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 1-30-2015 | GC | 30% DESIGN SUBMITTAL |

SCALE: 1/4" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED G CLARK
DRAWN G CLARK
CHECKED D MIKLAS

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FMC

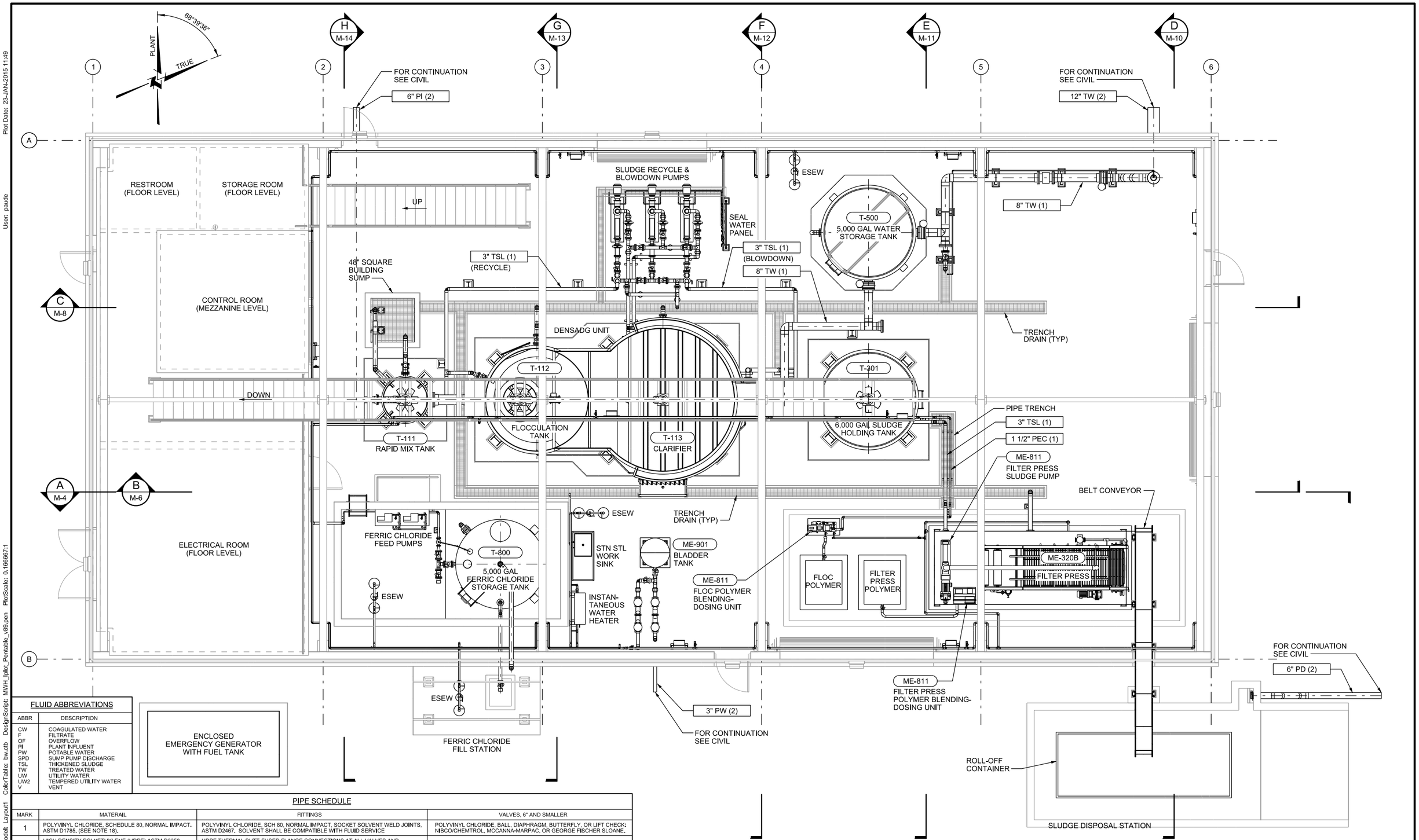
PROJECT LOCATION: POCATELLO, IDAHO

STRUCTURAL

FMC OU GROUNDWATER REMEDIAL DESIGN
FLOOR PLAN

DRAWING S-1

File: Structural Floor Plan.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 22-JAN-2015 19:25




## FLUID ABBREVIATIONS

| ABBR | DESCRIPTION |
|---|---|
| CW | COAGULATED WATER |
| F | FILTRATE |
| OF | OVERFLOW |
| PI | PLANT INFLUENT |
| PW | POTABLE WATER |
| SPD | SUMP PUMP DISCHARGE |
| TSL | THICKENED SLUDGE |
| TW | TREATED WATER |
| UW | UTILITY WATER |
| UW2 | TEMPERED UTILITY WATER |
| V | VENT |

## PIPE SCHEDULE

| MARK | MATERAIL | FITTINGS | VALVES, 6" AND SMALLER |
|---|---|---|---|
| 1 | POLYVINYL CHLORIDE, SCHEDULE 80, NORMAL IMPACT. ASTM D1785. (SEE NOTE 18). | POLYVINYL CHLORIDE, SCH 80, NORMAL IMPACT, SOCKET SOLVENT WELD JOINTS, ASTM D2467. SOLVENT SHALL BE COMPATIBLE WITH FLUID SERVICE | POLYVINYL CHLORIDE, BALL, DIAPHRAGM, BUTTERFLY, OR LIFT CHECK: NIBCO/CHEMTROL, MCCANNA-MARPAC, OR GEORGE FISCHER SLOANE. |
| 2 | HIGH DENSITY POLYETHYLENE (HDPE) ASTM D3350 - SDR AS SPECIFIED. | HDPE THERMAL BUTT-FUSED FLANGE CONNECTIONS AT ALL VALVES AND TRANSITIONS. | — |
| 3 | POLYVINYL CHLORIDE GRAVITY SEWER PIPE, ASTM D3034, BELL AND SPIGOT. | POLYVINYL CHLORIDE, ANSI/ASTM D3034, BELL AND/OR SPIGOT. | — |

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: 1/4" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED B SICK
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CHECKED D MIKLAS

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FMC

PROJECT LOCATION: POCATELLO, IDAHO

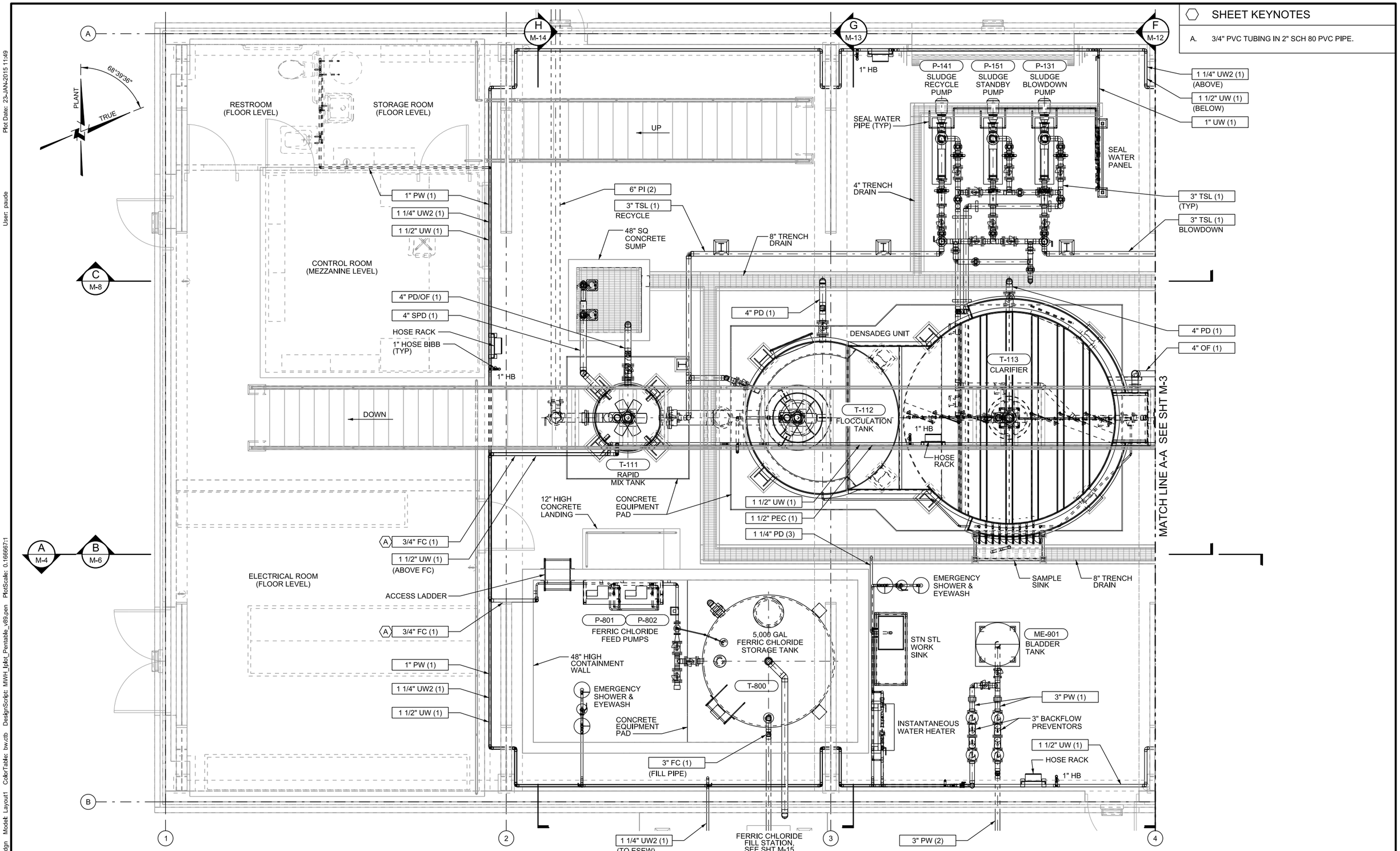
MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN

OVERALL FLOOR PLAN

DRAWING M-1

File: FMC 0M01A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 23-JAN-2015 11:49




| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: 3/8" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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FMC

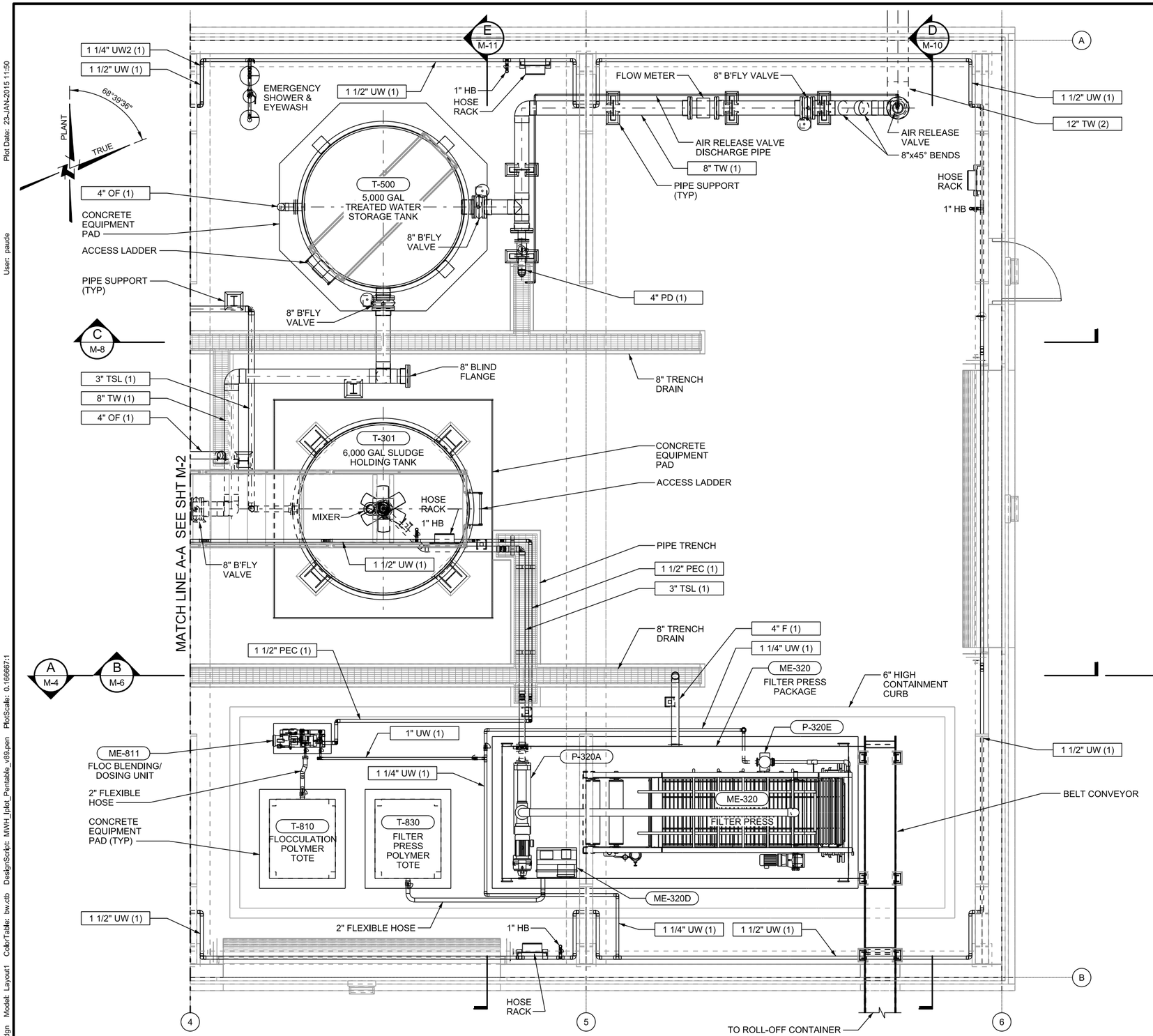
PROJECT LOCATION: POCATELLO, IDAHO

MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN
FLOOR PLAN - 1 OF 2

DRAWING M-2

File: FMC 0M02A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 23-JAN-2015 11:49




| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: 3/8" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED B SICK
DRAWN P UDE
CHECKED D MAKLIS

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PROJECT LOCATION: POCATELLO, IDAHO

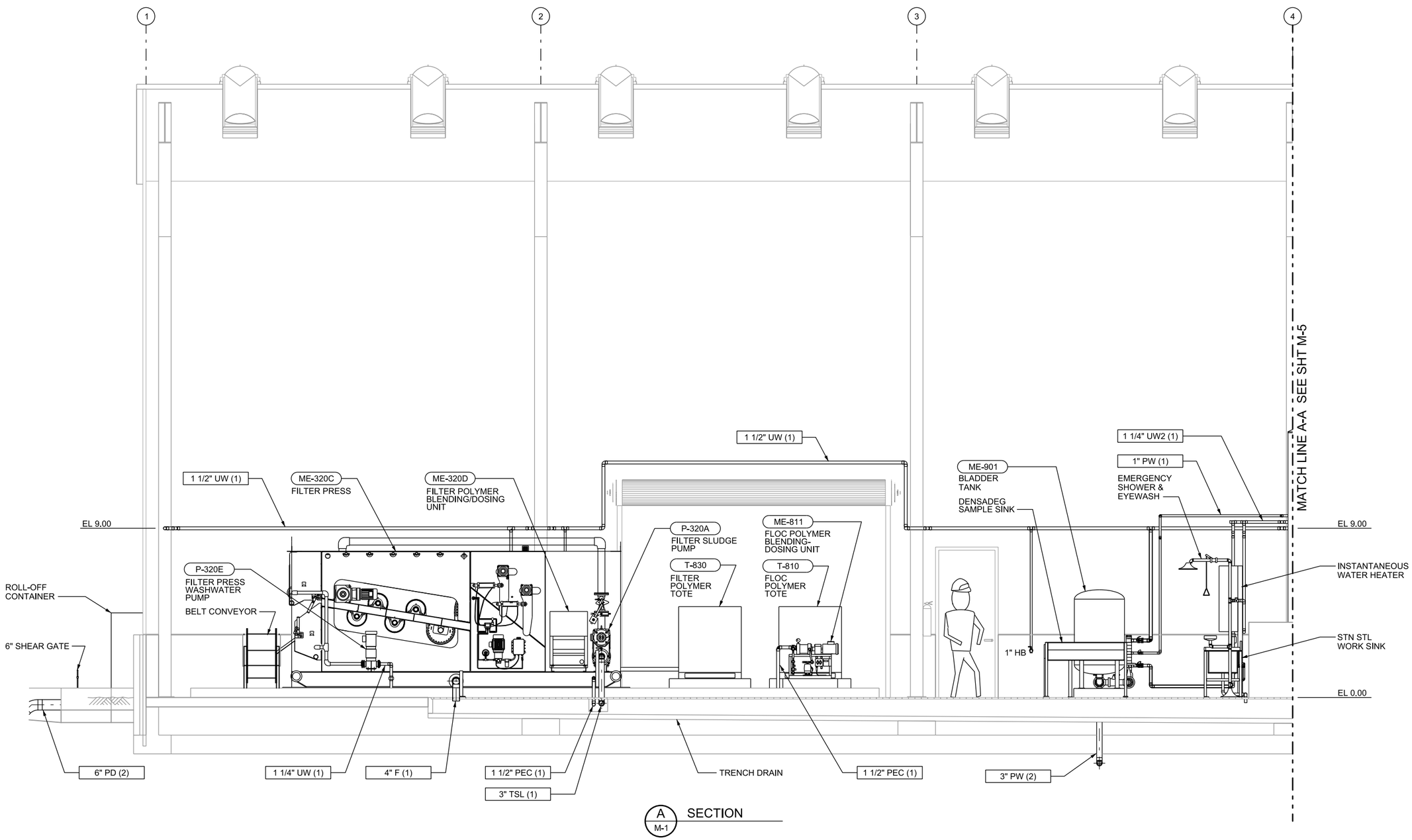
MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN
FLOOR PLAN - 2 OF 2

DRAWING M-3

File: FMC 0M03A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 23-JAN-2015 11:50

File: FMC 0M04A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.1666667:1
User: paude Plot Date: 23-JAN-2015 11:50




A M-1 SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: 3/8" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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PROJECT LOCATION: POCATELLO, IDAHO

MECHANICAL

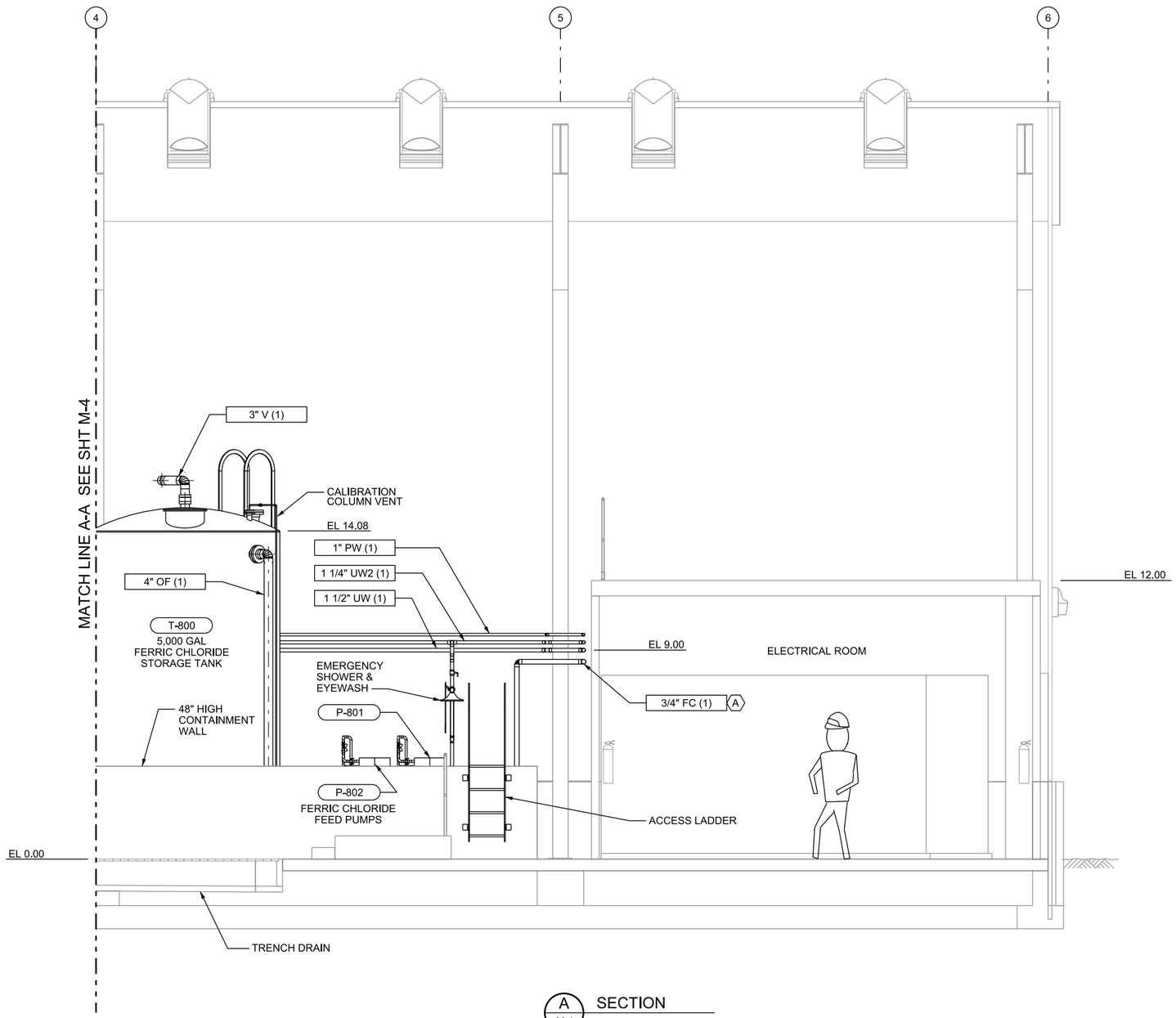
FMC OU GROUNDWATER REMEDIAL DESIGN

SECTION - I

DRAWING M-4

## SHEET KEYNOTES

A. 3/4" PVC TUBING IN 2" SCH 80 PVC PIPE.




A M-1 SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE 3/8" = 1'-0"

WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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PROJECT LOCATION: POCATELLO, IDAHO

MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN

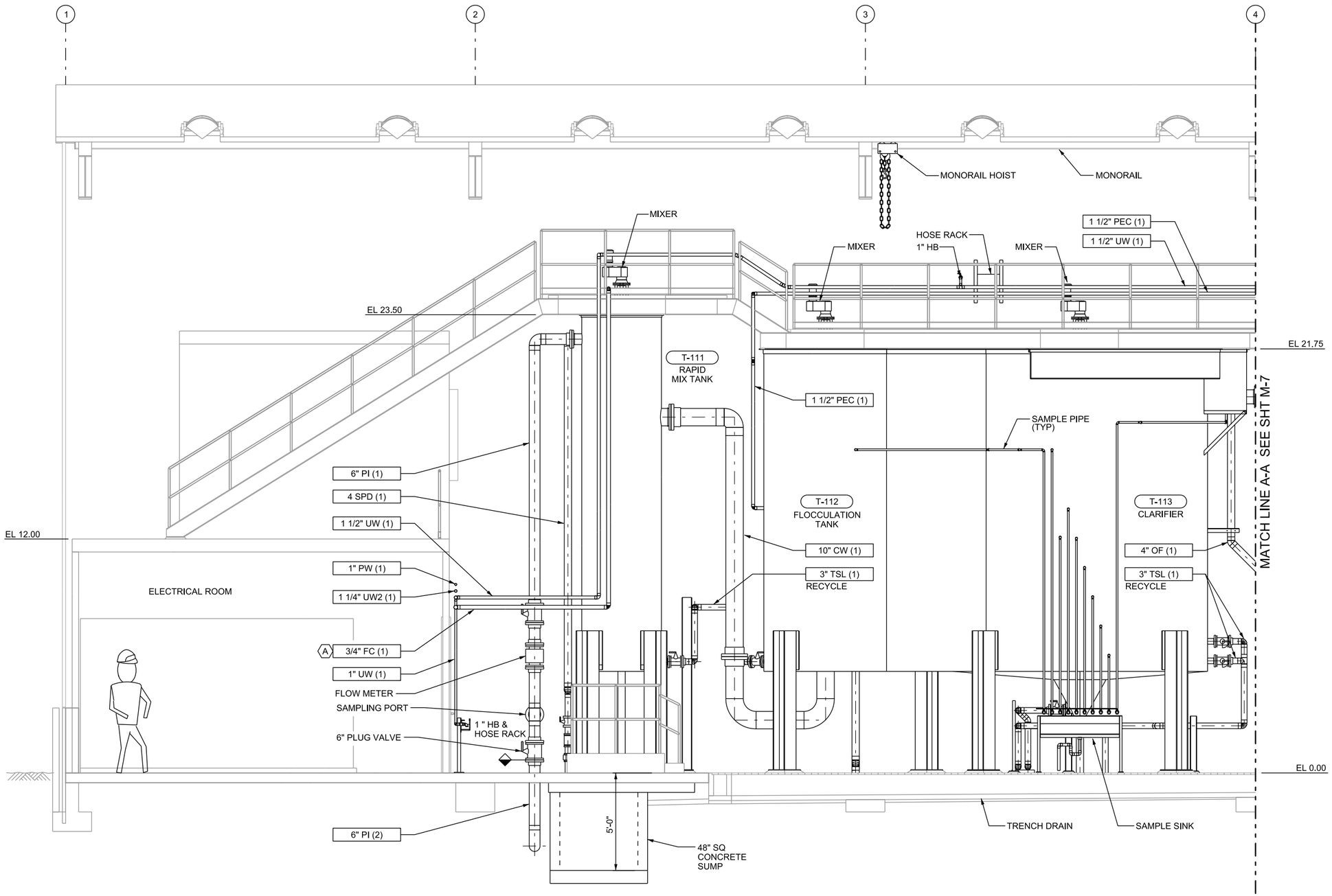
SECTION - II

DRAWING M-5

File: FMC 0M05A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 23-JAN-2015 11:50

## SHEET KEYNOTES

A. 3/4" PVC TUBING IN 2" SCH 80 PVC PIPE.




B / M-1 SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE 3/8" = 1'-0"

WARNING 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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CHECKED D MIKLAS

PRELIMINARY DESIGN PHASE - 01-30-2015

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PROJECT LOCATION: POCATELLO, IDAHO

MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN

SECTION - III

DRAWING M-6

File: FMC OM06A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 23-JAN-2015 11:50

Plot Date: 23-JAN-2015 11:50
User: paude
PlotScale: 0.166667:1
DesignScript: MWH_Iplot_Pentable_v89.pen
ColorTable: bw.ctb
Model: Layout1
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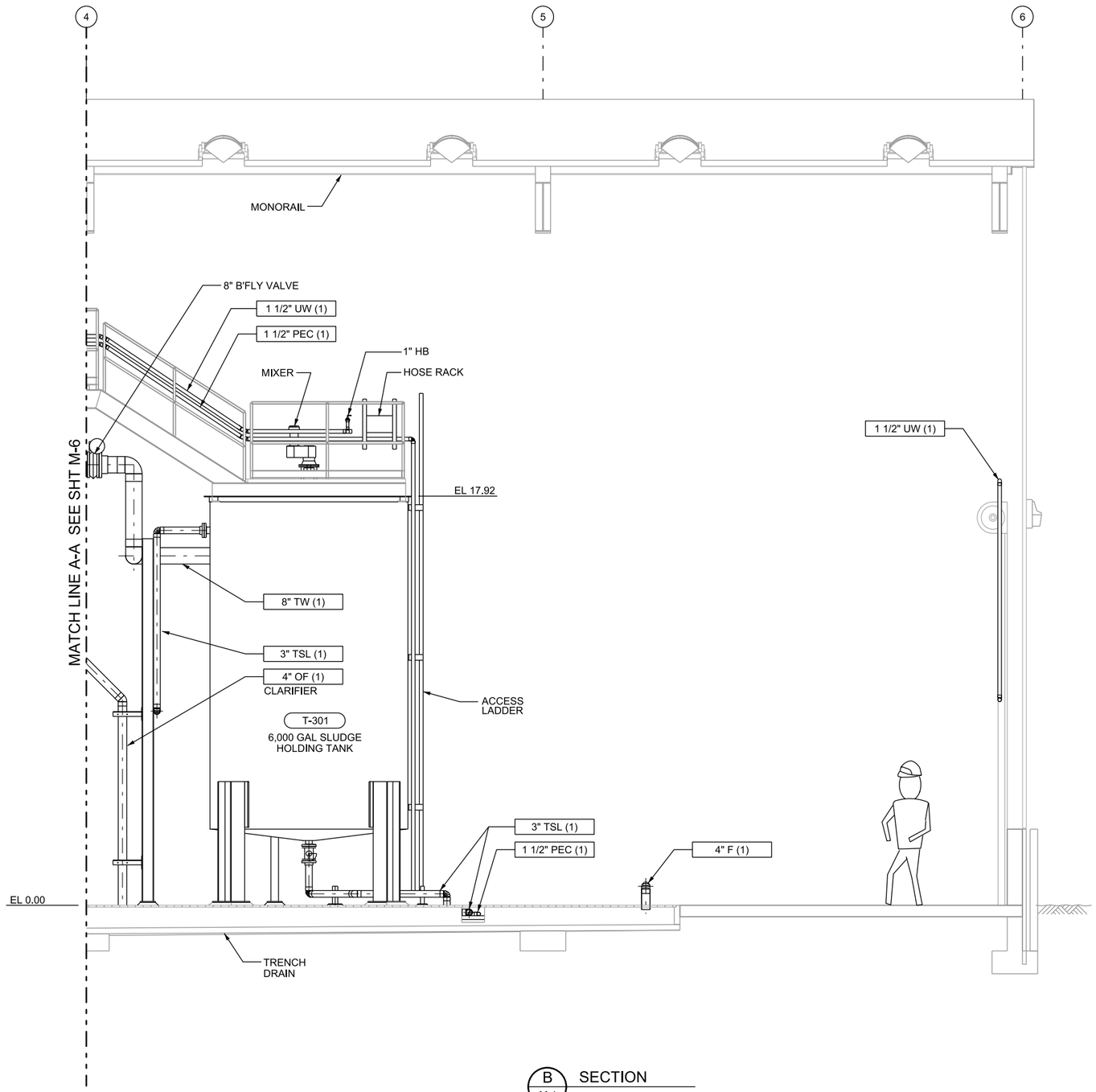


B M-1 SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE: 3/8" = 1'-0"

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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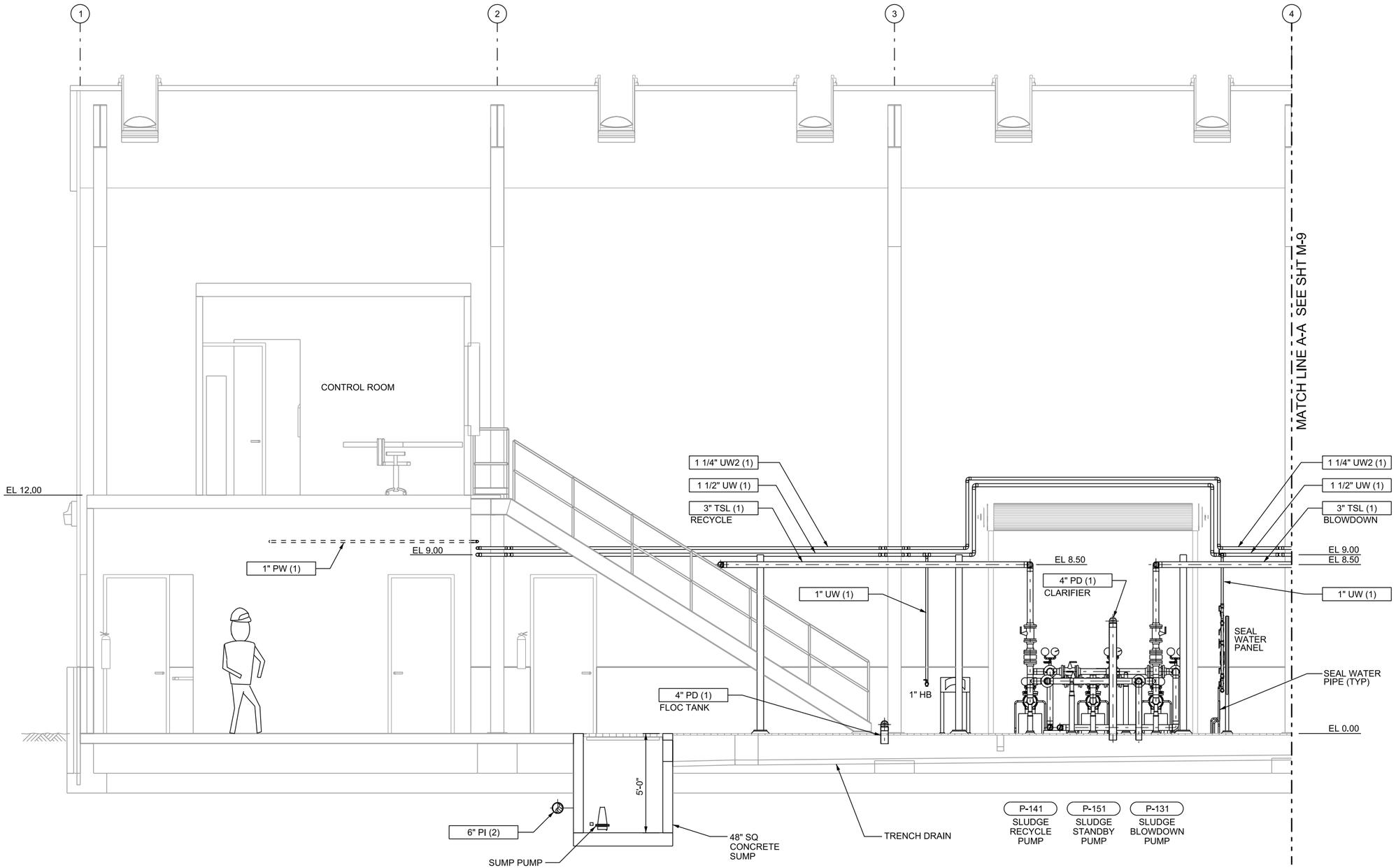
MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - IV

DRAWING M-7

File: FMC 0M08A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1
User: paude Plot Date: 23-JAN-2015 11:50




C
M-1
SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE
3/8" = 1'-0"

WARNING
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DESIGNED B SICK
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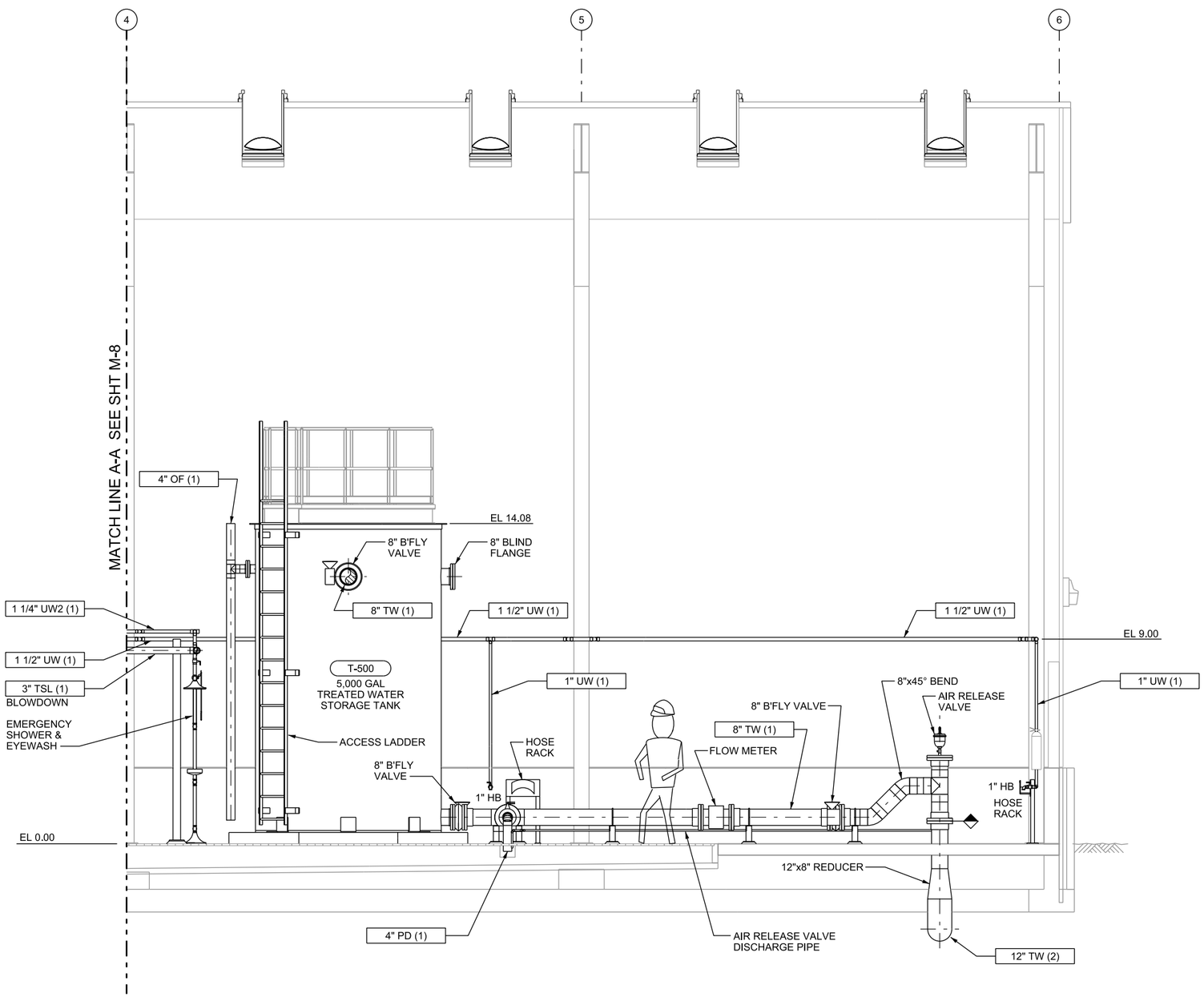
MECHANICAL
FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - V

DRAWING
M-8




C
M-1
SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE
3/8" = 1'-0"

WARNING
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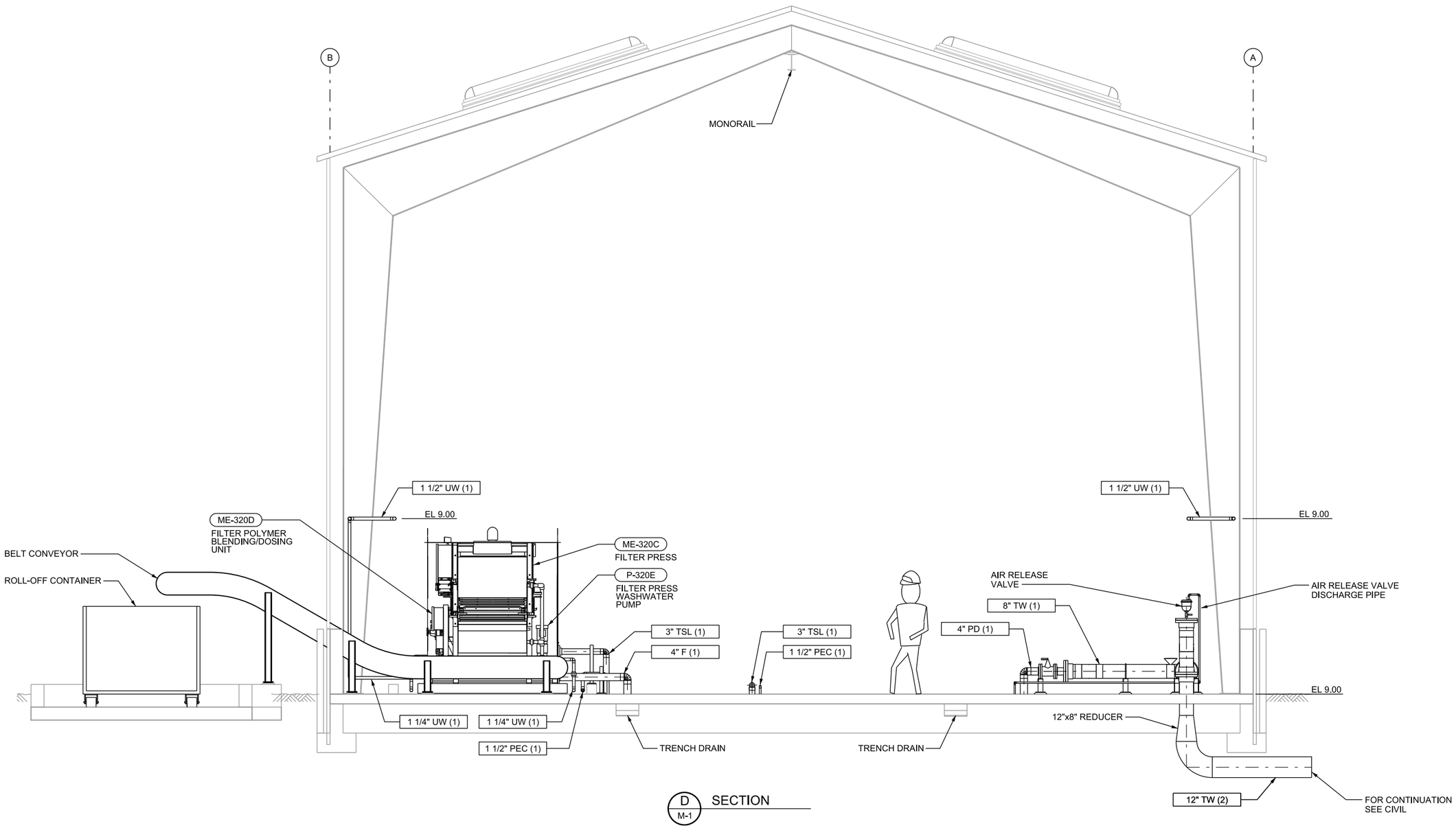
PROJECT LOCATION: POCATELLO, IDAHO
MECHANICAL
FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - VI

DRAWING
M-9

File: FMC 0M09A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_IpIot_Pentable_v89.pen PlotScale: 0.166667:1 User: paude Plot Date: 23-JAN-2015 11:50

Plot Date: 23-JAN-2015 11:50
User: paude
PlotScale: 0.166667:1
DesignScript: MWH_Iplot_Pentable_v89.pen
ColorTable: bw.ctb
Model: Layout1
File: FMC 0M10A.dgn




D
M-1
SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 305 DESIGN SUBMITTAL |

SCALE
3/8" = 1'-0"

WARNING
0 ½ 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED B SICK
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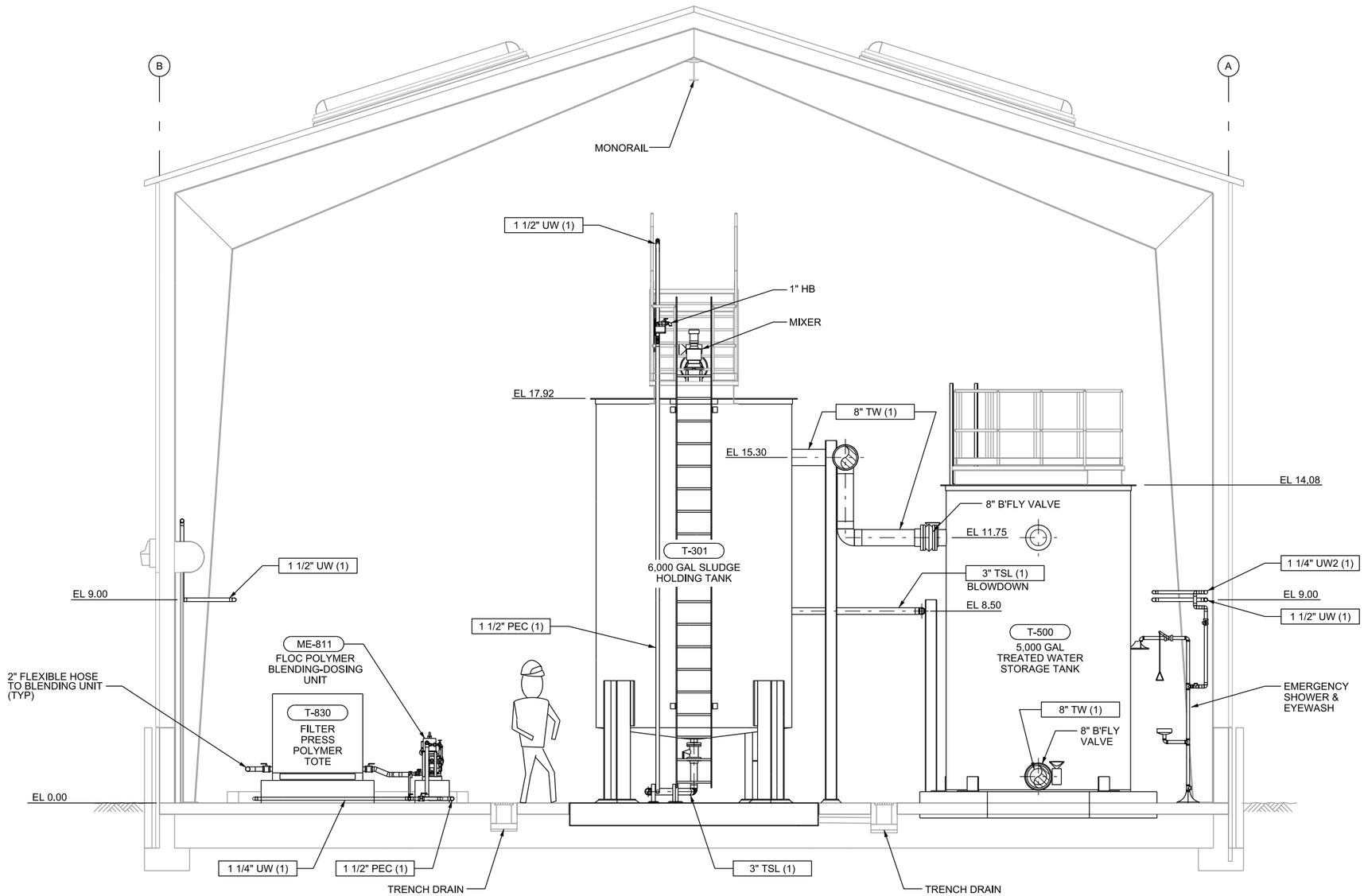
MECHANICAL
FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - VII

DRAWING
M-10

Plot Date: 23-JAN-2015 11:50
User: paude
File: FMC 0M11A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1




E
M-1
SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE
3/8" = 1'-0"

WARNING
0 ½ 1
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CHECKED D MIKLAS

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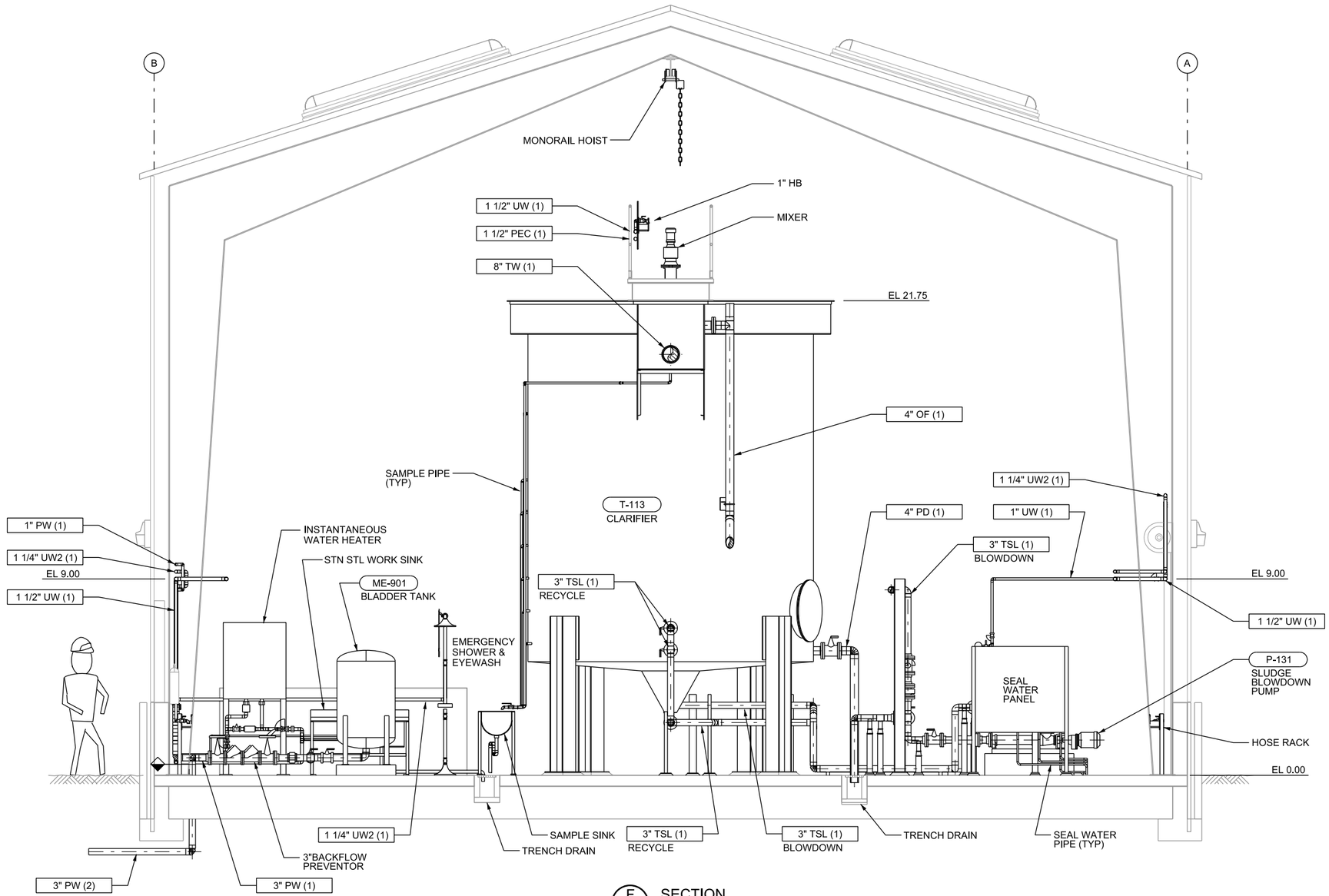
MECHANICAL
FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - VIII

DRAWING
M-11

Plot Date: 23-JAN-2015 11:50
User: paude
File: FMC 0M12A.dgn Model: Layout1 ColorTable: bw.ctb DesignScript: MWH_Iplot_Pentable_v89.pen PlotScale: 0.166667:1




F
M-1
SECTION

| REV | DATE | BY | DESCRIPTION |
|---|---|---|---|
| A | 01-30-2015 | PU | 30% DESIGN SUBMITTAL |

SCALE
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FMC

PROJECT LOCATION: POCATELLO, IDAHO
MECHANICAL
FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - IX

DRAWING
M-12

## SHEET KEYNOTES

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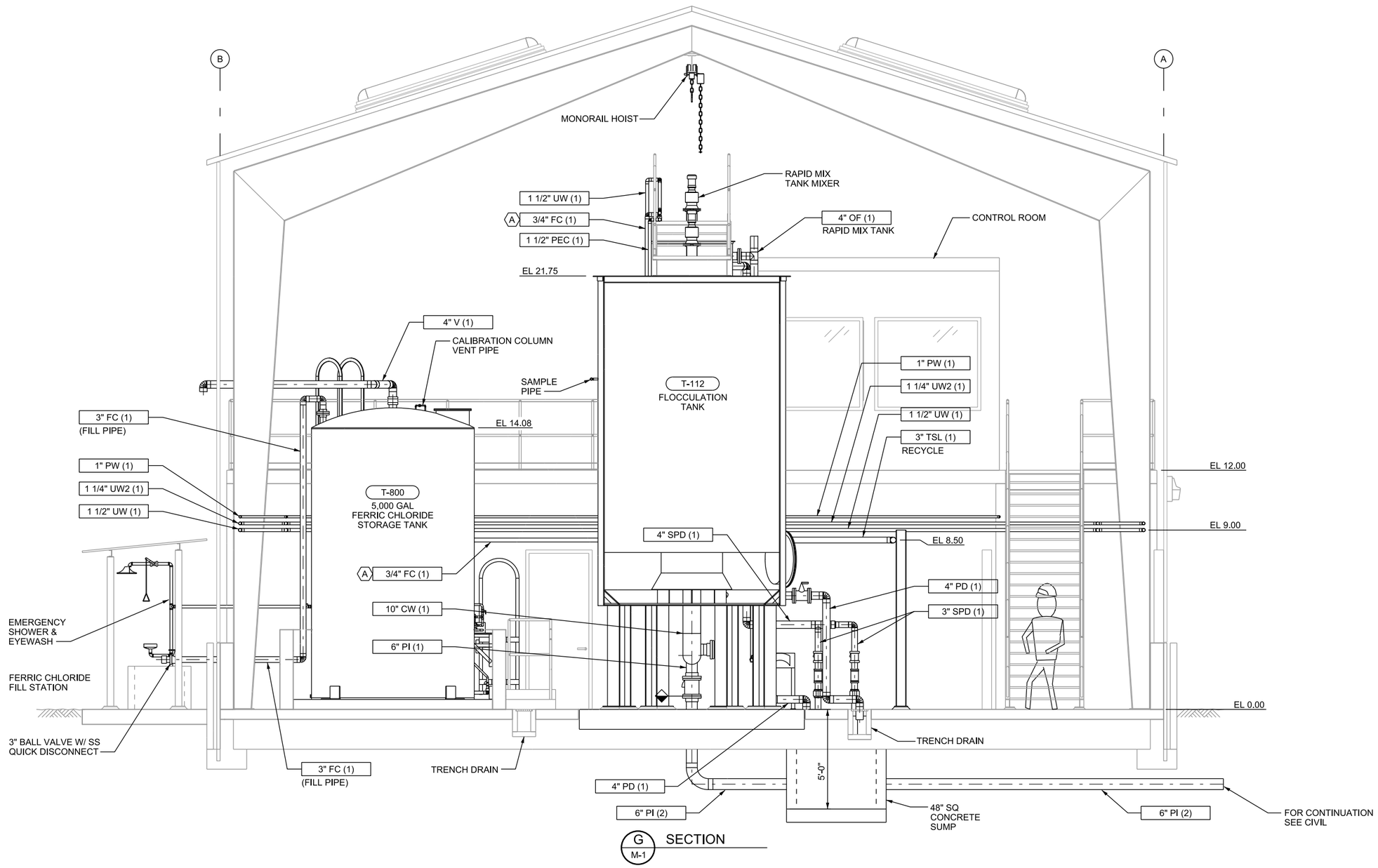


G M-1 SECTION

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WARNING 0 ½ 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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SECTION - X

DRAWING M-13

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## SHEET KEYNOTES

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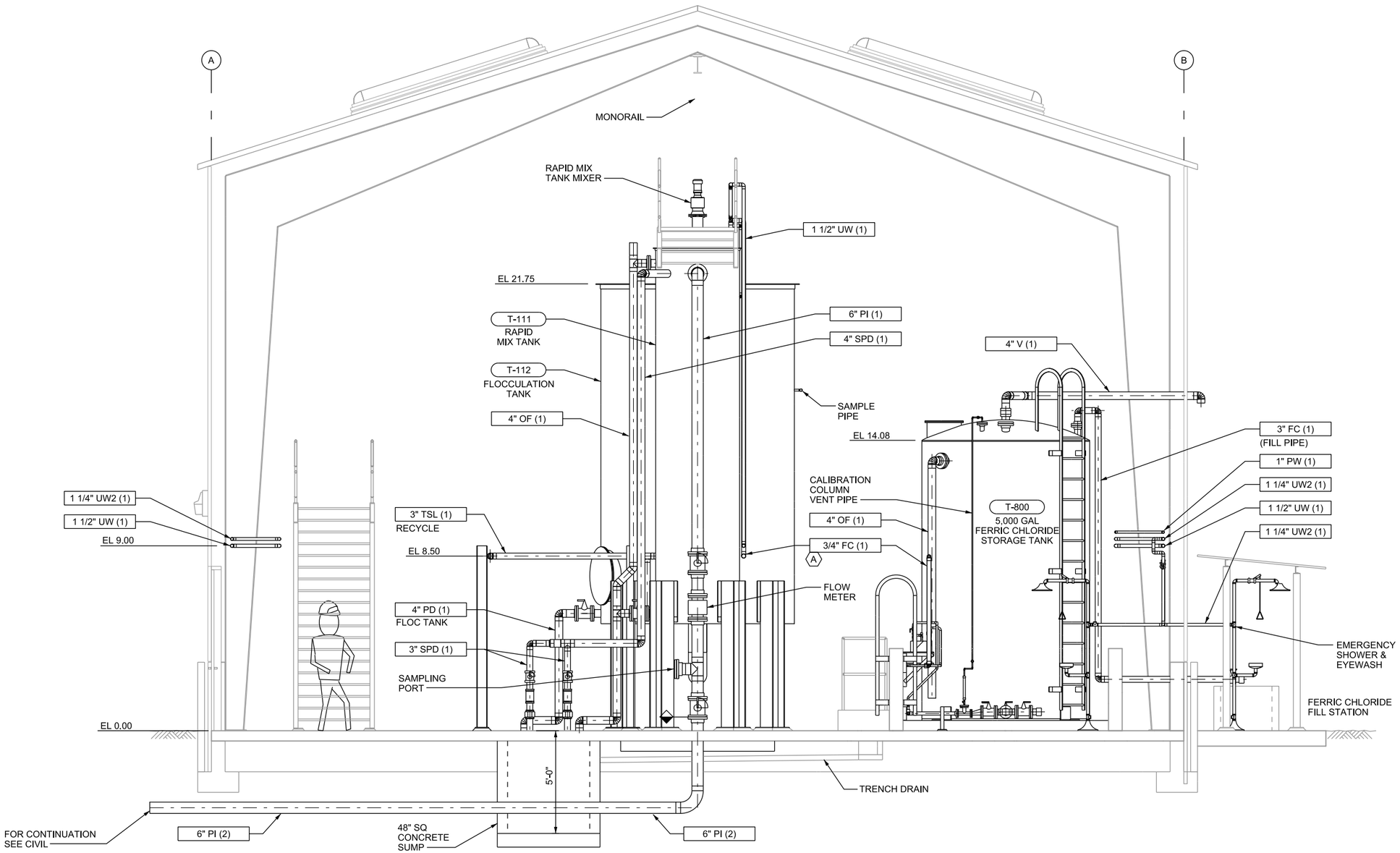


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MECHANICAL
FMC OU GROUNDWATER REMEDIAL DESIGN
SECTION - XI

DRAWING
M-14

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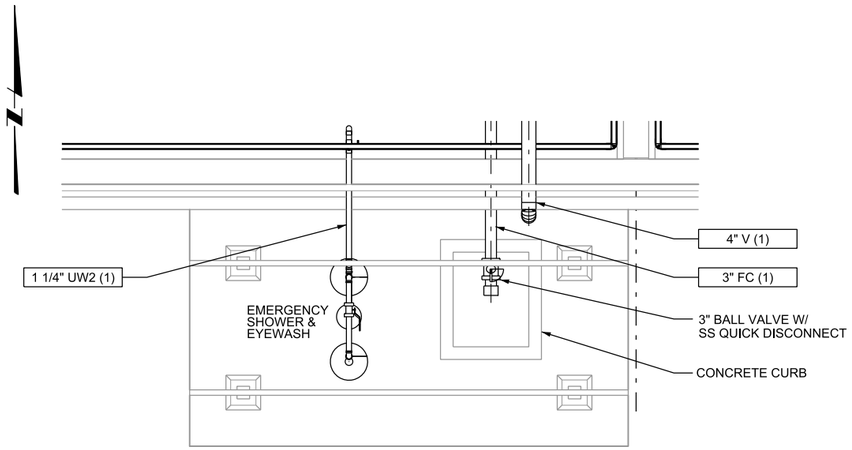
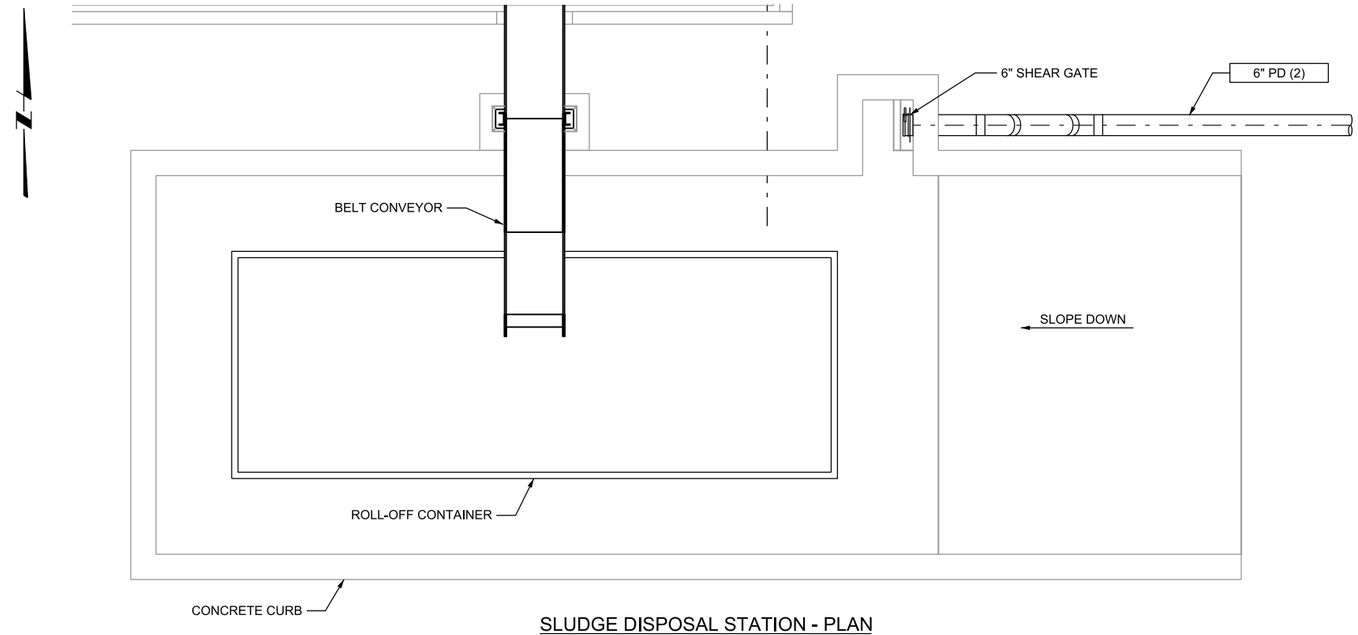
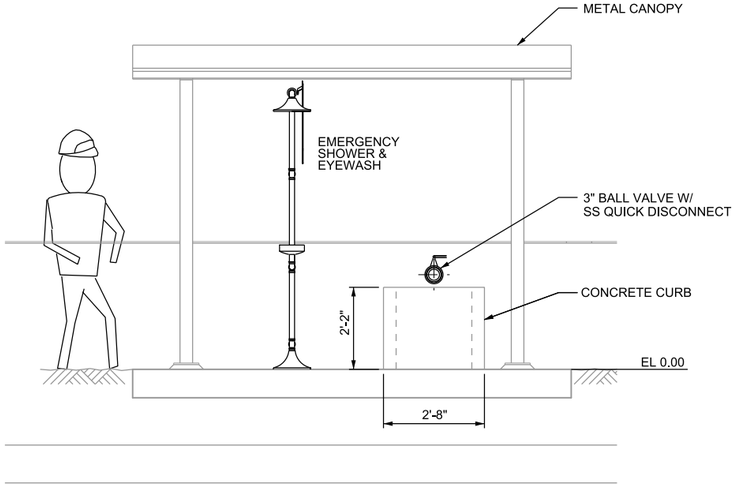


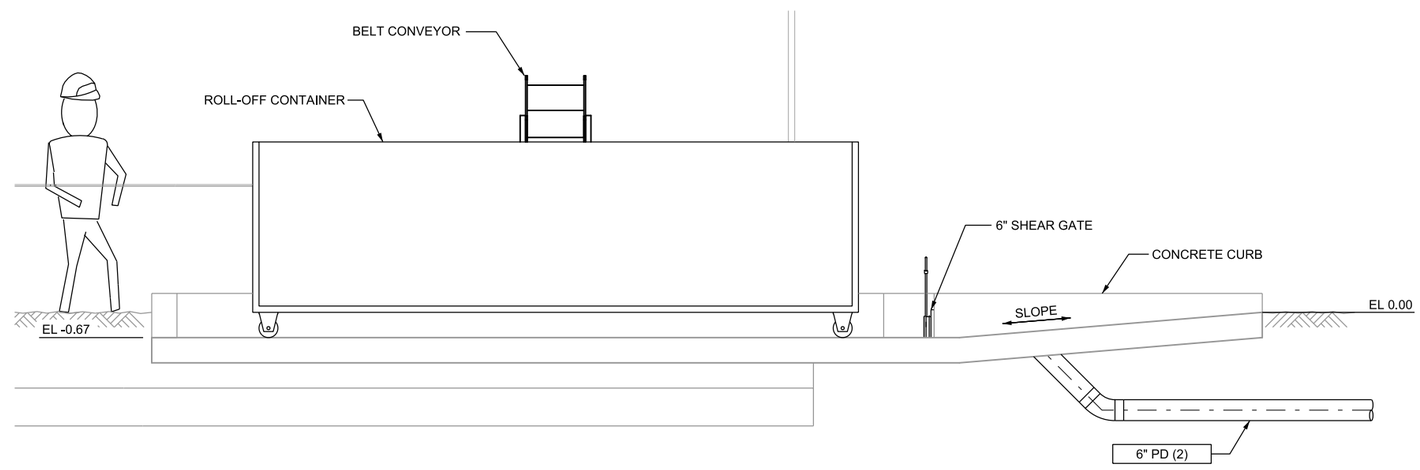

FERRIC CHLORIDE FILL STATION - PLAN




SLUDGE DISPOSAL STATION - PLAN




FERRIC CHLORIDE FILL STATION - ELEVATION




SLUDGE DISPOSAL STATION - ELEVATION

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PROJECT LOCATION: POCATELLO, IDAHO

MECHANICAL

FMC OU GROUNDWATER REMEDIAL DESIGN
MISC PLANS AND SECTIONS

DRAWING M-15

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User: paude Plot Date: 23-JAN-2015 11:50

# APPENDIX B

## Groundwater Treatability Study Report

# FMC OU - Groundwater Remedial Action

# BENCH-SCALE TREATABILITY STUDY REPORT

## FMC Idaho LLC, Pocatello, Idaho

## September 2014

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## ATTACHMENTS

Attachment A: Regulatory Agency Comments on TS Work Plan
Attachment B: Bench-Scale Treatability Study Work Plan
Attachment C: FLSmidth Bench Testing Data Sheets
Attachment D: Analytical Lab Reports
Attachment E: Parsons Technical Memorandum
Attachment F: Bench-Scale Testing Photographs

# 1.0 INTRODUCTION AND OBJECTIVE

As described in the Extraction Zone Hydrogeologic Study Work Plan (January 2014), FMC conducted bench-scale groundwater treatability testing to support the remedial design (RD) for the groundwater remedial action for the FMC OU. The study was performed consistent with the Bench-Scale Treatability Study Work Plan (TS Work Plan; May 23, 2014). This Bench-Scale Treatability Study Report summarizes the methods and results of the bench-scale treatability testing. As described in FMC's email to EPA on June 4, 2014, IDEQ's June 4, 2014 comments on the TS Work Plan were considered in the preparation of the report. The IDEQ comments are included as Attachment A. The results presented herein will be utilized to advance the RD of the groundwater treatment process component of the selected groundwater remedy for the FMC OU.

## 1.1 SELECTED GROUNDWATER REMEDY

The selected groundwater remedy involves a Hydraulic Containment System comprised of multiple groundwater extraction wells located along the property boundary (northeast portion of the FMC Plant Site) that will capture the flow of site groundwater from the shallow aquifer. Once extracted, the groundwater will pass through an on-site water treatment process prior to being discharged to an on-site infiltration/evaporation basin located in the Western Undeveloped Area.

The primary goals of the water treatment process are to lower the concentration of arsenic (As) to the MCL of 10 µg/l and total phosphorus (P) to the 95$^{th}$ percentile background of 300 µg/l. All other COCs are expected to be below their maximum contaminant levels (MCLs) or other remedial action standards as shown on Table 4.1 of the Hydrogeologic Study Report (August 2014). The treatment process being considered includes a chemical coagulation/flocculation process followed by sedimentation and/or filtration. Solids (i.e., sludge) generated by the treatment process will be dewatered and disposed of offsite.

## 1.2 GROUNDWATER SAMPLING

As detailed in the Hydrogeologic Study Report (August 2014), three extraction wells, EW-1, EW-2, and EW-3, were installed within the proposed extraction zone in order to determine hydrogeologic characteristics of the shallow aquifer. A 72-hour hydraulic containment aquifer (pump) test was performed on these wells from May 7 to 10, 2014. During this 72-hour pump test, bulk, time-composited samples were collected in seven 5-gallon containers. These bulk sample containers were then delivered to subcontractor treatability laboratories and used for all bench-scale treatability tasks described in this report.

## 1.3 TREATABILITY STUDY OBJECTIVE

The primary objectives of the treatability testing were to determine optimum treatment materials and conditions and to provide parameters for the treatment process design by accomplishing the following tasks:

- Determine the most appropriate coagulant type, coagulant dose, required mixing rates, and optimum pH to lower arsenic and phosphorus concentrations below the treatment goals of 10 µg/l and 300 µg/l, respectively.
- Determine the anticipated volume and characteristics of sludge generated by the treatment process, including analysis for RCRA 8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using the toxicity characteristic leaching procedure (TCLP) to determine whether the sludge will likely be characterized as hazardous or non-hazardous.

# 2.0 SUMMARY OF METHODS

Two separate testing subcontractors were utilized to perform bench-scale testing. FLSmidth (FLS) was retained by MWH to perform treatability testing. ALS Laboratory, a NELAP accredited laboratory, performed laboratory analyses for all MWH/FLS samples. FMC also subcontracted Parsons Treatability Lab (Parsons) as an independent testing firm. Pace Analytical Services performed laboratory analysis for Parsons. Each testing firm conducted a separate set of tasks, some of which were unique to each testing firm and some of which overlapped for redundancy. In general, the tasks performed in support of the treatability study consisted of the following:

- Analysis of raw groundwater to determine the characteristics of the water, with particular emphasis on measuring the concentrations of arsenic in its various valence states (i.e., As(III) and As(V));
- Bench-scale jar testing to determine the most appropriate coagulant, dosing rate, mixing rate, and pH required for effective removal of arsenic and phosphorus to levels below the treatment goals of 10 µg/l and 300 µg/l, respectively;
- Water quality characterization of the supernatant to measure treatment effectiveness; and
- Testing to determine the physical and chemical characteristics of the precipitate (i.e., sludge).

## 2.1 FLSMIDTH TESTING

As a subcontractor to MWH, FLS performed treatability tasks outline in the Bench-Scale Treatability Study Work Plan (WP; Attachment B). In summary, this included an iterative process that aimed to independently analyze various coagulant doses, mixing rates, and pH adjustments. Both ferric chloride ($FeCl_3$) and aluminum sulfate ($Al_2(SO_4)_3$) were tested as chemical coagulants. Using the optimized coagulant, dose, mixing scheme, and pH, a final set of jar tests was conducted to observe the repeatability of results, and also to generate composite 'treated' water and sludge samples for laboratory analysis.

### 2.1.1 Water Sample Analysis

An extended list of water quality analyses were conducted on the raw (i.e., untreated) groundwater sample and the composite 'treated' water sample. Water quality analysis of the raw sample included an analysis of arsenic speciation in order to determine the dominant oxidation state of arsenic present in the groundwater. Laboratory analysis for arsenic and phosphorus was conducted on each of the supernatant samples collected from each iterative batch or jar tests. TLCP analysis for RCRA-8 metals was conducted on the collected bulk sludge sample. Analytical method numbers are included in Table B-2 of the WP (Attachment B).

### 2.1.2 Work Plan Deviations

Due to the iterative nature of this testing, there were various deviations from the tasks described in the attached WP, as follows:

1. Jar Testing Step 1 – Ferric Chloride doses tested: 5, 10, 20, 30, 40, 50, 60, 70, 80, and 90 mg/l as $FeCl_3$. Aluminum Sulfate doses tested: 10, 20, 30, 40, and 50 mg/l as $Al_2(SO_4)_3$. A rapid mix speed of 90 rpm (maximum speed of available equipment) and a slow mix speed of 48 rpm were used.

2. Jar Testing Step 2 – Mixing scheme '$M_3$' changed to a 1 minute rapid mix period followed by two 10 minuet slow mix periods. The rapid mix speed was 90 rpm, the speed for first slow period was 48 rpm, and the speed for second slow mix period was 23 rpm. The flowing doses were tested using mixing schemes '$M_2$' and '$M_3$': 10, 20, and 30 mg/l $FeCl_3$ and 50, 60, and 70 mg/l as $Al_2(SO_4)_3$.

3. Jar Testing Step 3 – This step was broken into two steps, referred to as 'Step 3' and 'Step 3b'. Step 3 involved an added task of evaluating direct filtration versus settling. Doses of 20 and 40 mg/l as $FeCl_3$ were used, with two jars set at each dose. Mixing scheme '$M_1$' was used for all jars. Aluminum sulfate was not tested. One jar of each of the three doses was successively filtered through 25, 8, and then 1.2 µm nominal pore size filters, and a sample of filtrate from each filter size was collected and submitted for laboratory analysis. The mass of solid retained on each filter was also measured gravimetrically after drying the filter at 50 degrees Celsius. The second, identical set of jars was allowed to settle for a 40 minute setting period before a supernatant sample was collected for laboratory analysis.

4. Jar Testing Step 3b – This step followed the Step 3 procedure listed in the WP (pH Optimization). Two jars of raw sample were lowered to each of the following pH set points using an HCl solution: 7, 6, and 5. One jar at each pH set point was doses with 40 mg/l $FeCl_3$ and the other was dosed with 80 mg/l $FeCl_3$. All jars were mixed using mixing scheme $M_1$. Each of the jars was allowed to settle for 30 minutes prior to collecting supernatant samples.

5. Jar Testing Step 4 – Ten identical jars were tested using the selected optimum conditions: 80 mg/L $FeCl_3$, mixing scheme $M_1$, no pH adjust, and a 30 minute settling time for solid-liquid separation. A 250 mL aliquot of supernatant from each of the 10 jars was combined to create composite 'treated' water samples for analysis. The mass of solids from one of the jars was measured gravimetrically after drying the filter at 50 degrees Celsius in order to measure the amount of sludge generated. The sludge from the

remaining 9 jars was gravity-thicken and submitted for TCLP analysis. Due to the very small amount of sludge generated, a particle size distribution was not conducted.

FLS bench testing data sheets are included in Attachment C. ALS Laboratory reports for each submitted sample are included in Attachment D. Analytical results for supernatant and filtrate samples are labeled according to steps outlined above.

## 2.2 PARSONS TESTING METHODS

As a direct subcontractor to FMC, Parsons performed treatability testing in parallel to the work conducted by FLS, but with various tasks differing from those described in the WP. A summary of the treatability tasks conducted by Parsons is included here, with a more thorough description of methods and results described in the Parsons Technical Memorandum included as Attachment E.

Parsons conducted laboratory analysis to characterize the initial groundwater samples. The list of parameters analyzed varied significantly from the list described in the WP, and focused mainly on metals (including RCRA-8 metals), and an extended list of VOCs. Triplicate alkalinity and acidity titrations were also conducted on the initial groundwater sample.

Three sets of jar tests (16 jars total) were conducted using ferric chloride as a coagulant; aluminum sulfate was not tested. The same mixing scheme was used for all jar testing, as follows: 1 minute at 200 rpm, 5 minutes at 50 rpm, 5 minutes at 30 rpm, and then 5 minutes at 10 rpm, followed by a 30 minute settling period. Supernatant samples were collected from each jar and were analyzed for arsenic, phosphorus, and total suspended solids (TSS).

The first two sets of jar tests (5 jars per set) included the following ferric chloride doses: 0, 29, 58, 116, and 232 mg/l as $FeCl_3$ (0, 10, 20, 40, and 80 mg/l as Fe). In addition to the ferric chloride coagulant, a 1 mg/l dose of anionic flocculation polymer was added to each jar included in the first two sets of jars. The first set of jars was conducted at a pH of 7.5, and the second was conducted at a pH of 9.0. The third set of jar tests (6 jars) were performed at a pH of 7.5 using doses of 116, 232, and 349 mg/l as $FeCl_3$ (40, 80, and 120 mg/l as Fe). Two jars were set at each dose, one with 1 mg/l of anionic polymer and one without polymer. A portion of the supernatant from the jars without polymer was also filtered through a 1.5 µm nominal pore size filter to evaluate the effect of filtering the supernatant.

A bulk sludge sample was created by treating an approximately 2 gallon batch of sample using a coagulant dose of 232 mg/l $FeCl_3$ (80 mg/l Fe) and 1 mg/l anionic polymer. Settled and gravity-thickened sludge was submitted for TCLP analysis. No characterization of 'treated' water was conducted beyond As, P, and TSS.

# 3.0 SUMMARY OF RESULTS

This section provides a summary of results and a discussion of design implications guided by the results. Results from both subcontractors, FLS and Parsons, have been combined where treatability testing tasks overlapped.

## 3.1 RAW WATER CHARACTERIZATION

A summary of laboratory results characterizing the untreated bulk groundwater sample is presented in Table 3.1 and 3.2. Table 3.1 presents arsenic speciation results. A composite aliquot, labeled '405 Comp' was collect from the bulk 72 hour pump test samples and analyzed in duplicate for total inorganic arsenic, trivalent arsenic (As(III)), and pentavalent arsenic (As(V)). Depending on the oxidation-reduction state of the aquifer from which the groundwater was extracted, inorganic arsenic will be present in either its reduced (i.e., As(III)) or oxidized (i.e., As(V)) form. The oxidized arsenic species is significantly more amenable to removal via the proposed coagulation/flocculation process. As such, it is important to understand the oxidation state of the arsenic present in the groundwater to determine whether an oxidation process upstream of the coagulation/flocculation process is necessary. Based on the results presented in Table 3.1, greater than 99% of inorganic arsenic is present in its oxidized form, negating the need for oxidation prior to treatment.

Table 3.2 presents a summary of laboratory results from raw water characterization testing conducted by MWH and Parsons (i.e., columns labeled '72 HR COMP, MWH' and 'Raw Water, Parsons,' respectively). A column of comparative values (CVs) and a column summarizing past groundwater characterization from three wells (i.e., wells 110, 146, and TW-9S) located near the proposed extraction zone, are also provided in Table 3.2 for reference. Based on these results, arsenic and phosphorus, the target compounds of this treatability work, are above their respective CVs. Sulfate and nitrate is also at or slightly above CV, but all other constituent values were below their corresponding CV. Parsons also analyzed the untreated groundwater sample for a list of common volatile organic compounds (VOCs). These results are not shown here, as only two compounds, toluene and trichloroethene were detected at trace values. The full list of VOC analytical results are included in the laboratory data sheets included in Attachment E.

**Table 3.1**
**SUMMARY OF ARSENIC SPECIATION LABORATORY RESULTS**

| Analyte (µg/l) | 405 Comp | 405 Comp Dup |
|---|---|---|
| As (III) | 0.068 | 0.053 |
| As (V) | 40.7 | 40.8 |
| Inorganic Arsenic | 40.8 | 40.9 |

Note: 405 Comp is an aliquot of the composite sample from the 72 HR pump test (collected 5/10/2014) and was submitted to ALS 6/4/2014.

## Table 3.2
## SUMMARY OF GROUNDWATER LABORATORY RESULTS

| Parameter | Comparative Value (CV)** | Average of Wells 110, 146, and TW-9S [1] | 72 HR COMP, MWH [2] | Raw Water, Parsons [3] |
|---|---|---|---|---|
| **Field Parameters** | | | | |
| pH (pH Units) | 6.5 - 8.5 (2nd) | 7.01 | 7.11 | - |
| Spec. Conductance (µhmos/cm) | NA | 1,521 | 1,618 | - |
| Temperature (degrees Celsius) | NA | 16.1 | 17.04 | - |
| Turbidity (NTU) | NA | 2.9 | - | - |
| **General Chemistry (mg/l)** | | | | |
| Alkalinity (as $CaCO_3$) | NA | - | - | 334 |
| Chloride (as Cl) | 250 (2nd) | 136 | 240 | - |
| Cyanide | 0.2 | <0.0.10 | 0.043 | - |
| Fluoride | 4 | 0.3 | 0.17 | - |
| Nitrogen, Ammonia (as N) | NA | 0.17 | 0.41 | - |
| Nitrogen, Nitrate (as N) | 10 | 6.6 | 11 | - |
| Sulfate as ($SO_4$) | 250 (2nd) | 168 | 250 | - |
| **Metals (µg/l)** | | | | |
| Antimony | 6 | - | - | 0.25 |
| Arsenic | **10** | **30** | **52.7** | **53.8** |
| Beryllium | 4 | - | - | <0.2 |
| Cadmium | 5 | <5 | <10 | 0.065 |
| Chromium | 100 | - | - | 0.62 |
| Chromium (VI) | NA | - | - | <10 |
| Copper | 1,300 (TT) | <13 | 29 | 3.2 |
| Iron | 300 (2nd) | - | 67 | - |
| Lead | 15 (TT) | <3 | <20 | 0.34 |
| Mercury | 2 | <0.2 | <0.2 | <0.2 |
| Nickel | 730 | <40 | <80 | 3.2 |
| Total Phosphorus | **300 (RG)** | **2,540** | **3,210** | **3,600** |
| Ortho Phosphorus | NA | - | - | 3,000 |
| Potassium | NA | 43,400 | 79,400 | - |
| Selenium | 50 | 12 | <40 | 15 |
| Silver | 100 (2nd) | <5 | <20 | <0.5 |
| Sodium | NA | - | 98,100 | - |
| Thallium | 2 | - | - | 0.17 |
| Zinc | 5,000 (2nd) | 1 | 42 | 45.8 |

**CVs are National Primary Drinking Water Regulation Maximum Contaminant Levels (MCLs), except as noted:
2nd = Secondary Standard per National Secondary Drinking Water Regulations.
TT = Treatment Technique required if 10% of tap water samples exceed the action level listed.
RG = Remediation Goal set by the selected GW Remedy.

1. From Supplemental Feasibility Study Report, Table 7-4.
2. Composite sample from 72 HR pump test (collected 5/10/2014), as analyzed by ALS as part of the MWH Hydrogeologic Study Report, submitted to ALS on 5/22/2014.
3. Composite sample from 72 HR pump test (collected 5/10/2014), as analyzed as part of Parsons Treatability Study (Attachment E), submitted to Pace Analytical Services on 6/27/2014.

## 3.2 COAGULATION/FLOCCULATION RESULTS

### 3.2.1 Coagulant Type and Dose

Jar testing was performed using various doses of ferric chloride ($FeCl_3$) and aluminum sulfate ($Al_2(SO_4)_3$) in order to select an optimum coagulant type and coagulant dose. Dose-response curves for each coagulant, in terms of arsenic and phosphorus removal, are presented in Figure 3.1. Curves labeled '$Al_2(SO_4)_3$' and '$FeCl_3$' were generated by Step 1 of FLS testing, with the exception of 60 and 70 mg/l doses of $Al_2(SO_4)_3$, which were generated in Step 2 using mixing scheme $M_2$. The curve labeled '$FeCl_3$ + Polymer' was generated by Parsons testing with samples at a pH of 7.5 and with 1 mg/l of anionic polymer. Parsons conducted additional testing at doses 116, 232, and 349 mg/l as $FeCl_3$ (40, 80, and 120 mg/l as Fe), both with and without the added 1 mg/l polymer. This data is not presented in Figure 3.1, but supports the observation that polymer addition results in slightly greater removal of both arsenic and phosphorus.

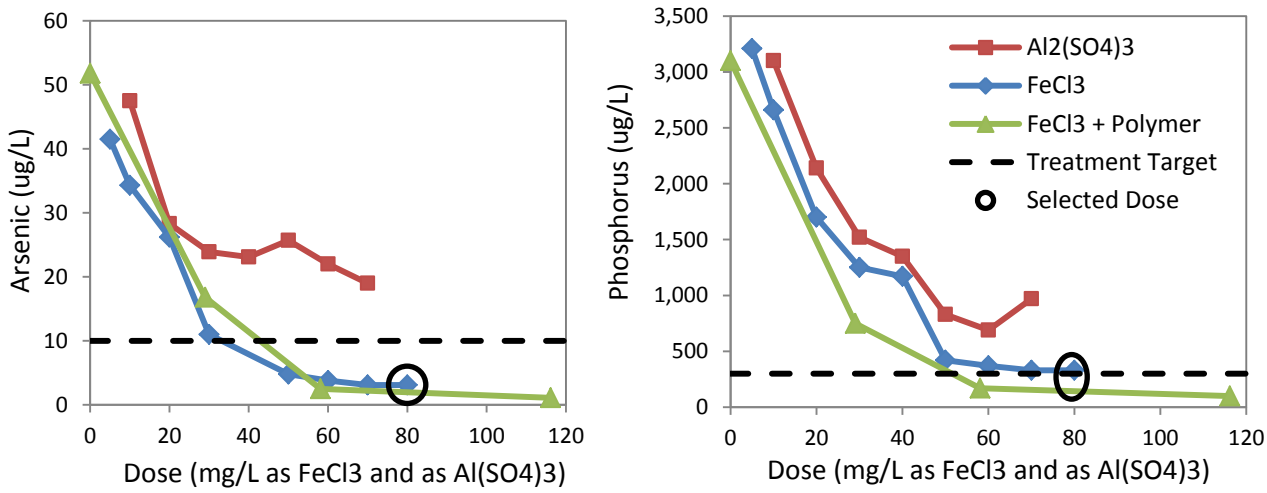


***Figure 3.1: Arsenic and Phosphorus Removal with Varying Coagulants and Doses***

Based on these results, ferric chloride is more effective than aluminum sulfate in removing arsenic and phosphorus from the studied groundwater. The 1 mg/of anionic polymer added to ferric chloride doses generally increased the effectiveness of the ferric dose, particularly in terms of phosphorus removal. In addition to the improvement in phosphorus removal, the 1 mg/l polymer dose also significantly decreased sludge setting time, final settled sludge volume, and supernatant turbidity. It is also expected that polymer addition will aid in sludge dewatering.

Both the arsenic and phosphorus treatment goals were met using 58 mg/l as $FeCl_3$ (20 mg/l as Fe) with 1 mg/l of anionic polymer. Based on these results, ferric chloride with a flocculation aiding polymer was determined to be the most effective coagulant type tested, and 80 mg/l as $FeCl_3$ (27.5 mg/l as Fe) plus 1 mg/l anionic polymer was selected as the optimum dose.

### 3.2.2 Mixing Energy

Three different mixing schemes were tested to determine the effect of various mixing times and speeds on the coagulation/flocculation process (Step 2 tasks performed by FLS). Arsenic and phosphorus removal using each mixing scheme tested (i.e., '$M_1$', '$M_2$, and '$M_3$') are presented in Figure 3.2. Only minor differences were observed among each of the mixing schemes, with $M_1$ performing slightly better in terms of arsenic removal. These results suggest that flocculation energy has a relatively small effect on arsenic and phosphorus removal for this application.

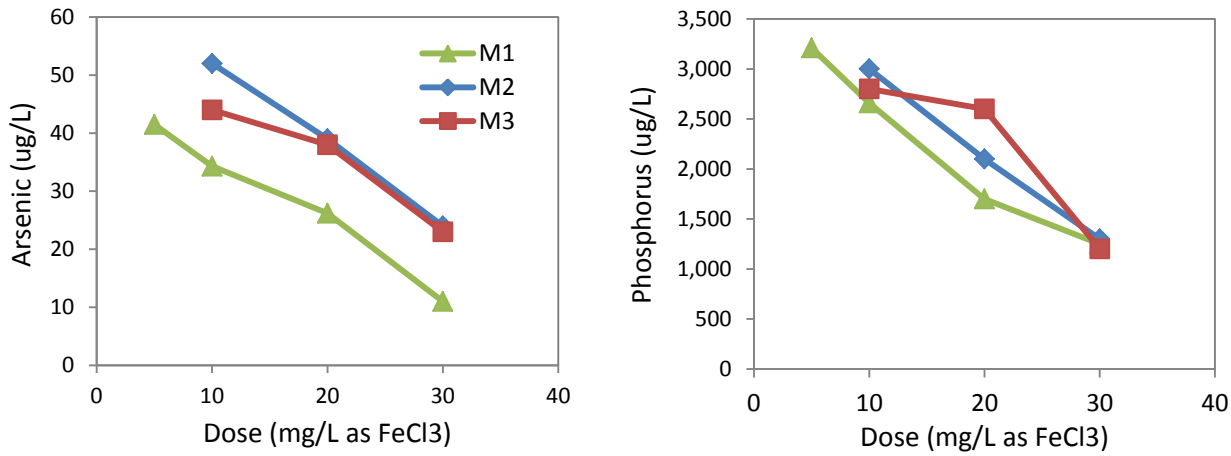


***Figure 3.2: Arsenic and Phosphorus Removal with Varying Mixing Schemes***

### 3.2.3 pH Adjustments and Buffering Capacity

Groundwater samples were adjusted to various pH set points in order to determine the change in effectiveness of the coagulation/flocculation process with varying pH. Results from jar tests conducted at pH set points of 8 (unadjusted), 7, and 6 are presented in Figure 3.3. The curve labeled 'pH 8' was generated in Step 1 of FLS testing and represents an unadjusted sample (the measured pH of the bulk groundwater sample was 7.93 at the time of testing). Data for pH set points of 7, 6, and 5 were generated in Step 3b of FLS testing. The curve for pH set point 5 is not shown on figure 3.3, as no significant removal of arsenic or phosphorus was observed at a pH of 5, due to the lack of ferric hydroxide precipitation at this low pH. Parsons also generated data for pH set points of 7.5 and 9. This data is not presented in Figure 3.3, as FLS data was generated using ferric doses without a polymer addition and Parsons data was generated using ferric doses with polymer addition. Arsenic and phosphorous removal was very similar at pH 7.5 and 9, based on Parsons' results, as presented in Attachment E.

Very little difference in arsenic and phosphorus removal was observed at the various set points tested, with the exception of pH 5, where no significant removal was observed. The tested ferric coagulation process is effective across a wide pH range of 6 to 9, with minimal variance in

treatability across this range. As such, there is little to no benefit in adjusting the pH of the groundwater upstream of the coagulation/flocculation process if influent water is between pH 6 and 9.

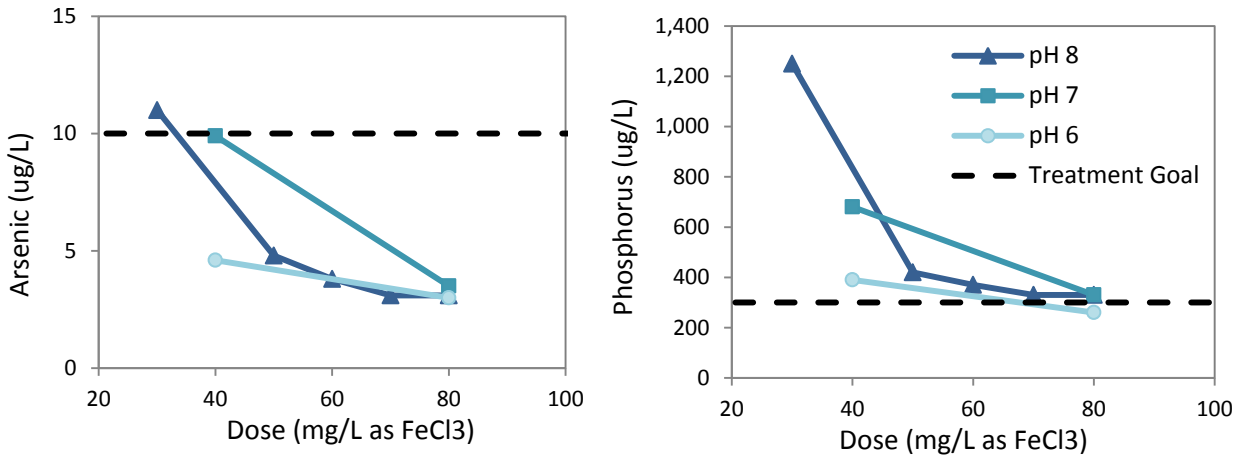


***Figure 3.3: Arsenic and Phosphorus Removal with Varying pH***

Based on triplicate alkalinity titrations conducted by Parsons, the groundwater contains 330 mg/l as $CaCO_3$ of alkalinity, suggesting a sufficient buffering capacity (i.e., capacity to buffer against changes in pH). Based on Step 4 of FLS testing, the pH of the groundwater decreased from 8.28 to an average of 7.01 (based on an average of 10 jars) after being dosed with 80 mg/l $FeCl_3$. As such, the addition of the ferric chloride at the selected optimum dose will not lower the pH of the groundwater to an unacceptably low level and additional alkalinity will not need to be added to the groundwater as part of the proposed treatment process.

### 3.2.4 Filtration Testing

Step 3 of FLS testing involved evaluating the effect of direct filtration against settling (i.e., sedimentation). Tests were conducted using doses of 20 and 40 mg/l as $FeCl_3$. One jar of each dose was successively filtered through 25, 8, and then 1.2 µm nominal pore size filters immediately after the slow mix flocculation period ended (i.e., no settling time prior to filtration). An identical jar at each tested dose was allowed to settle for 40 minutes prior to collecting a supernatant sample. Turbidity readings recorded in the lab, as well as arsenic and phosphorus concentrations for the post-settling supernatant sample and filtrate samples collected after the sampled passed through each filter size are presented in Table 3.3. Results generated from the samples dosed with 20 mg/l as $FeCl_3$ are not presented, as significant arsenic and phosphorus removal was not observed at this dose.

**Table 3.3**
**SUMMARY RESULTS FOR DIRECT FILTATION TESTING**

| | | Turbidity (NTU) | As (ug/l) | P (ug/l) |
|---|---|---|---|---|
| Settling (40 min) | | 0.42 | 11 | 1,170 |
| Direct Filtration (No Settling) | Unfiltered | 10.8 | 53 | 3,200 |
| | 25 µm | 10.6 | 46 | 3,200 |
| | 8 µm | 9.83 | 43 | 3,000 |
| | 1.2 µm | 1.09 | 10 | 660 |

Based on these results, a significant reduction in turbidity and arsenic and phosphorus concentrations was only observed after filtration with a 1.2 µm equivalent pore size filter, suggesting that the majority of the floc particles formed passed through the 8 µm equivalent pore size filter. The settled sample and the 1.2 µm filtrate sample were fairly similar, with the exception of a significantly lower concentration of phosphorous measured in the 1.2 µm filtrate sample. These results suggest that direct filtration is comparable, or potentially marginally more effective as a solid-liquid separation technique, compared to sedimentation (i.e., settling) only. However, based on these results, fairly small equivalent pore size filters would be required to effectively remove the small floc particles (or other measures would need to be taken in attempt to form larger floc particles).

Parsons conducted a task to observe the effect of filtration after sedimentation (based on a 30 minute settling period). Based on the results (presented in Attachment E), filtration of supernatant using a 1.5 µm equivalent pore size filter suggests no significant additional removal of target parameters compared to sedimentation only. These results suggest that sedimentation will be sufficient for solid-liquid separation for the proposed treatment process and that additional filtration will not be necessary.

## 3.3 TREATED WATER QUALITY

A summary of the laboratory result for the composite treated water sample collected from 10 identical jars conducted as part of the Step 4 task conducted by FLS is provided in Table 3.4. These testing conditions are expected to be similar to those used in the full scale treatment process (coagulant dose of 80 mg/L as $FeCl_3$), with the exception that a polymer was not used. It should be noted that the total phosphorus concentration presented in Table 3.4 slightly exceeds the treatment goal of 300 µg/l. Based on the results presented above, it is expected that with the addition of a polymer the phosphorus concentration in the treated water at this coagulation dose will be less than 170 µg/l (concentration of phosphorus using a dose of 58 mg/L as $FeCl_3$ with 1 mg/l of anionic polymer).

**Table 3.4**
**SUMMARY OF TREATED WATER LABORATORY RESULTS**

| Parameter | Comparative Value (CV)** | Treated WQ[1] |
|---|---|---|
| **General Chemistry (mg/l)** | | |
| Chloride (as Cl) | 250 (2nd) | 250 |
| Cyanide | 0.2 | 0.0234 |
| Fluoride | 4 | <0.30 |
| Nitrogen, Ammonia (as N) | NA | 0.34 |
| Nitrogen, Nitrate (as N) | 10 | 10 |
| Sulfate as ($SO_4$) | 250 (2nd) | 230 |
| **Metals (ug/l)** | | |
| Arsenic | 10 | 4.6 |
| Cadmium | 5 | <0.15 |
| Copper | 1,300 (TT) | 3.4 |
| Lead | 15 (TT) | <0.45 |
| Mercury | 2 | 0.068 |
| Nickel | 730 | 27 |
| Total Phosphorus | 300 (RG) | 350 |
| Potassium | NA | 85,000 |
| Selenium | 50 | 14 |
| Silver | 100 (2nd) | <0.33 |
| Zinc | 5,000 (2nd) | 12 |

**CVs are National Primary Drinking Water Regulation Maximum Contaminant Levels (MCLs), except as noted:
2nd = Secondary Standard per National Secondary Drinking Water Regulations.
TT = Treatment Technique required if 10% of tap water samples exceed the action level listed.
RG = Remediation Goal set by the selected GW Remedy.
1. Supernatant sample of jars treated using optimum treatment conditions (except without polymer) as collected by FLS and analyzed by ALS.

## 3.4 SLUDGE CHARACTERIZATION

Laboratory results generated by both FLS and Parsons for TCLP analysis of the generated sludge for RCRA 8 metals are presented in Table 3.5. Barium was the only RCRA 8 metal detected and is at a concentration less than 1% of the TCLP threshold. As such, the dewatered sludge is expected to be fit for disposal as non-hazardous waste at a municipal landfill contingent upon it passing the paint filter test (typically 10-16% solids by dry weight).

The gravimetric analysis of solids retained on a 1.2 µm equivalent pore size filter for sludge generated in step 4 tasks of FLS testing resulted in 68.5 mg of dry solids per liter of treated water (this does not include polymer addition, which would be expected to add roughly 1 mg of dry solids per liter of treated water). This solids production correlates to roughly 500 lbs of dry solids produced per day at a full-scale treatment flow rate of 600 gpm. The settled sludge can be observed in the jars testing photographs included as Attachment F.

**Table 3.5**
**SLUDGE TCLP ANALYTICAL RESULTS FOR RCRA-8 METALS**

| Parameter | TCLP Threshold (mg/l) | Parsons (mg/l) | FLSmidth (mg/L) |
|---|---|---|---|
| Arsenic | 5 | <0.1 | <0.3 |
| Barium | 100 | 0.58 | 0.199 |
| Cadmium | 1 | <0.015 | <0.010 |
| Chromium | 5 | <0.05 | <0.020 |
| Lead | 5 | <0.05 | <0.10 |
| Mercury | 0.2 | <0.6 | <0.2 |
| Selenium | 1 | <0.1 | <0.3 |
| Silver | 5 | <0.05 | <0.02 |

# 4.0 CONCLUSIONS

The following list summarizes the results of the treatability testing tasks and the associated conclusions regarding how each result is expected to impact the treatment process design:

- Inorganic arsenic present in the groundwater is >99% oxidized (i.e. is present as As(V)). Therefore an oxidation treatment process is not need to be included upstream of the coagulation process.
- Coagulation dose-response curves produced expected trends for As and P removal, and results generated independently by FLS and Parsons are in good agreement.
- Ferric chloride is more effective than aluminum sulfate at reducing the concentration of both arsenic and phosphorus for this application.
- A ferric does of 80 mg/L $FeCl_3$ (27.5 mg/L as Fe) will sufficiently lower the concentration of both arsenic and phosphorus to levels below the respective treatment goals of 10 µg/l and 300 µg/l, with the aid of a roughly 1 mg/L anionic flocculation polymer.
- Based on testing of various mixing schemes, the coagulation/flocculation process tested is not highly sensitive to variations in flocculation energies. A rapid mix rate that correlates with 90 to 200 rpm at jar testing bench scale is sufficient for the rapid mix stage. Flocculation mixing energies should be designed according to the selected equipment and should be optimized at plant startup
- The tested ferric coagulation process is effective across a wide pH range of 6 to 9, with minimal variance in treatability across this range. As such, the pH of the groundwater should be adjusted upstream of the coagulation/flocculation process.
- The subject groundwater contains a sufficient pH buffering capacity and it is not expected that additional alkalinity will need to be added to maintain an optimal pH range of 6 to 8 in the process effluent.
- Direct filtration would require a fairly small nominal particle size filter or additional measures to increase size and strength of floc.
- Sedimentation alone results in sufficient solid-liquid separation for the proposed treatment process; filtration is not necessary to meet treatment goals.
- Using the selected ferric chloride dose of 80 mg/l as $FeCl_3$ with 1 mg/l anionic polymer, the treated water will meet all treatment goals for discharge to the on-site infiltration/evaporation basin.
- The sludge generated from the coagulation/flocculation treatment process was below toxicity characteristic thresholds for RCRA 8 metals, and as such is fit for disposal as non-hazardous waste at a municipal landfill after being dewatered to a solids concentration great enough to pass the paint filter test (typically 10-16% solids by dry weight).

- A very low suspended solids concentration is expected in the influent groundwater stream. As such, sludge generated from the treatment process is expected to be composed primarily of ferric hydroxide ($Fe(OH)_3$). This should be considered in designing the sludge conditioning and dewatering process.

# Attachment A

# Regulatory Agency Comments on TS Work Plan

# Technical Review of the Bench-Scale Treatability Study Work Plan, Groundwater Remedial Design for the FMC OU dated May 23, 2014

Reviewed by: Scott Miller, Idaho Dept. of Environmental Quality

Date: June 4, 2014

## General Comments

1. The results of the bench-scale treatability study needs to be reproducible. A section of the work plan should describe how the proposed study will demonstrate reproducibility of jar test results as there are no duplicate tests proposed.

## Specific Comments

<u>Section 3.1, Step 1: Dose Optimization, page 4</u>

1. The final paragraph on this page states the optimum dose will be selected as the minimum dose where an increase in dose does not result in a significant increase in arsenic removal. Include a description of how a signification increase will be determined.

<u>Attachment B, Section B.2.1, Bench Notes, page B-1</u>

2. Replace 'should' with "*will*" in each paragraph in this section.

<u>Attachment B. Section B.3.1, Liquid and Solid Sampling Procedures, page B-2</u>

3. Clarify why only untreated water samples are to be analyzed for As(III) and As(V), the reason for the speciation of arsenic, and why untreated water samples will not be analyzed for the entire suite of analytes run for the Step 4 treatment. This should also be addressed in the main body of the work plan.

## Rob Hartman

**From:** Barbara Ritchie <BARBARA.RITCHIE@fmc.com>
**Sent:** Monday, June 09, 2014 6:47 AM
**To:** Rob Hartman; Marc Bowman; Chad Tomlinson; Marguerite Carpenter; Michael Steiner; David Heineck
**Subject:** FW: GW Bench Treatability Study work plan

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**From:** Barbara Ritchie
**Sent:** Monday, June 09, 2014 8:46 AM
**To:** 'Kelly Wright'; Rochlin, Kevin
**Cc:** Williams, Jonathan; Douglas.Tanner; Greutert, Ed [USA]; Scott Miller; Stifelman, Marc; susanh@ida.net; Zavala, Bernie
**Subject:** RE: GW Bench Treatability Study work plan

Per the Extraction Zone Hydrogeologic Study Work Plan (EZHWP), the 72-hour aquifer test composite sample was analyzed for the following metals: Arsenic, Cadmium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Zinc

The metals analyses of the extracted groundwater is consistent with the metal COCs in groundwater (As and Se) at the FMC OU and seven non-COC metals for comparison to the POTW pretreatment limits for those metals. Per the Bench-Scale Treatability Study Work Plan (TSWP), the step 4 filtrate will be analyzed for the same suite of metals as the untreated sample.

With respect to the filter cake analyses, as described in the work plan the filter cake analyses are for preliminary RCRA waste characterization; therefore, we are only interested in TCLP for the eight RCRA metals. Analyzing the filter cake for other metals does not provide any “decision-able” data.

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**From:** Kelly Wright [mailto:kwright@sbtribes.com]
**Sent:** Friday, June 06, 2014 1:28 PM
**To:** Barbara Ritchie; Rochlin, Kevin
**Cc:** Williams, Jonathan; Douglas.Tanner; Greutert, Ed [USA]; Scott Miller; Stifelman, Marc; susanh@ida.net; Zavala, Bernie
**Subject:** RE: GW Bench Treatability Study work plan

Kevin and Barbara, here are two comments from the Tribes that we would like considered.

1. FMC is estimating compliance with some metals based on water tests from 2006 through 2008 (See table 1). With the many various projects scheduled for the Eastern Michaud Flats Superfund Sites, FMC should conduct a new round of special sampling for all metals to determine concentrations today so we can fully evaluate the impacts from the FMC OU.
2. FMC has proposed to sample and analyze filter cakes for 8 RCRA metals, we would like it changed to state that filter cakes will be analyzed for all metals.

These two changes should aid in fully understanding the current groundwater conditions as we know today and be able to demonstrate whether or not treatability is working as planned.
Sorry for being late.
Thanks
Kelly

**From:** Barbara Ritchie [mailto:BARBARA.RITCHIE@fmc.com]
**Sent:** Wednesday, June 04, 2014 9:24 AM
**To:** Rochlin, Kevin
**Cc:** Williams, Jonathan; Douglas.Tanner; Greutert, Ed [USA]; Kelly Wright; Scott Miller; Stifelman, Marc; susanh@ida.net; Zavala, Bernie
**Subject:** RE: GW Bench Treatability Study work plan

Kevin – confirmed. EPA is always in the position of accepting or rejecting or providing further comments, but it won't be because holding times were exceeded. Based on a quick review of the DEQ's comments, these are items that can be addressed during preparation of the report on the bench treatability study results.

---

**From:** Rochlin, Kevin [mailto:rochlin.kevin@epa.gov]
**Sent:** Wednesday, June 04, 2014 10:53 AM
**To:** Barbara Ritchie
**Cc:** Rochlin, Kevin; Williams, Jonathan; Douglas.Tanner; Greutert, Ed [USA]; Kelly Wright; Scott Miller; Stifelman, Marc; susanh@ida.net; Zavala, Bernie
**Subject:** RE: GW Bench Treatability Study work plan

Barbara,

I just want to memorialize our conversation. As I informed you, FMC may proceed with the submitted plan to avoid holding time violations. However, because the plan has not been reviewed, FMC is taking a risk that EPA may not accept the data or that the data may not be useable for its intended purpose.

Kevin Rochlin

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**From:** Barbara Ritchie <BARBARA.RITCHIE@fmc.com>
**Sent:** Friday, May 23, 2014 11:57 AM
**To:** Rochlin, Kevin
**Cc:** Douglas.Tanner@deq.idaho.gov; Scott.Miller@deq.idaho.gov; 'Kelly Wright'; susanh@ida.net
**Subject:** GW Bench Treatability Study work plan

Please see attached.

Click here to report this email as spam.

# Attachment B

# Bench-Scale Treatability Study Work Plan

# Bench-Scale Treatability Study Work Plan
# Groundwater Remedial Design for the FMC OU
## May 26, 2014

## 1.0 INTRODUCTION/PURPOSE

In accordance with the Unilateral Administrative Order (UAO) for Remedial Design and Remedial and Remedial Action at the FMC OU and as described in the Remedial Design Work Plan, FMC is proceeding with bench-scale treatability testing is association with the remedial design (RD) for the groundwater remedial action for the FMC OU. This work plan describes the bench-scale treatability testing and laboratory analytical procedures to be followed to evaluate the effectiveness of various treatment process steps and provide guidance on design parameters for a groundwater treatment facility pursuant to the selected groundwater remedy treatment option B for the FMC OU.

MWH has retained FLSmidth (FLS) as a subcontractor to perform bench scale treatability testing to evaluate and optimize a coagulation/flocculation process and to evaluate an alternative lime softening process. FMC has also retained Parsons Treatability Lab (Parsons) as an independent testing firm. The coagulation/flocculation jar testing described in this work plan will also be performed by Parsons. ALS Laboratory, a NELAP accredited laboratory, will perform the laboratory analyses of all pre- and post-treatability test samples. The bench-scale treatability testing will be performed using the bulk groundwater samples collected during the 72-hour aquifer (pump) testing pursuant to the Extraction Zone Hydrogeologic Study Work Plan and thus this testing program will not involve any field work on site at the FMC OU.

The primary objective of the treatability testing is to determine the most appropriate coagulant type, coagulant dose, required mixing rates, and optimum pH to lower the arsenic level below the current EPA drinking water standard of 10 μg/L. The focus of the treatability study is arsenic due to the fact that arsenic is the primary risk-driving constituent in groundwater at the FMC OU and, as shown on Table 1, is the only constituent in the extracted groundwater that is expected to exceed its comparative value (CV). The treatability study will also evaluate removal of total phosphorus which, although there is no CV, will be reduced to a target level of 0.3 mg/L as described in the SFS Report.

The sludge produced during the treatability testing will be analyzed for RCRA-8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using the toxicity characteristic leaching procedure (TCLP) to determine whether the sludge will likely be characterized as hazardous or non-hazardous.

In summary, the tasks to be performed in support of the treatability study consist of the following:

- Analysis of raw groundwater to determine the characteristics of the water, with particular emphasis on measuring the concentrations of arsenic in its various valence states (i.e. As(III) and As(V))

**TABLE 1**
**Estimated Average Extracted Groundwater Quality Vs Comparative Values**

| PARAMETER | WELL-110 | WELL-146 | TW-9S | Average Concentration of Constituent | Comparative Value[1] |
|---|---|---|---|---|---|
| Sampling Event Date | 4thQ2006 thru 2ndQ2008 | 4thQ2006 thru 2ndQ2008 | 4thQ2006 thru 2ndQ2008 | | |
| **Field Measurements** | | | | | |
| pH (Field) | 6.86 | 7.11 | 7.06 | **7.01** | **6.5-8.5** |
| SC (UMHOS/CM) | 1429 | 1294 | 1842 | **1521.7** | **NA** |
| | | | | | |
| **General WQP (mg/L)** | | | | | |
| Potassium | 25.4 | 46.3 | 58.4 | **43.4** | **NA** |
| Sulfate | 215 | 128 | 161 | **168.0** | **250** |
| Chloride | 89.8 | 132 | 187 | **136.3** | **250** |
| Fluoride | 0.44 | 0.38 | 0.10 | **0.30** | **4.0** |
| Ammonia | 0.15 | 0.15 | 0.2 | **0.17** | **NA** |
| Nitrate | 3.8 | 6.13 | 9.95 | **6.63** | **10** |
| Orthophosphate/ Total Phosphorus | 3.09 | 1.33 | 3.21 | **2.54** | **NA** |
| | | | | | |
| **Metals (mg/L)** | | | | | |
| Arsenic | 0.048 | 0.029 | 0.027 | **0.03** | **0.01** |
| Cadmium | <0.0005 | <0.0005 | <0.0005 | **<0.0005** | **0.005** |
| Copper[2] | 0.0015 | <0.025 | 0.0011 | **0.001** | **1** |
| Cyanide[3] | <0.01 | 0.011 | <0.01 | **0.01** | **0.2** |
| Lead[2] | <0.003 | <0.003 | <0.003 | **<0.003** | **TT, 0.015** |
| Mercury[2] | <0.0002 | <0.0002 | <0.0002 | **<0.0002** | **0.0006** |
| Nickel[2] | <0.04 | <0.04 | <0.04 | **<0.04** | **0.73** |
| Silver[2] | <0.005 | <0.005 | <0.005 | **<0.005** | **0.1** |
| Selenium | 0.029 | 0.003 | 0.005 | **0.012** | **0.05** |
| Zinc[2] | 0.00036 | 0.0024 | 0.00037 | **0.001** | **5** |

[1] - The Comparative Values (CVs) are taken from Table 4.2-1 "Groundwater Representative Concentrations and Comparative Values" in the GWCCR, June 2009 Final. Comparative values are primary MCLs, treatment technology standards or secondary standards.

[2] - Results from November 2001 Special Groundwater sampling event.

[3] - Results from May 2008 Special Groundwater sampling event.

Yellow highlight indicates groundwater concentration exceeds CV.

- Bench-scale jar testing to determine the most appropriate coagulant, dosing rate, mixing rate, and pH required for effective removal of arsenic to below the current EPA drinking water standard of 10 μg/L, with a secondary goal to reduce total phosphorous levels
- Water quality characterization of the supernatant to measure treatment effectiveness
- Testing to determine the physical and chemical characteristics of the precipitate (e.g. sludge)

This work plan is primarily focused on testing procedures to optimize a coagulation/flocculation treatment process. FLS has proposed conducting additional bench-scale testing to evaluate the effectiveness of a lime softening process as an alternative to a coagulation/flocculation process. The methods for bench-scale testing of the lime softening process will be conducted according to FLS's standard procedures, and as such are not specified in this work plan.

## 2.0 GROUNDWATER SAMPLES

MWH will provide FLS and Parsons each with a minimum of 13 gallons (50 liters) of the bulk groundwater samples collected during the 72-hour aquifer (pump) testing pursuant to the Extraction Zone Hydrogeologic Study Work Plan (EZHP). As specified in the EZHP, a sample from the 72-hour composite bulk samples was submitted to ALS laboratory for analyses per the EZHP quality assurance project plan (QAPP) and Table 3-2 of the EZHP. Those validated analytical results will be utilized in this study as representing the raw (untreated) water quality.

## 3.0 JAR TESTING

Jar testing methods will generally conform to ASTM D2035-13 (Attachment A), except where stated differently in this work plan. Jar testing will be performed in batches of 5 jars, with each individual jar using 1 L of source water. Multiple batches of jar tests will be conducted to incrementally optimize dose, mixing scheme, and pH, as shown in Table 2.

**TABLE 2**
**Schedule of Jar Testing**

| Step | Coagulant Dose | Mixing | pH |
|---|---|---|---|
| 1 | Variable (Table 2) | $M_1$ (Table 3) | Not adjusted |
| 2 | Optimum from Step 1 | Variable (Table 3) | Not adjusted |
| 3 | Optimum from Step 1 | Optimum from Step 2 | 6, 7, 7.5, 8, and 9 |

Jar testing will be conducted using the following chemical coagulants:

- Ferric Chloride ($FeCl_3$)
- Aluminum sulfate (Alum; $Al_2(SO_4)_3$)

A concentrated stock solution of each coagulant type should be freshly made or obtained prior to conducting jar testing. The volume of stock solution required to achieve the desired coagulant dose for a 1 L total sample volume should be calculated for each coagulant dose.

All testing should be conducted with the source water at 60±5 degrees F, the expected temperature that the groundwater will enter the full scale treatment process. Water temperature should be measured and recorded (from an individual jar, not from the bulk sample) for each set of jar tests conducted.

Visual observations should be recorded throughout each batch of jar testing, including observations regarding the timing of floc formation, size of floc, and settling rate.

### 3.1 Step 1: Dose Optimization (minimum of two batches of 5 jars = 10 L)

Using the mixing scheme $M_1$ shown in Table 3 and without adjusting the pH of the source water, test 5 separate jars (for each coagulant) with each coagulant dose presented in Table 3. If sufficient flocculation is not observed at the highest proposed dose of 40 mg/L, an additional batch of jars should be tested with higher doses (i.e., 50 mg/L, 60 mg/L, etc.) until sufficient floc formation is observed.

**TABLE 3**
**Proposed Coagulant Doses**

| Coagulant Dose (mg/L as $FeCl_3$ or mg/L as $Al_2(SO_4)_3$) |
|---|
| 5 |
| 10 |
| 20 |
| 30 |
| 40 |

Once the slow mixing has ended, a turbidity reading should be collected every 5 minutes from each jar in order to measure the floc settling rate. Turbidity samples should be collected using a pipette or sampling port to draw a supernatant sample from roughly half of the total sample depth, and should be measured immediately using a turbidimeter. These measurements should be taken until 20 minutes after commencement of the slow mix period (i.e., a total of 4 turbidity measurements per jar). At the discretion of the engineer or technician performing the testing, additional turbidity measurements (beyond 20 minutes) may be beneficial.

At 20 minutes after the commencement of slow mixing, a 30 mL supernatant sample should be collected from each jar for supernatant water quality analysis, as presented in Section 4. The pH of this sample should also be measured and recorded.

Once the Step 1 jar testing is complete and analytical results for the supernatant samples are reviewed, an optimum coagulant dose will be selected based on measured As removals. The optimum does will be selected as the minimum dose where an increase in dose does not result in a significant increase in As removal.

### 3.2 Step 2: Mixing Optimization (2 batches of 4 jars = 8 L)

Each batch of Step 2 testing will use 4 jars; two jars will be dosed with $FeCl_3$ and two will be dosed with $Al_2(SO_4)_3$. The optimum dose (determined in Step 1) and the next lowest dose will be used for each coagulant type. Two doses are used for each coagulant type in order to better compare the effect of various mixing schemes on floc formation and setting rate.

Without adjusting the source water pH, test the two remaining mixing schemes presented in Table 4 (i.e., $M_2$ and $M_3$). The purpose of the step is to compare the effectiveness of various mixing schemes.

**TABLE 4**
**Mixing Schemes**

| Mixing Scheme | Rapid Mix | | Slow Mix 1 | | Slow Mix 2 | |
|---|---|---|---|---|---|---|
| | *Minutes* | *rpm* | *Minutes* | *rpm* | *Minutes* | *rpm* |
| $M_1$ | 1 | 100 | 30 | 45 | - | - |
| $M_2$ | 1 | 100 | 15 | 45 | 15 | 20 |
| $M_3$ | 0.5 | 100 | 15 | 45 | 15 | 20 |

Again, collect turbidity readings from each jar every 5 minutes over a 20 minute setting period to measure the setting rate. Collect a 30 mL supernatant sample from each jar at the end of the 20 minute setting period, measure the pH of each sample, and submit the sample for As and Total phosphorous water quality analysis.

Out of the three mixing schemes tested, the optimum mixing scheme will be selected for each coagulant type based on the measured turbidity and As removal after the 20 minuet setting period as well as the overall turbidity profile (i.e., setting rate).

### 3.3 Step 3: pH Optimization (2 batches of 5 jars = 10 L)

Using the optimum dose selected in Step 1 and the optimum mixing scheme selected in Step 2, test the effect of variable pH on coagulant/flocculation. Use NaOH to increase pH and HCl to decrease pH of the source water to 5 separate pH target points of: 6, 7, 7.5, 8, and 9. Each pH should be within ±0.10 pH units of the target prior to beginning the jar testing.

Again, collect turbidity readings from each jar every 5 minutes over a 20 minute setting period to measure the setting rate. Collect a 30 mL supernatant sample from each jar at the end of the 20 minute setting period, measure the pH of each sample, and submit the sample for As and total phosphorous water quality analysis.

### 3.4 Step 4: Optimum Conditions (2 batches of 5 jars = 10 L)

In order to determine the reproducibility of treatment at the optimum conditions determined by Steps 1 through 3, and also to generate a sufficient volume of sludge for solids analysis, 5 jars will be run using the optimum dose, mixing, and pH for each of the coagulants. If it is clear that one coagulant greatly outperforms the other, this step may only be conducted for one of the coagulants.

At the end of the 20 minute setting period, a 30 mL sample should be collected from each jar, and a 2 L composite sample should be collected using 400 mL from each of the 5 jars.

The jars should then be left undisturbed beyond the 20 minute setting period, until no additional setting is observed. The remaining supernatant should then be decanted from each jar, without disturbing the sludge blanket at the bottom of the jar.

The mass of solids generated per volume of treated water should also be measured and recorded for the each type of coagulant. This may be achieved by drying (at 105 degrees C) and weighing a measured portion (i.e., percent volume) of the resulting sludge (preferably prior to filterability testing).

Filterability testing should be conducted on the decanted sludge (sludge from each of the 5 jars can be combined into 1 bulk sludge sample). Filter testing methods are left to the discretion of FLS and Parsons, depending on the bench scale filter testing equipment available. This testing may include an analysis of particle size distribution and/or performance of leaf-filter testing.

The remaining filter cake from the treatability testing should be collected and submitted for laboratory analysis, as described in Section 4.

## 4.0 LABORATORY ANALYSIS

The liquid and solid samples collected during the treatability study will be analyzed at ALS, a NELAP-accredited analytical laboratory. Sample collection, submission, and analysis will be conducted according to the attached Quality Assurance Project Plan (Attachment B) and as summarized below.

### 4.1 Water Quality Analysis

All 30 mL treated water (supernatant) samples collected as part of the Step 1 through 4 testing (anticipated total of 38 samples) will be submitted for laboratory analysis of As and total phosphorous. The 30 mL supernatant samples will be submitted for analysis immediately after each step of jar testing is complete, and a 2-day turnaround time will be requested, so that analytical results can be reviewed prior to moving on to the next step of jar testing.

Each of the 2 L composite supernatant samples (maximum of 2) collected as part of the Step 4 treatment testing will be submitted for a more extensive list of water quality parameters, as described in Attachment B.

### 4.2 Solids Analysis

For the Step 4 testing of each coagulant type, the filter cake remaining from the treatability testing should be collected and submitted for laboratory analysis of RCRA-8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) using the toxicity characteristic leaching procedure (TCLP) to determine whether the sludge is characterized as hazardous or non-hazardous

and whether it will require special disposal. A minimum sample size of 100 g is required for this procedure.

The mass of solids generated per volume of treated water should also be measured and recorded for the each type of treatment (i.e., including softening) and each type of coagulant, under optimum conditions.

## 5.0 DATA AND REPORTING

All data collected during this bench-top treatability study for the groundwater remedy will be retained by FMC and/or its contractors consistent with the records retention requirements under the UAO. The data and analytical laboratory results collected in direct support of this bench-top treatability study will be reported to EPA in the Groundwater Remedy Preliminary (30%) Design Submittal that is scheduled for submittal in December 2014 per the Groundwater RD/RA Preliminary Schedule (Rev. 5.2) submitted with the April 2014 UAO monthly report.

# ATTACHMENT A

## ASTM D2035-13: STANDARD PRACTICE FOR COAGULATION-FLOCCULATION JAR TEST OF WATER

Designation: D2035 – 13

# Standard Practice for Coagulation-Flocculation Jar Test of Water[1]

This standard is issued under the fixed designation D2035; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This practice covers a general procedure for the evaluation of a treatment to reduce dissolved, suspended, colloidal, and nonsettleable matter from water by chemical coagulation-flocculation, followed by gravity settling. The procedure may be used to evaluate color, turbidity, and hardness reduction.

1.2 The practice provides a systematic evaluation of the variables normally encountered in the coagulation-flocculation process.

1.3 The values stated in SI units are to be regarded as standard.

1.4 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1129 Terminology Relating to Water
D1193 Specification for Reagent Water
D1293 Test Methods for pH of Water
D3370 Practices for Sampling Water from Closed Conduits
D6855 Test Method for Determination of Turbidity Below 5 NTU in Static Mode
D7315 Test Method for Determination of Turbidity Above 1 Turbidity Unit (TU) in Static Mode

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice, refer to Terminology D1129.

## 4. Summary of Practice

4.1 The coagulation-flocculation test is carried out to determine the chemicals, dosages, and conditions required to achieve optimum results. The primary variables to be investigated using the recommended practice include, but are not limited to:

4.1.1 Chemical additives,
4.1.2 pH,
4.1.3 Temperature, and
4.1.4 Order of addition and mixing conditions.

## 5. Significance and Use

5.1 This practice permits the evaluation of various coagulants and coagulant aids used in the treatment of water and waste water for the same water and the same experimental conditions.

5.2 The effects of concentration of the coagulants and coagulant aids and their order of addition can also be evaluated by this practice.

## 6. Interferences

6.1 There are some possible interferences that may make the determination of optimum jar test conditions difficult. These include the following:

6.1.1 *Temperature Change (During Test)*—Thermal or convection currents may occur, interfering with the settling of coagulated particles. This can be prevented by temperature control.

6.1.2 *Gas Release (During Test)*—Flotation of coagulated floc may occur due to gas bubble formation caused by mechanical agitator, temperature increase or chemical reaction.

6.1.3 *Testing-Period*— Biological activity or other factors may alter the coagulation characteristics of water upon prolonged standing. For this reason the period between sampling and testing should be kept to a minimum, with the time being recorded.

## 7. Apparatus

7.1 *Multiple Stirrer*— A multiposition stirrer with continuous speed variation from about 20 to 150 rpm should be used. The stirring paddles should be of light gage corrosion-resistant material all of the same configuration and size. An illuminated base is useful to observe the floc formation. Precautionary

[1] This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.03 on Sampling Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

Current edition approved Jan. 1, 2013. Published February 2013. Originally approved in 1964. Last previous edition approved in 2008 as D2035 –08. DOI: 10.1520/D2035-13.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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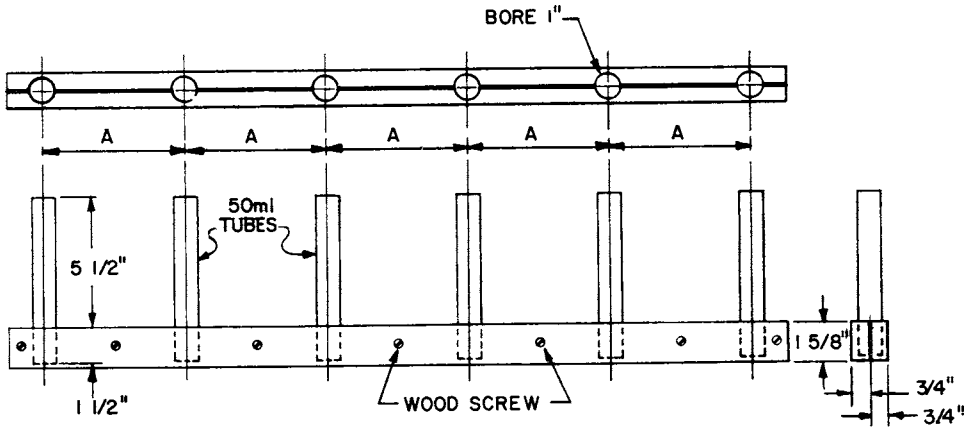


A = ℄ Distance between jars in multiple stirrer apparatus (6" for a Phipps-Bird)

TUBES - 1" x 7" 50ml Color Comparator Type

RACK - Oak 3/4" x 1-5/8"

**FIG. 1 Reagent Rack for Multiple Stirrer Jar Test Apparatus**

measures should be taken to avoid heat being imparted by the illumination system which may counteract normal settling.

7.2 *Jars (or Beakers)*, all of the same size and shape; 1500-mL Griffin beakers may be used (1000-mL recommended minimum size).

7.3 *Reagent Racks*— A means of introducing each test solution to all jars simultaneously. There should be at least one rack for each test solution or suspension. The racks should be similar to that shown in Fig. 1.

## 8. Reagents

8.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available.[3] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.2 *Purity of Water*—Reference to water that is used for reagent preparation, rinsing or dilution shall be understood to mean water that conforms to the quantitative specifications of Type IV reagent water of Specification D1193.

8.3 The following chemicals and additives are typical of those used for test solutions and suspensions. The latter, with the exception of coagulant aids, may be prepared daily by mixing chemicals with water to a concentration of 10 (±0.1) g/L (1.0 mL of test solution or suspension when added to 1 L of sample is equivalent to 10 mg/L):

Prime Coagulants
- Alum[$Al_2(SO_4)_3 \cdot 18H_2O$]
- Ferric sulfate [$Fe_2(SO_4)_3 \cdot xH_2O$]
- Ferric chloride ($FeCl_3 \cdot 6H_2O$)
- Ferrous sulfate ($FeSO_4 \cdot 7H_2O$)
- Magnesium carbonate ($MgCO_3 \cdot 3H_2O$)
- Sodium aluminate ($NaAlO_2$)

Coagulant Aids
- Activated silica
- Anionic (polyelectrolyte)
- Cationic (polyelectrolyte)
- Nonionic Polymer

Oxidizing Agents
- Chlorine ($Cl_2$)
- Chlorine dioxide ($ClO_2$)
- Potassium permanganate ($KMnO_4$ )
- Calcium hypochlorite [$CaCl(ClO) \cdot 4H_2O$]
- Sodium hypochlorite (NaClO)

Alkalis
- Calcium carbonate ($CaCO_3$)
- Dolomitic lime (58 % CaO, 40 % MgO)
- Lime, hydrated [$Ca(OH)_2$]
- Magnesium oxide (MgO)
- Sodium carbonate ($Na_2CO_3$)
- Sodium hydroxide (NaOH)

Weighting Agents
- Bentonite
- Kaolin
- Other clays and minerals

Miscellaneous
- Activated carbon (powdered)

8.4 *Coagulant Aids*— There are numerous commercially available coagulant aids or polyelectrolytes. All polyelectrolytes are classified anionic, cationic or nonionic, depending upon their composition. These aids may have the ability to produce large, tough, easily-settled floc when used alone or in conjunction with inorganic coagulants. A small dosage (under 1 mg/L) may permit a reduction in the dosage of, or complete elimination of, the coagulant. In the latter case, the polyelectrolyte would be considered the prime coagulant rather than a coagulant aid. Aids come in powdered and liquid form. Powdered aids should be prepared as 0.1 % solutions with appropriate aliquots to provide proper dosage. Always add

[3] *Reagent Chemicals, American Chemical Society Specifications* , American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.



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powdered aids to the dissolving water rather than the reverse, and add slowly to the shoulder of a vortex created by stirring. If a vortex is not formed, the dry powder will merely collect on the surface of the water in gummy masses and become very difficult to dissolve. Dissolving time may vary from several minutes to several hours. Suggested manufacturers' procedures for wetting, dissolving, and storing should be followed when available. Liquid forms can be readily prepared to the above strength without difficulty.[4]

## 9. Sampling

9.1 Collect the water sample under test in accordance with the applicable Practices D3370.

## 10. Procedure

10.1 Measure equal volumes (1000 mL) of sample into each of the jars or 1500-mL Griffin beakers. As many sample portions may be used as there are positions on the multiple stirrer. Locate beakers so that the paddles are off-center, but clear the beaker wall by about 6.4 mm (¼ in.). Record the sample temperature at the start of the test.

10.2 Load the test chemicals in the reagent racks. Use one rack for each series of chemical additions. Make up each tube in the rack to a final volume of 10 mL, with water, before using. There may be a situation where a larger volume of reagent will be required. Should this condition prevail, fill all tubes with water to a volume equal to the largest volume of reagent in the reagent rack. When adding slurries, it may be necessary to shake the rack to produce a swirling motion just prior to transfer.

10.3 Start the multiple stirrer operating at the "flash mix" speed of approximately 120 rpm. Add the test solution or suspensions, at predetermined dosage levels and sequence. Flash mix for approximately 1 min after the additions of chemicals. Record the flash mix time and speed (rpm).

10.4 Reduce the speed as necessary to the minimum required to keep floc particles uniformly suspended throughout the "slow mix" period. Slow mix for 20 min. Record the time for the first visible floc formation. Every 5 min (during the slow mix period), record relative floc size and mixer speed (rpm). If coagulant aids are used, mixing speed is critical because excessive stirring tends to break up early floc formation and may redisperse the aid.

10.5 After the slow mix period, withdraw the paddles and observe settling of floc particles. Record the time required for the bulk of the particles to settle. In most cases this time will be that required for the particles to settle to the bottom of the beaker; however, in some cases there may be interfering convection currents. If so, the recorded settling time should be that at which the unsettled or residual particles appear to be moving equally upward and downward.

10.6 After 15 min of settling, record the appearance of floc on the beaker bottom. Record the sample temperature. By means of a pipet or siphon, withdraw an adequate sample volume of supernatant liquor from the jar at a point one half of the depth of the sample, to conduct color,[5] turbidity, pH and other required analyses, (Note 1) determined in accordance with Test Methods D6855 or D7315 (for turbidity) and D1293 (for pH). A suggested form for recording results is appended (see Fig. 2).

NOTE 1—Tests for residual chemicals should be included, for example, alum; residual $Al_2O_3$; copperas; residual $Fe_2O_3$; etc.

10.7 Repeat steps 10.1-10.6 until all pertinent variables have been evaluated.

10.8 The times given in 10.3, 10.4, and 10.6 are only suggestions.

## 11. Reproducibility

11.1 It is recognized that reproducibility of results is important. To demonstrate reproducibility, the so-called 3 and 3 procedure is suggested. In this procedure, duplicate sets of 3 jars each are treated simultaneously with the same chemical dosages in jars 1 and 4, 2 and 5, and 3 and 6.

## 12. Keywords

12.1 coagulation; flocculation; jar tests

[4] A periodically updated "Report on Coagulant Aids for Water Treatment" is published by the Environmental Protection Agency Office of Water Supply, Cincinnati, Ohio 45268, listing coagulant aids that may be used in water treatment without adverse physiological effects on those using the water, based on information submitted by the manufacturers or distributors, or both.

[5] For the color determination, reference is made to *Standard Methods for the Examination of Water and Waste Water*, Fourteenth edition, American Public Health Association, Inc., New York, NY, 1975, pp. 64–71.



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Sample _____ pH _____ Turbidity _____ Date _____

Location _____ Color _____ Temperature _____ Sample Size _____ ml

| | JAR NUMBER | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Chemicals, mg/litre *(a)* | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Flash Mix Speed, rpm | | | | | | |
| Flash Mix Time, min | | | | | | |
| Slow Mix Speed, rpm | | | | | | |
| Slow Mix Time, min | | | | | | |
| Temperature, °F | | | | | | |
| Time First Floc, min | | | | | | |
| Size Floc | | | | | | |
| Settling rate | | | | | | |
| Turbidity | | | | | | |
| Color | | | | | | |
| pH | | | | | | |

*(a)* Indicate order of addition of chemicals.

**FIG. 2 Jar Test Data**

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**ATTACHMENT B**

**QUALITY ASSURANCE PROJECT PLAN (QAPP)**

# QUALITY ASSURANCE PROJECT PLAN

## B.1 INTRODUCTION

This attachment presents the Quality Assurance Project Plan (QAPP) for the groundwater bench-scale treatability study samples for analytical laboratory analyses.

## B.2 DATA QUALITY OBJECTIVES

During execution of the Treatability Study, two types of data to be collected:

1. Data on reagent types and addition rates utilized during the bench-top testing; and
2. Analyses of liquid samples collected prior to and after bench-top testing and analysis of solid (filter cake) samples collected after the bench-top testing.

### B.2.1 Bench Notes

If chemical coagulant stock solutions are made in-house, the amounts and chemical formulas of all reagents used to create stock solutions should be recorded. The volume of stock solution added to each jar to obtain the desired doses should also be recorded.

Visual observations should be recorded throughout each batch of jar testing, including observations regarding the timing of floc formation, size of floc, and settling rate.

For each jar, turbidity readings should be measured and recorded every 5 minutes over the 20 minuet setting period. The pH for the samples collected at the end of the 20 minuet setting period should be measured and recorded.

For pH optimization testing, the volume of NaOH and HCl added to each 1 L sample to reach the pH target points should be recorded.

Detailed documentation of volumes, drying temperature and times, and weights collected to measure the mass of solids generated per volume of treated water should be recorded.

Detailed documentation should also be recorded describing the methods and results for any other testing conducted, including softening testing and filterability testing.

### B.2.2 Treatability Samples - Laboratory Analyses

Samples will be collected for laboratory analyses. The liquid and solid samples collected during the treatability study will be analyzed at a NELAP-accredited analytical laboratory. The liquid samples will be analyzed for the all or some of the parameters listed in Table B-2 and the solid samples will be analyzed for the TCLP metals as listed in Table B-3. Samples will be collected and handled as described in Section B.3 below. The specified reporting limits are below the lower of the groundwater cleanup standard or comparative values (for parameters with no cleanup standard) to assure the data are useable.

## B.3 SAMPLING/MEASUREMENT PROCEDURES

### B.3.1 Liquid and Solid Sampling Procedures

As described in Section 3 of the Work Plan, liquid (supernatant) and solid (settled sludge) samples will be collected during the treatability study. The following samples are anticipated:

- Raw (untreated) water
- Treated water samples (supernatant)
- Settled Sludge (filtered from decanted jars)

Two raw water samples will be collected and analyzed for As(III) and As (V). All 30 mL treated water (supernatant) samples collected as part of the Step 1 through 4 testing (anticipated total of 38 samples) will be submitted for laboratory analysis of As and total phosphorous. The 30 mL supernatant samples will be submitted for analysis immediately after each step of jar testing is complete, and a 2-day turnaround time will be requested, so that analytical results can be reviewed prior to moving on to the next step of jar testing.

Each of the 2 L composite supernatant samples (maximum of 2) collected as part of the Step 4 (Optimized) treatment testing will be submitted for the full list of parameters presented in Table B-2 except As(III) and As(V) analysis will not be performed.

Solid samples of the settled sludge will be collected in 250 mL jars and submitted for analysis for the RCRA metals using the TCLP method as shown on Table B-3.

The procedures for collecting, labeling and handling these samples is described below.

### B.3.2 Sample Designation

All collected samples will be labeled in a clear and precise way for proper identification and tracking in the laboratory. Each sample will be labeled and recorded in the logbook as follows:

FMC TS
[Testing Company]
[Date, Time]
[Treatment Testing Step #, Coagulant Type, Coagulant Dose (mg/L), Mixing Scheme, pH (if adjusted)]

<u>Example:</u>
*FMC TS*
*FLS*
*6/16/2014, 13:05*
*Step 1, Alum, 30, $M_1$*

### B.3.3 Sample Collection

For each step of jar testing, a 30 mL sample should be collected from each jar at the end of the 20 minute setting period. A 2 L composite sample should be collected from each batch of Step 4 testing by collecting 400 mL from each of the 5 jars. All supernatant samples should be collected using a pipette or sampling port to draw a sample from roughly half of the depth of liquid in the jar. Care should be taken to ensure that the settled sludge blanket is not disturbed and drawn into the supernatant sample.

A minimum sample size of 100 g of filtered sludge should be submitted for TCLP analysis (Table B-3) for each batch of Step 4 testing (maximum of 2; one for ferric chloride and one for alum).

The recommended sample containers and required sample preservation and holding times for the liquid samples to be submitted for laboratory analysis are summarized in the inset table below.

**TABLE B-1**
**Sample Preservation and Holding Time Requirements for Laboratory Analyses**

| Parameter | Recommended Container | Preservative | Maximum Holding Time |
|---|---|---|---|
| Water Quality ($Cl^-$, $F^-$, $NO_3^-$, and $SO_4^{2-}$) | 0.5-liter polyethylene bottle | Cool to 4°C | 28 days |
| Metals (Ag, As, Cd, Cu, Hg, K, Pb, Ni, Se, Mn, B, V, Zn and Total phosphorus) | 0.25-liter polyethylene bottles | $HNO_3$ to pH $\leq$ 2, Cool to 4°C | 6 months; except Hg is 28 day hold time |
| Arsenic Species (As(III), As(V) | HCl cleaned 0.25-liter polyethylene bottles | 6M HCl, Cool to 4°C | 28 days |
| Total Ammonia | 0.5-liter polyethylene bottle | $H_2SO_4$ to pH $\leq$ 2; Cool to 4°C | 28 days |
| Total cyanide | 0.5-liter polyethylene bottle | NaOH to pH $\geq$ 12; Cool to 4°C | 14 days |

### B.3.4 Sample Handling

All sample containers will be pre-cleaned. Preservatives, if required, will be added to the containers prior to shipment of the sample containers from the laboratory (pre-preserved) or added to the samples(s) in the field as needed to meet sample preservation requirements.

All sample containers for submittal for laboratory analysis will be placed in a strong, rigid-walled shipping container such as a heavy plastic cooler. The following outlines the packaging procedures that will be followed.

1. When ice is used, secure the drain plug of the cooler with tape to prevent melting ice from leaking out of the cooler.
2. Line the cooler with bubble wrap, as needed, to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
4. Affix sample labels onto the containers and write sample number on container with indelible ink.
5. Wrap all glass sample containers in bubble wrap to prevent breakage.

All samples will be placed in coolers with the appropriate chain-of-custody form. All forms will be enclosed in a large plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap to prevent movement and breakage during shipment. Ice used to cool samples will be placed on top and around the samples to chill them to the correct temperature. Both samples and ice will be double-bagged in large plastic bags. Each ice chest will be securely taped shut with strapping tape; and custody seals will be affixed to the front and back of each cooler.

## B.4 PERSONNEL TRAINING

All personnel directly involved with the Treatability Study will be provided with a copy of this Plan. Personnel will be trained in the requirements specified herein and provided ample time to read and become familiar with these requirements prior to beginning the testing program.

**TABLE B-2**
LIQUID SAMPLE LABORATORY ANALYSIS REQUIREMENTS
GROUNDWATER TREATABILITY STUDY WORK PLAN FOR THE FMC OU


| Parameter WQP | Analytical Method Number | Method Type | Reporting Limit (mg/l) | Estimated Accuracy* | Precision ** | Average Concentration of Constituent in Groundwater (wells 110, 146, and TW-9S) | Groundwater Cleanup Standards (mg/l)*** | Pocatello POTW Pretreatment Limits |
|---|---|---|---|---|---|---|---|---|
| Fluoride | 9056 (b) or 340.2 (c) | Ion Chromatography or Potentiometric, Ion Selective Electrode | 0.1 | 75% - 125% | ± 30% | 0.30 | 4 | 32 |
| Nitrate | 9056 (b) or 353.2 (d) | Ion Chromatography or Colorimetric | 0.1 | 75% - 125% | ± 35% | 6.63 | 10 | NA |
| Total Phosphorus | 6010B (a) or 365.2 (c) | Inductively Coupled Plasma / Mass Spectrometry or Colorimetric (ascorbic acid) | 0.02 | 75% - 125% | ± 30% | 2.54 | NA | 7.0 |
| Sulfate | 9056 (b) or 375.4 (d) | Ion Chromatography or Turbidimetric | 1 | 75% - 125% | ± 30% | 168 | 250 | NA |
| Potassium | 6010B (a) | Inductively Coupled Plasma Atomic Emission Spectrometry | 0.1 | 75% - 125% | ± 30% | 43.4 | NA | NA |
| Chloride | 9056 (b) or 325.3 (c) | Ion Chromatography or Titrimetric | 1 | 75% - 125% | ± 30% | 136.3 | 250 | NA |
| Total Ammonia (NH3 + NH4 as N) | 350.3 (d) | Potentiometric, Ion Selective Electrode | 0.2 | 75% - 125% | ± 30% | 0.17 | NA | NA |
| **Parameter Metals (mg/l)** | **Analytical Method Number** | **Method Type** | **Reporting Limit (mg/l)** | **Estimated Accuracy*** | **Precision **** | **Average Concentration of Constituent in Groundwater (wells 110, 146, and TW-9S)** | **Groundwater Cleanup Standards (mg/l)***** | **Pocatello POTW Pretreatment Limits** |
| Arsenic | 6010B (a) | Inductively Coupled Plasma Atomic Emission Spectrometry | 0.002 | 75% - 125% | ± 30% | 0.03 | 0.01 | 0.06 |
| Arsenic(V) | 1632 (e) | Atomic Absorption Spectrometry | 0.001 | 75% - 125% | ± 30% | Unknown | NA | NA |
| Arsenic(III) | 1632 (e) | Atomic Absorption Spectrometry | 0.001 | 75% - 125% | ± 30% | Unknown | NA | NA |
| Cadmium | 6010B (a) | Inductively Coupled Plasma Atomic Emission Spectrometry | 0.002 | 75% - 125% | ± 30% | <0.0005 | 0.01 | 0.2 |
| Copper | 6010B (a) | Inductively Coupled Plasma / Mass Spectrometry | 0.01 | 75% - 125% | ± 20% | 0 | 1 | 0.5 |
| Cyanide | 335.4 (d) | Colorimetric | 0.01 | 75% - 125% | ± 30% | 0.01 | 0.2 | 0.2 |
| Lead | 6010B (a) | Inductively Coupled Plasma / Mass Spectrometry | 0.01 | 75% - 125% | ± 20% | 0 | TT, 0.015 | 0.3 |
| Mercury | SW 7470A (b) | Cold Vapor Atomic Absorbtion Spectrometry | 0.0005 | 75% - 125% | ± 20% | <0.0002 | 0.002 | 0.0006 |
| Nickel | 6010B (a) | Inductively Coupled Plasma / Mass Spectrometry | 0.01 | 75% - 125% | ± 20% | <0.04 | 0.73 | 1 |
| Selenium | 6010B (a) | Inductively Coupled Plasma Atomic Emission Spectrometry | 0.0005 | 75% - 125% | ± 30% | 0.012 | 0.050 | NA |
| Silver | 6010B (a) | Inductively Coupled Plasma / Mass Spectrometry | 0.01 | 75% - 125% | ± 20% | <0.005 | 0.1 | 0.6 |
| Zinc | 6010B (a) | Inductively Coupled Plasma / Mass Spectrometry | 0.02 | 75% - 125% | ± 20% | 0.001 | 71 | 1.2 |

**TABLE B-2**
LIQUID SAMPLE LABORATORY ANALYSIS REQUIREMENTS
GROUNDWATER TREATABILITY STUDY WORK PLAN FOR THE FMC OU


(a) Analysis may also be performed using method 6020, both 6010 and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(b) Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(c) Methods for Chemical Analysis of Water and Wastes, EPA600/4–79–020, Revision, March 1983.

(d) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

(e) Chemical Speciation of Arsenic in Water and Tissue by Hydride Generation Quartz Furnace Atomic Absorption Spectrometry (EPA Method 1632).

* percent recovery

** relative percent difference

*** Groundwater Cleanup Standards are Maximum Contaminant Levels or Secondary Standards per National Secondary Drinking Water Regulations. TT means Treatment Technique action level per the National Primary Drinking Water Regulations.

NA Not Applicable; no POTW standard

**TABLE B-3**
SOLID SAMPLE LABORATORY ANALYSIS REQUIREMENTS
GROUNDWATER TREATABILITY STUDY WORK PLAN FOR THE FMC OU

| Parameter | Analytical Method Number | Method Type | Reporting Limit (mg/l) | Estimated Accuracy* | Precision** | TCLP Threshold (mg/l) |
|---|---|---|---|---|---|---|
| Arsenic | 1311 | TCLP | 0.05 | 75% - 125% | ± 30% | 5.0 |
| Barium | 1311 | TCLP | 0.05 | 75% - 125% | ± 30% | 100.0 |
| Cadmium | 1311 | TCLP | 0.05 | 75% - 125% | ± 30% | 1.0 |
| Chromium | 1311 | TCLP | 0.05 | 75% - 125% | ± 30% | 5.0 |
| Lead | 1311 | TCLP | 0.05 | 75% - 125% | ± 20% | 5.0 |
| Mercury | 1311 | TCLP | 0.01 | 75% - 125% | ± 20% | 0.2 |
| Selenium | 1311 | TCLP | 0.05 | 75% - 125% | ± 30% | 1.0 |
| Silver | 1311 | TCLP | 0.05 | 75% - 125% | ± 20% | 5.0 |

* percent recovery

** relative percent difference

# Attachment C

# FLSmidth Bench Testing Data Sheets

| FLSmidth | PROJECT: MWH - FMC OU - GWR | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT: BENCH TESTING $FeCl_3$ & $Al_2(SO_4)_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

7/22/14

STOCK SOLUTIONS – $FeCl_3$

$FeCl_3$ => DRY $FeCl_3 \cdot 6H_2O$

MW

$FeCl_3$ : 162.204
$H_2O$ : 18.01528
} $FeCl_3 \cdot 6H_2O$ : 270.30

% MASS

$FeCl_3$: 162.204/270.30 = 0.60 => 60%
$6H_2O$: 108.092/270.30 = 0.40 => 40%

TO GENERATE STOCK SOLUTION @ 1.0 g/L w/ VOLUME: 500 mL

$500\,mL \cdot \frac{1L}{1000\,mL} = 0.5L \cdot \frac{1g}{1L} = 0.5\,g\,FC \cdot \frac{1.0\,g\,FCH}{0.6\,g\,FC} = 0.8333\,g$ FCH

- 0.833g of FERRIC CHLORIDE HEXAHYDRATE YIELDS 0.500g OF FERRIC CHLORIDE RESULTING IN STOCK SOLUTION OF 1.0 g/L OR 1.0mg/mL

STOCK SOLUTIONS – ALUM

$Al_2(SO_4)_3$ => DRY $Al_2(SO_4)_3 \cdot 14H_2O$

MW

$Al_2(SO_4)_3$ : 342.151
$H_2O$ : 18.01528
} $Al_2(SO_4)_3 \cdot 14H_2O$ : 594.36

% MASS

$Al_2(SO_4)_3$ : 342.151/594.36 = 0.58 => 58%
$H_2O$ : 18.01528/594.36 = 0.42 => 42%

TO GENERATE STOCK SOLUTION @ 1.0 g/L w/ VOLUME: 500 mL

$500\,mL \cdot \frac{1L}{1000\,mL} = 0.5L \cdot \frac{1g}{1L} = 0.5\,g\,ALUM \cdot \frac{1.0\,g\,ALH}{0.58\,g\,AL} = 0.8621\,g$ ALH

- 0.8621 g of ALUMINUM SULFATE HYDRATE YIELDS 0.500g OF ALUM RESULTING IN STOCK SOLUTION OF 1.0 g/L OR 1.0mg/mL

| FLSmidth | PROJECT<br>MWH - FMC OU - GWR | PROJ NO.<br>CALC NO. |
|---|---|---|
| | SUBJECT<br>BENCH TESTING $FeCl_3$ & $Al_2(SO_4)_3$ | BY DATE<br>CHK DATE<br>SHEET OF REV |

FERRIC CHLORIDE TESTING 7/22/14

- pH METER
  - MODEL: OAKTON pH5+
  - RANGE: 0.00 – 14.00 pH
  - RESOLUTION: 0.01 pH
  - ACCURACY: ±0.01 pH
  - CALIBRATED: 7/22/14
- TURBIDITY METER
  - MODEL: HACH 2100P
  - RANGE: 0-1000 NTU
  - REPEAT: ±1%
  - ACCURACY: ±2%
  - CALIBRATED: 7/22/14

PROCEDURE

- USE DOSAGES OF 5, 10, 20, 30, 40 mg/L
- MIXER ACHIEVED 90 RPM FOR RAPID MIX OF 1 MINUTE $M_1$
- MIXER REDUCED TO 48 RPM FOR SLOW MIX OF 30 MIN $M_1$
- MIXING CEASED @ 31 MINUTES AND TURBIDITY SAMPLES COLLECTED @ 31, 36, 41, 46, 51 MIN
- AT 51 MINUTES 30 mL SAMPLES COLLECTED FOR ANALYSIS
- AT 51 MINUTES pH OF JARS RECORDED

OBSERVATIONS START: 13:59 FINISH: 14:50

- STOCK $FeCl_3$ HAS YELLOW COLOR
- WATER TEMP: 60.4 F STOCK TEMP: 64.1 F
- PIN FLOC APPEARS 2-3 MINUTES
- VERY SLOW SETTLING AND RATE NOT CALCULATED DUE TO LACK OF CLEAR INTERFACE
- ANNA RECOMMENDS INCREASING DOSAGE BASED ON HER OBSERVATIONS

PROCEDURE REPEATED @ 50, 60, 70, 80, 90 mg/L START: 15:09 FINISH: 16:00

- WATER TEMP: 64.4 F STOCK TEMP: 64.1 F
- PIN FLOC @ 2-3 MINUTES
- VERY SLOW SETTLING
- GREATER SOLIDS VOLUME AT CONCLUSION OF TEST
- SAMPLES COLLECTED

| FLSmidth | PROJECT<br>MWM - FMC - OW - GWR | PROJ NO.<br>CALC NO. |
|---|---|---|
| | SUBJECT<br>BENCH TESTING $FeCl_3$ & $Al_2(SO_4)_3$ | BY DATE<br>CHK DATE<br>SHEET OF REV |

ALUM TESTING 7/23/14

-pH METER

MODEL: OAKTON pH 5+

RANGE: 0.00 - 14.00 pH

RESOLUTION: 0.01 pH

ACCURACY: ± 0.01 pH

CALIBRATED: 7/23/14

TURBIDITY METER

MODEL: HACH 2100P

RANGE: 0 - 1000 NTU

REPEAT: ±1%

ACCURACY: ±2%

CALIBRATED: 7/23/14

PROCEDURE

- USE DOSAGES OF 10, 20, 30, 40, 50 mg/L
- MIXER ACHIEVED 90 RPM DURING RAPID MIX OF 1 MINUTE M1
- MIXER 40 RPM FOR SLOW MIX OF 30 MINUTES M1
- MIXING STOPPED @ 31 MINUTES
- TURBIDITY COLLECTED @ 31, 36, 41, 46, 51 MINUTES
- 30 ML SAMPLES COLLECTED @ 51 MINUTES
- pH OF JARS RECORDED @ 51 MINUTES

OBSERVATIONS START: 9:54 FINISH: 10:45

- MINIMAL PIN FLOC APPEARS 5 MINUTES
- NO COLOR
- DIFFICULT TO SEE FLOC
- SETTLING WAS NO VISIBLE
- AT TEST END SLIGHT "HAZE" AT BOTTOM OF JARS
- WATER TEMP: 58.7F STOCK TEMP: 63.8F

MWH Testing

$FeCl_3$

Stock 1 g/L

| Dosages | | Rapid Mix | | Slow Mix | | | Turbidity Samples 0 Min | 5 min | 10 min | 15 min | 20 min | Supernatant Sample | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg/L | mLs | Mixing RPM | Mixing Time | Mixing RPM | Mixing Time | Floc Structure | Sample 0 | Sample 1 | Sample 2 | Sample 3 | Sample 4 | 30 mL | pH | Water Temp | Stock Temp | Start | Finish |
| 5 | 5 | 90 | 1 | 48 | 30 | Pin | 1.80 | 1.33 | 1.24 | 0.96 | 0.92 | X | 7.51 | 60.4 | 64.1 | 13:59 | 14:50 |
| 10 | 10 | 90 | 1 | 48 | 30 | Pin | 3.30 | 2.13 | 1.84 | 1.18 | 1.17 | X | 7.62 | 60.4 | 64.1 | 13:59 | 14:50 |
| 20 | 20 | 90 | 1 | 48 | 30 | Pin | 6.96 | 2.89 | 2.03 | 2.06 | 1.43 | X | 7.29 | 60.4 | 64.1 | 13:59 | 14:50 |
| 30 | 30 | 90 | 1 | 48 | 30 | Pin | 14.10 | 8.90 | 4.29 | 4.11 | 2.48 | X | 7.40 | 60.4 | 64.1 | 13:59 | 14:50 |
| 40 | 40 | 90 | 1 | 48 | 30 | Pin | 19.50 | 12.10 | 3.64 | 3.15 | 2.60 | X | 7.09 | 60.4 | 64.1 | 13:59 | 14:50 |
| 50 | 50 | 90 | 1 | 48 | 30 | Pin | 12.10 | 8.64 | 1.81 | 3.17 | 1.52 | X | 7.12 | 64.4 | 64.1 | 15:09 | 16:00 |
| 60 | 60 | 90 | 1 | 48 | 30 | Pin | 12.80 | 7.39 | 2.51 | 2.94 | 1.09 | X | 7.04 | 64.4 | 64.1 | 15:09 | 16:00 |
| 70 | 70 | 90 | 1 | 48 | 30 | Pin | 17.90 | 11.60 | 2.33 | 3.61 | 1.90 | X | 6.95 | 64.4 | 64.1 | 15:09 | 16:00 |
| 80 | 80 | 90 | 1 | 48 | 30 | Pin | 20.50 | 14.60 | 10.20 | 3.32 | 2.19 | X | 6.90 | 64.4 | 64.1 | 15:09 | 16:00 |
| 90 | 90 | 90 | 1 | 48 | 30 | Pin | 19.80 | 11.60 | 5.50 | 1.64 | 1.70 | X | 6.83 | 64.4 | 64.1 | 15:09 | 16:00 |

$Al_2(SO_4)_3$

Stock 1 g/L

| Dosages | | Rapid Mix | | Slow Mix | | | Turbidity Samples 0 Min | 5 min | 10 min | 15 min | 20 min | Supernatant Sample | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg/L | mLs | Mixing RPM | Mixing Time | Mixing RPM | Mixing Time | Floc Structure | Sample 0 | Sample 1 | Sample 2 | Sample 3 | Sample 4 | 30 mL | pH | Water Temp | Stock Temp | Start | Finish |
| 10 | 10 | 90 | 1 | 48 | 30 | Pin | 0.71 | 0.68 | 0.66 | 0.48 | 0.38 | X | 7.75 | 58.7 | 63.8 | 9:54 | 10:45 |
| 20 | 20 | 90 | 1 | 48 | 30 | Pin | 1.11 | 0.82 | 0.58 | 0.54 | 0.51 | X | 7.85 | 58.7 | 63.8 | 9:54 | 10:45 |
| 30 | 30 | 90 | 1 | 48 | 30 | Pin | 1.58 | 1.51 | 1.33 | 0.63 | 0.65 | X | 7.57 | 58.7 | 63.8 | 9:54 | 10:45 |
| 40 | 40 | 90 | 1 | 48 | 30 | Pin | 2.69 | 2.54 | 2.30 | 0.94 | 0.64 | X | 7.52 | 58.7 | 63.8 | 9:54 | 10:45 |
| 50 | 50 | 90 | 1 | 48 | 30 | Pin | 3.61 | 3.29 | 2.83 | 2.72 | 2.54 | X | 7.45 | 58.7 | 63.8 | 9:54 | 10:45 |

| FLSmidth | PROJECT<br>MUH - FMC OU - GWR STEP 2 | PROJ NO.<br>CALC NO. |
|---|---|---|
| | SUBJECT<br>BENCH TESTING $FeCl_3$ & $Al_2(SO_4)_3$ | BY DATE<br>CHK DATE<br>SHEET OF REV |

7/25/14

STOCK SOLUTION - $FeCl_3$

$FeCl_3 \cdot 6H_2O$ : 270.30 g

% MASS

$FeCl_3$: 0.60 => 60%

$6H_2O$: 0.40 => 40%

TO GENERATE STOCK SOLUTION @ 10 g/L w/ VOLUME: 500 mL

$500\ mL \cdot \frac{1\ L}{1000\ mL} = 0.5\ L \cdot \frac{10\ g}{L} = 5\ g\ Fe \cdot \frac{1.0\ g\ FCH}{0.60\ Fe} = 8.33\ g\ FCH$

- 8.33 g OF FERRIC CHLORIDE HEXAHYDRATE YIELDS 5 g OF FERRIC CHLORIDE RESULTING IN STOCK SOLUTION OF 10 g/L OR 10 mg/mL

STOCK SOLUTION - ALUM

$Al_2(SO_4)_3 \cdot 14H_2O$ : 594.36 g

% MASS

$Al_2(SO_4)_3$: 0.58 => 58%

$14H_2O$ : 0.42 => 42%

TO GENERATE STOCK SOLUTION @ 10 g/L w/ VOLUME: 500 mL

$500\ mL \cdot \frac{1\ L}{1000\ mL} = 0.5\ L \cdot \frac{10\ g}{L} = 5\ g\ ALUM \cdot \frac{1\ ALH}{0.58\ ALUM} = 8.62\ g\ ALH$

- 8.62 g OF ALUMINUM SULFATE HYDRATE YIELDS 5 g OF ALUM RESULTING IN STOCK SOLUTION OF 10 g/L OR 10 mg/mL

| FLSmidth | PROJECT: MWH - FMC - OU - GWR STBP 2 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT: BENCH TESTING $FeCl_3$ / $Al_2(SO_4)_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

JAR TESTS - ROUND 1 7/25/14

- pH METER
  - MODEL: OAKTON pH 5+
  - RANGE: 0.00 - 14.00 pH
  - RESOLUTION: 0.01 pH
  - ACCURACY: ±0.01 pH
  - CALIBRATED: 7/25/14

- TURBIDITY METER
  - MODEL: HACH 2100P
  - RANGE: 0 - 1000 NTU
  - REPEAT: ±1%
  - ACCURACY: ±2%
  - CALIBRATED: 7/25/14

PROCEDURE

- TEST PARAMETERS:

| Mixing Scheme | Rapid Mix Minutes | Rapid Mix rpm | Slow Mix 1 Minutes | Slow Mix 1 rpm | Slow Mix 2 Minutes | Slow Mix 2 rpm |
|---|---|---|---|---|---|---|
| $M_2$ | 1 | 100 | 15 | 45 | 15 | 20 |

| Jar | Coag | Dose (mg/L) |
|---|---|---|
| 1 | FeCl3 | 10 |
| 2 | FeCl3 | 20 |
| 3 | FeCl3 | 30 |
| 4 | Al(SO4) | 50 |
| 5 | Al(SO4) | 60 |
| 6 | Al(SO4) | 70 |

- MIXER ACHIEVED 90 RPM FOR RAPID MIX 1 MINUTE $M_2$
- MIXER REDUCED TO 48 RPM FOR SLOW MIX 1 15 MINUTES $M_2$
- MIXER REDUCED TO 22 RPM FOR SLOW MIX 2 15 MINUTES $M_2$
- MIXING CEASED @ 51 MINUTES AND TURBIDITY SAMPLES COLLECTED @ 31, 36, 41, 46, 51 MIN
- AT 51 MINUTES 100 mL SAMPLES COLLECTED FOR ANALYSIS
- AT 51 MINUTES pH OF JARS RECORDED

OBSERVATIONS START: 11:04 FINISH: 11:55

- RAW WATER pH: 7.93
- RAW WATER TURBIDITY: 0.32 NTU
- PIN FLOC AFTER 3-4 MINUTES
- $FeCl_3$ => YELLOW COLOR ALUM => CLEAR
- DIFFICULT TO SEE FLOC
- SETTLING INTERFACE NOT VISIBLE
- YELLOW SOLIDS IN $FeCl_3$ JARS AT 51 MINUTES
- WHITE "HAZE" IN ALUM JARS AT 51 MINUTES
- SOLIDS COLLECTED FROM $FeCl_3$ (30 mg/L) JAR FOR WEIGHT

| FLSmidth | PROJECT: MWH – FMC – OU – GWR STEP 2 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT: BENCH TESTING $FeCl_3$ & $Al_2(SO_4)_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

JAR TESTS – ROUND 2 7/25/14

– pH METER:

MODEL: OAKTON pH 5+

RANGE: 0.00 – 14.00 pH

RESOLUTION: 0.01 pH

ACCURACY: ± 0.01 pH

CALIBRATED: 7/25/14

– TURBIDITY METER

MODEL: HACH 2100P

RANGE: 0 – 1000 NTU

REPEAT: ± 1%

ACCURACY: ± 2%

CALIBRATED: 7/25/14

PROCEDURE

– TEST PARAMETERS:

| Mixing Scheme | Rapid Mix | | Slow Mix 1 | | Slow Mix 2 | |
|---|---|---|---|---|---|---|
| | *Minutes* | *rpm* | *Minutes* | *rpm* | *Minutes* | *rpm* |
| $M_3$ | 1 | 100 | 10 | 45 | 10 | 20 |

| Jar | Coag | Dose (mg/L) |
|---|---|---|
| 1 | FeCl3 | 10 |
| 2 | FeCl3 | 20 |
| 3 | FeCl3 | 30 |
| 4 | Al(SO4) | 50 |
| 5 | Al(SO4) | 60 |
| 6 | Al(SO4) | 70 |

- MIXER ACHIEVED 90 RPM FOR RAPID MIX 1 MINUTE $M_3$
- MIXER REDUCED TO 48 RPM FOR SLOW MIX #1 10 MINUTES $M_3$
- MIXER REDUCED TO 22 RPM FOR SLOW MIX #2 10 MINUTES $M_3$
- MIXING CEASED @ 21 MINUTES AND TURBIDITY SAMPLES COLLECTED @ 21, 26, 31, 36, 41 MIN
- AT 41 MINUTES 100 mL SAMPLES COLLECTED FOR ANALYSIS
- AT 41 MINUTES pH OF JARS RECORDED

OBSERVATIONS START: 12:59 FINISH: 13:40

- RAW WATER pH: 7.93
- RAW WATER TURBIDITY: 0.52 NTU
- PIN FLOC @ 3-4 MINUTES
- $FeCl_3$ => YELLOW ALUM => CLEAR
- DIFFICULT TO SEE FLOC
- SETTLING INTERFACE NOT VISIBLE
- YELLOW SOLIDS IN $FeCl_3$ JARS @ 41 MINUTES
- WHITE "HAZE" IN ALUM JARS @ 41 MINUTES
- SOLIDS COLLECTED FROM $FeCl_3$ (30 mg/L) JAR FOR WEIGHT

MWH Testing
Step 2
Stock 10 g/L

Raw Water pH: 7.93
Raw Water Turbidity: 0.32

| Dosages | | | Rapid Mix | | Slow Mix 1 | | | Slow Mix 2 | | Turbidity Samples | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg/L | Coag | mLs | Mixing RPM | Mixing Time | Mixing RPM | Mixing Time | Floc Structure | Mixing RPM | Mixing Time | 0 Min Sample 0 | 5 min Sample 1 | 10 min Sample 2 | 15 min Sample 3 | 20 min Sample 4 | Supernatant 100 mL | pH | Water Temp | Stock Temp | Start | Finish |
| 10 | $FeCl_3$ | 1 | 90 | 1 | 48 | 15 | Pin | 22 | 15 | 3.89 | 2.21 | 2.15 | 1.60 | 1.42 | X | 7.74 | 60.3 | 64.3 | 11:04 | 11:55 |
| 20 | $FeCl_3$ | 2 | 90 | 1 | 48 | 15 | Pin | 22 | 15 | 5.23 | 1.60 | 1.35 | 0.69 | 0.66 | X | 7.56 | 60.3 | 64.3 | 11:04 | 11:55 |
| 30 | $FeCl_3$ | 3 | 90 | 1 | 48 | 15 | Pin | 22 | 15 | 8.74 | 2.86 | 2.19 | 0.64 | 0.65 | X | 7.48 | 60.3 | 64.3 | 11:04 | 11:55 |
| 50 | $Al_2(SO_4)_3$ | 5 | 90 | 1 | 48 | 15 | Pin | 22 | 15 | 4.83 | 1.45 | 1.11 | 0.66 | 0.61 | X | 7.26 | 60.3 | 64.3 | 11:04 | 11:55 |
| 60 | $Al_2(SO_4)_3$ | 6 | 90 | 1 | 48 | 15 | Pin | 22 | 15 | 6.18 | 4.59 | 2.20 | 1.07 | 1.03 | X | 7.18 | 60.3 | 64.3 | 11:04 | 11:55 |
| 70 | $Al_2(SO_4)_3$ | 7 | 90 | 1 | 48 | 15 | Pin | 22 | 15 | 6.97 | 3.84 | 2.47 | 2.16 | 1.62 | X | 7.12 | 60.3 | 64.3 | 11:04 | 11:55 |

Raw Water pH: 7.93
Raw Water Turbidity: 0.32

| Dosages | | | Rapid Mix | | Slow Mix 1 | | | Slow Mix 2 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mg/L | Coag | mLs | Mixing RPM | Mixing Time | Mixing RPM | Mixing Time | Floc Structure | Mixing RPM | Mixing Time | 0 Min Sample 0 | 5 min Sample 1 | 10 min Sample 2 | 15 min Sample 3 | 20 min Sample 4 | Supernatant 100 mL | pH | Water Temp | Stock Temp | Start | Finish |
| 10 | $FeCl_3$ | 1 | 90 | 1 | 48 | 10 | Pin | 22 | 10 | 3.00 | 1.64 | 0.95 | 0.89 | 0.77 | X | 7.81 | 60.1 | 64.3 | 12:59 | 13:40 |
| 20 | $FeCl_3$ | 2 | 90 | 1 | 48 | 10 | Pin | 22 | 10 | 6.34 | 2.42 | 1.06 | 0.97 | 0.74 | X | 7.58 | 60.1 | 64.3 | 12:59 | 13:40 |
| 30 | $FeCl_3$ | 3 | 90 | 1 | 48 | 10 | Pin | 22 | 10 | 7.73 | 1.72 | 0.97 | 0.98 | 0.64 | X | 7.39 | 60.1 | 64.3 | 12:59 | 13:40 |
| 50 | $Al_2(SO_4)_3$ | 5 | 90 | 1 | 48 | 10 | Pin | 22 | 10 | 5.49 | 2.02 | 1.85 | 0.86 | 0.83 | X | 7.22 | 60.1 | 64.3 | 12:59 | 13:40 |
| 60 | $Al_2(SO_4)_3$ | 6 | 90 | 1 | 48 | 10 | Pin | 22 | 10 | 7.48 | 5.88 | 4.17 | 1.67 | 1.04 | X | 7.16 | 60.1 | 64.3 | 12:59 | 13:40 |
| 70 | $Al_2(SO_4)_3$ | 7 | 90 | 1 | 48 | 10 | Pin | 22 | 10 | 6.76 | 5.62 | 1.27 | 1.13 | 0.90 | X | 7.12 | 60.1 | 64.3 | 12:59 | 13:40 |

| FLSmidth | PROJECT<br>MWH-FMC OU-GWR STEP 2 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT<br>BENCH TESTING $FeCl_3$ & $Al_2(SO_4)_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

SOLIDS COLLECTION 7/28/14

ROUND 1: FILTER $FeCl_3$ @ 30 mg/L w/ VOLUME: 1 L

- MEDIA: WHATMAN GF/C 42.5mm Ø 1.2μM RETENTION CAT NO 1822042
- PLACED IN 50°C OVEN FOR ~60 HRS

TARE: 1.0625 g
DRY: 1.0919 g
} 0.0294 g OF SOLIDS

ROUND 2: FILTER $FeCl_3$ @ 30 mg/L w/ VOLUME: 1L

- MEDIA: WHATMAN GF/C 42.5mm Ø 1.2μM RETENTION CAT NO 1822042
- PLACED IN 50°C OVEN FOR ~60 HRS

TARE: 1.0468
DRY: 1.0697
} 0.0229 g OF SOLIDS

| FLSmidth | PROJECT<br>MWM - FMC OU - GWR STEP 3 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT<br>BENCH TESTING $FeCl_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

STOCK SOLUTION - $FeCl_3$

$FeCl_3 \cdot 6H_2O$ : 270.30g

% MASS

$FeCl_3$ : 0.60 => 60%

$6H_2O$ : 0.40 => 40%

7/30/14

TO GENERATE STOCK SOLUTION @ 10g/L w/ VOLUME : 500 mL

$500\,mL \cdot \frac{1\,L}{1000\,mL} = 0.5\,L \cdot \frac{10\,g}{L} = 5\,g\,FC \cdot \frac{1.0\,FCH}{0.60\,FC} = 8.33\,g\,FCH$

- 8.33g OF FERRIC CHLORIDE HEXAHYDRATE YIELDS 5g OF FERRIC CHLORIDE RESULTING IN STOCK SOLUTION OF 10g/L OR 10mg/mL

| FLSmidth | PROJECT: MWH - FMC OU-GWR STEP 3 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT: BENCH TESTING $FeCl_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

JAR TESTS 7/30/14

- pH METER:
  - MODEL: OAKTON pH 5+
  - RANGE: 0.00-14.00 pH
  - RESOLUTION: 0.01 pH
  - ACCURACY: ± 0.01 pH
  - CALIBRATED: 7/30/14

TURBIDITY METER:
- MODEL: HACH 2100P
- RANGE: 0-1000 NTU
- REPEAT: ± 1%
- ACCURACY: ± 2%
- CALIBRATED: 7/30/14

PROCEDURE

- TEST PARAMETERS:

Use mixing scheme M1 (1 min @ 100 rmp, then 30 min at 45 rpm) and the following doses:

| Jar | Coag. | Dose (mg/L) |
|---|---|---|
| 1 | FeCl3 | 10 |
| 2 | FeCl3 | 20 |
| 3 | FeCl3 | 40 |
| 4 | FeCl3 | 10 |
| 5 | FeCl3 | 20 |
| 6 | FeCl3 | 40 |

- MIXER ACHIEVED 90 RPM FOR RAPID MIX 1 MINUTE $M_1$
- MIXER ACHIEVED 48 RPM FOR SLOW MIX 30 MINUTES $M_1$
- MIXING CEASED @ 31 MINUTES AND TURBIDITY SAMPLES COLLECTED @ 31, 36, 41, 46, 51, 56, 61, 66, 71 MIN + JARS 4, 5, 6
- JARS 1, 2, 3 pH MEASURED & TURBIDITY RECORDED
  - + FILTER @ 25 µm TURBIDITY, PICTURE, 100 mL SAMPLE, DRY SOLIDS WEIGHT
  - + FILTER @ 8 µm TURBIDITY, PICTURE, 100 mL SAMPLE, DRY SOLIDS WEIGHT
  - + FILTER @ 1.2 µm TURBIDITY, PICTURE, 100 mL SAMPLE, DRY SOLIDS WEIGHT
- JARS 4, 5, 6 AT 71 MINUTES 100 mL SAMPLES COLLECTED & pH RECORDED

OBSERVATIONS START: 10:30 FINISH: 11:01 & 11:41

- RAW WATER pH: 7.97 TURBIDITY: 0.27
- FLOC @ 5-4 MINUTES
- SETTLING INTERFACE NOT VISIBLE
- YELLOW SOLIDS IN JARS 4, 5, 6
- SOLIDS COLLECTED FROM FILTERS FOR DRY SOLIDS WEIGHT

| FLSmidth | PROJECT: MNH - FMC OU - GWTP STEP 3 | PROJ NO. | |
|---|---|---|---|
| | | CALC NO. | |
| | SUBJECT: BENCH TESTING FeCl3 | BY | DATE |
| | | CHK | DATE |
| | | SHEET OF | REV |

SOLIDS COLLECTION 7/31/14

- FILTER JARS 1, 2, 3 THROUGH 25µm, 8µm AND 1.2µm FILTER MEDIA M,
- FILTER MEDIA:
  - +25µm: WHATMAN ASHLESS 90mm ø 25µm RETENTION CAT NO 1441 090
  - +8µm: WHATMAN ASHLESS 12.5cm ø 8µm RETENTION CAT NO 1440 125
  - +1.2µm: WHATMAN GF/C 42.5mm ø 1.2µm RETENTION CAT NO 1822 042
- PLACED IN 50C OVEN FOR ~24 HRS

JAR 1

| FILTER | TARE | DRY | GRAMS DRY SOLIDS |
|---|---|---|---|
| 25µm | 6.2117 | 6.2305 | 0.0188 |
| 8µm | 6.7449 | 6.7451 | 0.0002 |
| 1.2µm | 1.0562 | 1.0643 | 0.0081 |

JAR 2

| FILTER | TARE | DRY | GRAMS DRY SOLIDS |
|---|---|---|---|
| 25µm | 6.2321 | 6.2580 | 0.0259 |
| 8µm | 6.6767 | 6.6786 | 0.0019 |
| 1.2µm | 1.0573 | 1.0579 | 0.0006 |

JAR 3

| FILTER | TARE | DRY | GRAMS DRY SOLIDS |
|---|---|---|---|
| 25µm | 6.2792 | 6.2964 | 0.0172 |
| 8µm | 6.4731 | 6.4737 | 0.0006 |
| 1.2µm | 1.0595 | 1.0647 | 0.0052 |

OBSERVATIONS

- JARS 1 & 3 SHOWED SIMILAR RESULTS W/ MINIMAL SOLIDS @ 25µm & 8µm
- JAR 2 SHOWED MAJORITY OF SOLIDS @ 25µm

MWH Testing
Step 3
Stock 10 g/L

Raw Water pH: 7.97
Raw Water Turbidity: 0.27

| Jar | Dosages mg/L | Coag | mLs | Rapid Mix Mixing RPM | Mixing Time | Slow Mix 1 Mixing RPM | Mixing Time | Floc Structure | Turbidity 0 Min Sample 0 | Filtrate 1 Sample 1 | Supernatant Sample 100 mL | Filtrate 2 Sample 2 | Supernatant Sample 100 mL | Filtrate 3 Sample 3 | Supernatant Sample 100 mL | pH | Water Temp | Stock Temp | Start | Finish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 10 | $FeCl_3$ | 1 | 90 | 1 | 48 | 30 | Pin | 3.76 | 3.61 | X | 3.11 | X | 0.35 | X | 7.80 | 60.0 | 64.1 | 10:30 | 11:01 |
| 2 | 20 | $FeCl_3$ | 2 | 90 | 1 | 48 | 30 | Pin | 7.08 | 0.39 | X | 0.23 | X | 0.11 | X | 7.61 | 60.0 | 64.1 | 10:30 | 11:01 |
| 3 | 40 | $FeCl_3$ | 4 | 90 | 1 | 48 | 30 | Pin | 10.80 | 10.60 | X | 9.83 | X | 1.09 | X | 7.59 | 60.0 | 64.1 | 10:30 | 11:01 |

| Jar | Dosages mg/L | Coag | mLs | Rapid Mix Mixing RPM | Mixing Time | Slow Mix 1 Mixing RPM | Mixing Time | Floc Structure | Turbidity 0 Min Sample 0 | 5 min Sample 1 | 10 min Sample 2 | 15 min Sample 3 | 20 min Sample 4 | 25 min Sample 5 | 30 min Sample 6 | 35 min Sample 7 | 40 min Sample 8 | Supernatant Sample 100 mL | pH | Water Temp | Stock Temp | Start | Finish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 10 | $FeCl_3$ | 1 | 90 | 1 | 48 | 30 | Pin | 3.56 | 1.12 | 1.11 | 1.05 | 0.89 | 0.63 | 0.63 | 0.49 | 0.20 | X | 7.77 | 60.0 | 64.1 | 10:30 | 11:41 |
| 5 | 20 | $FeCl_3$ | 2 | 90 | 1 | 48 | 30 | Pin | 5.96 | 2.86 | 1.51 | 1.48 | 0.94 | 0.67 | 0.59 | 0.59 | 0.43 | X | 7.70 | 60.0 | 64.1 | 10:30 | 11:41 |
| 6 | 40 | $FeCl_3$ | 4 | 90 | 1 | 48 | 30 | Pin | 11.00 | 3.57 | 1.69 | 1.15 | 1.12 | 0.61 | 0.59 | 0.51 | 0.42 | X | 7.42 | 60.0 | 64.1 | 10:30 | 11:41 |

**Solids Samples**

| | Jar 1 | Tare | Dry | gds |
|---|---|---|---|---|
| 25um | Filter 1 | 6.2117 | 6.2305 | 0.0188 |
| 8um | Filter 2 | 6.7449 | 6.7451 | 0.0002 |
| 1.2um | Filter 3 | 1.0562 | 1.0643 | 0.0081 |
| | | | TOTAL | 0.0271 |
| | Jar 2 | | | |
| 25um | Filter 1 | 6.2321 | 6.2580 | 0.0259 |
| 8um | Filter 2 | 6.6767 | 6.6786 | 0.0019 |
| 1.2um | Filter 3 | 1.0573 | 1.0579 | 0.0006 |
| | | | TOTAL | 0.0284 |
| | Jar 3 | | | |
| 25um | Filter 1 | 6.2792 | 6.2964 | 0.0172 |
| 8um | Filter 2 | 6.4731 | 6.4737 | 0.0006 |
| 1.2um | Filter 3 | 1.0595 | 1.0647 | 0.0052 |
| | | | TOTAL | 0.0230 |

| FLSMIDTH | PROJECT<br>MWH – FMC OU – GWR STEP 3.5 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT<br>BENCH TESTING $FeCl_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

STOCK SOLUTION – $FeCl_3$ 8/4/14

$FeCl_3 \cdot 6H_2O$ : 270.30g

% MASS

$FeCl_3$ : 0.60 => 60%

$6H_2O$ : 0.40 => 40%

TO GENERATE STOCK SOLUTION @ 10g/L W/VOLUME : 500mL

$500\,mL \cdot \frac{1L}{1000mL} = 0.5L \cdot \frac{10g}{L} = 5g\ FC \cdot \frac{1.0g\ FCH}{0.6g\ FC} = 8.33g\ FCH$

– 8.33g OF FERRIC CHLORIDE HEXAHYDRATE YIELDS 5g OF FERRIC CHLORIDE RESULTING IN STOCK SOLUTION OF 10g/L OR 10mg/mL

| FLSmidth | PROJECT: MWH - FAC OU - GWR STEP 3.5 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT: BENCH TESTING $FeCl_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

8/4/14

JAR TESTS

- pH METER

MODEL: OAKTON pH 5+

RANGE: 0.00 – 14.00 pH

RESOLUTION: 0.01 pH

ACCURACY: ± 0.01 pH

CALIBRATED: 8/4/14

- TURBIDITY METER

MODEL: HACH 2100P

RANGE: 0 – 1000 NTU

REPEAT: ± 1%

ACCURACY: ± 2%

CALIBRATED: 8/4/14

PROCEDURES

TEST PARAMETERS:

| Jar | pH | Dose (mg/L) |
|---|---|---|
| 1 | 7 | 40 |
| 2 | 7 | 80 |
| 3 | 6 | 40 |
| 4 | 6 | 80 |
| 5 | 5 | 40 |
| 6 | 5 | 80 |

HCl FOR pH ADJUST

MW: 36.46

Wt%: 37

M: 12.178

- DILUTED TO 0.1 M
- pH ADJUSTED TO 5, 6 & 7 PER TEST PLAN

- MIXER ACHIEVED 90 RPM FOR RAPID MIX 1 MINUTE $M_1$
- MIXER REDUCED TO 40 RPM FOR SLOW MIX 30 MINUTES $M_1$
- MIXING CEASED @ 31 MINUTES AND TURBIDITY SAMPLES COLLECTED @ 31, 36, 41, 46, 51, 56, 61 MINUTES
- AT 61 MINUTES 100 ML SAMPLES COLLECTED FOR ANALYSIS

OBSERVATIONS START: 11:05 FINISH: 12:06

- RAW WATER pH: 7.96
- RAW WATER TURBIDITY: 0.40 NTU
- JARS SHOWED PIN FLOC @ 2-3 MINUTES
- JARS 5 & 6 (pH 5) WERE LIGHTER COLOR AND LESS FLOC
- SETTLING BEHAVIOR SIMILAR TO PREVIOUS TESTS

MWH Testing
Step 3.5
Stock 10 g/L

HCl Conc: 0.1 M
Raw Water Turbidity: 0.40
Raw Water pH: 7.96

| | Dosages | | | Rapid Mix | | Slow Mix 1 | | | Turbidity | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 0 Min | 5 Min | 10 Min | 15 Min | 20 Min | 25 Min | 30 Min | Supernatant Sample | | | | | | | |
| Jar | mg/L | Coag | mLs | Mixing RPM | Mixing Time | Mixing RPM | Mixing Time | Floc Structure | Sample 0 | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Sample 6 | 100 mL | Initial pH | HCl Added mLs | Adjusted pH | Water Temp | Stock Temp | Start | Finish |
| 1 | 40 | $FeCl_3$ | 4 | 90 | 1 | 48 | 30 | Pin | 13.80 | 7.79 | 1.84 | 1.19 | 1.11 | 0.85 | 0.68 | X | 7.96 | 7 | 7.02 | 59.9 | 64.1 | 11:05 | 12:06 |
| 2 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 24.10 | 11.68 | 1.79 | 1.27 | 0.67 | 0.59 | 0.57 | X | 7.96 | 7 | 7.03 | 59.9 | 64.1 | 11:05 | 12:06 |
| 3 | 40 | $FeCl_3$ | 4 | 90 | 1 | 48 | 30 | Pin | 9.89 | 4.95 | 0.62 | 0.41 | 0.49 | 0.39 | 0.35 | X | 7.96 | 20 | 6.03 | 59.9 | 64.1 | 11:05 | 12:06 |
| 4 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 22.30 | 10.29 | 1.19 | 0.85 | 0.63 | 0.61 | 0.57 | X | 7.96 | 20 | 6.02 | 59.9 | 64.1 | 11:05 | 12:06 |
| 5 | 40 | $FeCl_3$ | 4 | 90 | 1 | 48 | 30 | Pin | 13.20 | 12.87 | 12.60 | 12.49 | 12.20 | 11.73 | 11.60 | X | 7.96 | 25 | 4.98 | 59.9 | 64.1 | 11:05 | 12:06 |
| 6 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 12.00 | 11.59 | 11.30 | 11.22 | 11.10 | 11.06 | 11.05 | X | 7.96 | 25 | 4.99 | 59.9 | 64.1 | 11:05 | 12:06 |

| FLSmidth | PROJECT<br>MWH - FMC OU - GWR STEP 4 | PROJ NO. |
|---|---|---|
| | | CALC NO. |
| | SUBJECT<br>BENCH TESTING $FeCl_3$ | BY DATE |
| | | CHK DATE |
| | | SHEET OF REV |

STOCK SOLUTION - $FeCl_3$ 8/13/14

$FeCl_3 \cdot 6H_2O$ : 270.30g

% MASS

$FeCl_3$ :

$6H_2O$ :

TO GENERATE STOCK SOLUTION @ 10 g/L w/ VOLUME : 500 mL

$$500\,mL \cdot \frac{1\,L}{1000\,mL} = 0.5\,L \cdot \frac{10\,g}{L} = 5\,g\,Fe \cdot \frac{1.0\,g\,FCH}{0.60\,Fe} = 8.33\,g\,FCH$$

- 8.33g OF FERRIC CHLORIDE HEXAHYDRATE YIELDS 5g OF FERRIC CHLORIDE RESULTING IN STOCK SOLUTION OF 10g/L OR 10mg/mL

| FLSmidth | PROJECT: MINN - FMC OU - GWTP STEP 4 | PROJ NO. | |
|---|---|---|---|
| | | CALC NO. | |
| | SUBJECT: BENCH TESTING $FeCl_3$ | BY | DATE |
| | | CHK | DATE |
| | | SHEET | OF REV |

JAR TESTS 8/13/14

- pH METER:

MODEL: OAKTON pH 5+

RANGE: 0.00 - 14.00 pH

RESOLUTION: 0.01 pH

ACCURACY: ±0.01 pH

CALIBRATED: 8/13/14

- TURBIDITY METER:

MODEL: HACH 2100P

RANGE: 0 - 1000 NTU

REPEAT: ±1%

ACCURACY: ±2%

CALIBRATED: 8/13/14

PROCEDURE

TEST PARAMETERS:

- 10 JARS w/ 80 mg/L $FeCl_3$
- MIXER ACHIEVED 90 RPM FOR RAPID MIX 1 MINUTE M1
- MIXER ACHIEVED 40 RPM FOR SLOW MIX 30 MINUTES M1
- MIXING CEASED @ 31 MINUTES AND TURBIDITY MEASURED @ 31, 41, 51, 61 MINUTES
- pH RECORDED @ 61 MINUTES
- 250 mL OF SUPERNATANT DECANTED FROM EACH AND COMPOSITED
- COMPOSITE SAMPLE STIRRED AND PLACED IN FIVE 500 mL BOTTLES
- JAR 9 SLUDGE FILTERED AND DRIED @ 50 C FOR 18 HOURS
- SLUDGE COMPOSITED AND ALLOWED TO SETTLE FOR 2 HOURS
- SUPERNATANT DECANTED FROM SLUDGE
- SLUDGE PLACED IN 50 C OVEN TO "THICKEN" FOR 3 HOURS
- "THICKENED" SLUDGE PLACED IN 4 oz SAMPLE CONTAINER

OBSERVATIONS START: 13:43 FINISH: 15:56

- RAW WATER pH: 8.28 TURBIDITY: 0.79
- START pH & TURBIDITY MEASURED SLIGHTLY HIGHER THAN PREVIOUS TESTS + VERIFIED W/ MULTIPLE METERS
- PIN FLOC @ 2-3 MINUTES
- YELLOW SOLIDS IN ALL JARS
- SOLIDS COLLECTED & FILTERED FROM JAR 9 FOR DRY SOLIDS WEIGHT

SOLIDS COLLECTION

- FILTER JAR 9 THROUGH 1.2 μm WHATMAN GF/C 42.5 mm ϕ 1.2 μm RETENTION CAT NO. 1822 042

TARE: 1.0767 g DRY: 1.1452 g GRAMS OF DRY SOLIDS: 0.06685 g

MWH Testing
Step 4
Stock 10 g/L

| | |
|---|---|
| Raw Water Turbidity: | 0.79 |
| Raw Water pH: | 8.28 |

| Jar | Dosages mg/L | Coag | mLs | Rapid Mix Mixing RPM | Rapid Mix Mixing Time | Slow Mix 1 Mixing RPM | Slow Mix 1 Mixing Time | Floc Structure | Turbidity 0 Min Sample 0 | 10 Min Sample 1 | 20 Min Sample 2 | 30 Min Sample 3 | Supernatant Sample mL | Water Temp | Stock Temp | pH | Start | Finish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 19.70 | 1.25 | 0.56 | 0.49 | 250 | 60.3 | 63.1 | 7.12 | 13:43 | 14:44 |
| 2 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 19.00 | 1.17 | 0.40 | 0.36 | 250 | 60.3 | 63.1 | 7.11 | 13:43 | 14:44 |
| 3 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 20.20 | 1.35 | 0.30 | 0.29 | 250 | 60.3 | 63.1 | 7.07 | 13:43 | 14:44 |
| 4 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 19.50 | 1.04 | 0.29 | 0.37 | 250 | 60.3 | 63.1 | 7.12 | 13:43 | 14:44 |
| 5 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 20.20 | 1.39 | 0.39 | 0.36 | 250 | 60.3 | 63.1 | 7.10 | 13:43 | 14:44 |
| 6 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 22.50 | 1.59 | 0.76 | 0.54 | 250 | 60.3 | 63.1 | 7.09 | 13:43 | 14:44 |
| 7 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 24.30 | 2.30 | 0.72 | 0.57 | 250 | 60.3 | 63.1 | 7.07 | 14:55 | 15:56 |
| 8 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 19.60 | 1.84 | 0.66 | 0.60 | 250 | 60.3 | 63.1 | 7.12 | 14:55 | 15:56 |
| 9 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 26.90 | 2.58 | 0.99 | 0.77 | 250 | 60.3 | 63.1 | 7.10 | 14:55 | 15:56 |
| 10 | 80 | $FeCl_3$ | 8 | 90 | 1 | 48 | 30 | Pin | 22.90 | 2.37 | 0.57 | 0.43 | 250 | 60.3 | 63.1 | 7.08 | 14:55 | 15:56 |

| | Tare | Dry | gds |
|---|---|---|---|
| Jar 9 | 1.0767 | 1.1452 | 0.0685 |

# Attachment D

# Analytical Lab Reports

# ANALYTICAL REPORT

Report Date: June 09, 2014

Betty Van Pelt
MWH Americas
2890 E. Cottonwood Pkwy
Suite 300
Salt Lake City, UT 84121

Phone: (801) 617-3200
Fax: (801) 617-4200
E-mail: betty.vanpelt@mwhglobal.com

Workorder: **34-1414312**
Project ID: 10503371.010102
Purchase Order: 10503371.010102

| Client Sample ID | Lab ID | Collect Date | Receive Date | Sampling Site |
|---|---|---|---|---|
| 72 HR COMP | 1414312001 | 05/10/14 | 05/22/14 | 10503371.010102 |

# ANALYTICAL REPORT

**Workorder:** 34-1414312
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **72 HR COMP** | Sampling Site: 10503371.010102 | Collected: 05/10/2014
Lab ID: 1414312001 | Media: 1000 mL Nalgene | Received: 05/22/2014
Matrix: Water | Sampling Parameter: NA

### Analysis Method - EPA 300.0/SW 9056

**Preparation:** Not Applicable
**Analysis:** EPA 300.0/SW 9056, Water | **Instrument ID:** IC01
**Batch:** EIC/1462 (HBN: 127179) | **Percent Solid:** NA
**Analyzed:** 05/23/2014 14:01 | **Report Basis:** Wet

| Analyte | mg/L | MDL (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Fluoride | **0.17** | 0.030 | 0.10 | 1 | |

### Analysis Method - EPA 300.0/SW 9056

**Preparation:** Not Applicable
**Analysis:** EPA 300.0/SW 9056, Water | **Instrument ID:** IC01
**Batch:** EIC/1462 (HBN: 127179) | **Percent Solid:** NA
**Analyzed:** 05/23/2014 14:23 | **Report Basis:** Wet

| Analyte | mg/L | MDL (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Nitrite-N | 0.13 | 0.092 | 0.31 | 10 | J |
| Nitrate-N | **11** | 0.068 | 0.23 | 10 | |

### Analysis Method - EPA 300.0/SW 9056

**Preparation:** Not Applicable
**Analysis:** EPA 300.0/SW 9056, Water | **Instrument ID:** IC01
**Batch:** EIC/1462 (HBN: 127179) | **Percent Solid:** NA
**Analyzed:** 05/23/2014 14:45 | **Report Basis:** Wet

| Analyte | mg/L | MDL (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Chloride | **240** | 3.0 | 10 | 100 | |
| Sulfate | **250** | 3.0 | 10 | 100 | |

### Analysis Method - EPA 335.4

**Preparation:** Not Applicable
**Analysis:** EPA 335.4 w/ Micro Dist, Water | **Instrument ID:** WET01
**Batch:** EWC/5047 (HBN: 127325) | **Percent Solid:** NA
**Analyzed:** 05/23/2014 16:21 | **Report Basis:** Wet

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Cyanide | **43.4** | 5.0 | 15 | 1 | |

### Analysis Method - EPA 350.1

**Preparation:** Not Applicable
**Analysis:** EPA 350.1, Water | **Instrument ID:** WET01
**Batch:** EWC/5064 (HBN: 127588) | **Percent Solid:** NA
**Analyzed:** 06/04/2014 08:08 | **Report Basis:** Wet

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Ammonia as Nitrogen | **410** | 23 | 50 | 1 | |

### Analysis Method - SW 6010C

**Preparation:** SW-846, EPA 3010 Water Prep | **Weight/Volume**
**Batch:** EIPX/4900 (HBN: 127453) | **Initial:** 25 mL
**Prepared:** 05/29/2014 | **Final:** 50 mL
**Analysis:** SW 6010C, Water | **Instrument ID:** ICP08
**Batch:** EICP/4518 (HBN: 127586) | **Percent Solid:** NA
**Analyzed:** 06/04/2014 10:02 | **Report Basis:** Wet

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **52.7** | 6.0 | 20 | 1 | |
| Cadmium | ND | 3.0 | 10 | 1 | U |
| Copper | 29.3 | 12 | 40 | 1 | J |
| Iron | 66.9 | 60 | 200 | 1 | J |
| Lead | ND | 6.0 | 20 | 1 | U |
| Nickel | ND | 24 | 80 | 1 | U |
| Phosphorus | **3210** | 60 | 200 | 1 | |
| Potassium | **79400** | 600 | 2000 | 1 | |

**Results Continued on Next Page**

# ANALYTICAL REPORT

**Workorder:** 34-1414312
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

| | | | | | |
|---|---|---|---|---|---|
| Sample ID: | 72 HR COMP | Sampling Site: | 10503371.010102 | Collected: | 05/10/2014 |
| Lab ID: | 1414312001 | Media: | 500 mL Nalgene | Received: | 05/22/2014 |
| Matrix: | Water | Sampling Parameter: | NA | | |

### Analysis Method - SW 6010C

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3010 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4900 (HBN: 127453) | **Initial:** 25 mL | **Batch:** | EICP/4518 (HBN: 127586) | **Percent Solid:** NA |
| **Prepared:** | 05/29/2014 | **Final:** 50 mL | **Analyzed:** | 06/04/2014 10:02 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Selenium | ND | 12 | 40 | 1 | U |
| Silver | ND | 6.0 | 20 | 1 | U |
| Sodium | **98100** | 300 | 1000 | 1 | |
| Zinc | 41.8 | 30 | 100 | 1 | J |

### Analysis Method - SW 7470

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW 7470A, Water Prep | **Weight/Volume** | **Analysis:** | SW 7470A, Water | **Instrument ID:** AACV02 |
| **Batch:** | EHG/5360 (HBN: 127872) | **Initial:** 25 mL | **Batch:** | EHG/5363 (HBN: 127953) | **Percent Solid:** NA |
| **Prepared:** | 06/06/2014 | **Final:** 50 mL | **Analyzed:** | 06/06/2014 17:39 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Mercury | ND | 0.072 | 0.20 | 1 | U |

## Comments

**Workorder: 1414312**

EPA 300.0: Low nitrite recovery in MS/MSD is due to matrix interference.

**Sample: 1414312001**

SW 6010C: Sample 1414312001 and its associated QC's were prepared with a 2x dilution due to limited sample volume.

EPA 335.4: The cyanide result was biased high (see QC report and comments). The sample was reanalyzed on 05/27/2014 at 19:35. The reanalyzed cyanide result was 31.9 µg/L. Quality control data for the reanalysis was within control limits (see HBN:127182 QC report). The reanalysis was outside the sample hold time. Therefore the reanalysis value is for verification of the original result only.

SW 7470A: The sample and its matrix QC were prepared for mercury analysis as 2x dilutions due to limited sample volume.

**Quality Control: EPA 335.4 - (HBN: 127325)**

Cyanide matrix spike and matrix spike duplicate results are with HBN:127182 which is the batch that the field sample was originally distilled and analyzed as a part of.

Cyanide quality control results were biased high. Field sample result may also have then been biased high. See sample comments and NC/CAR-0783 comments for additional information.

## Report Authorization

| Method | Analyst | Peer Review |
|---|---|---|
| **EPA 300.0/SW 9056** | Thomas T. McKay | Christopher Winter |
| **EPA 335.4** | Christopher R. Hansen | Brittney Austin |
| **EPA 350.1** | Whitney Redd | Brittney Austin |
| **SW 6010C** | Neil A. Edwards | Kristie F. Bitner |
| **SW 7470** | Christopher R. Hansen | Kelsey Lockwood |

# ANALYTICAL REPORT

**Workorder:** 34-1414312
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Laboratory Contact Information

ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

Phone: (801) 266-7700
Email: alslt.lab@ALSGlobal.com
Web: www.alsslc.com

## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

# ANALYTICAL REPORT

**Workorder:** 34-1414312
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< This testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

## Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.

ALS Environmental
ALS Group USA, Corp.
1317 South 13th Avenue
Kelso, WA 98626
**T:** +1 360 577 7222
**F:** +1 360 636 1068
**www.alsglobal.com**

June 16, 2014 Analytical Report for Service Request No: K1405570

Betty Van Pelt
MWH Americas, Inc.
2890 East Cottonwood Parkway, Suite 300
Salt Lake City, UT 84121

**RE: FMC Hydro Study**

Dear Betty:

Enclosed are the results of the samples submitted to our laboratory on June 04, 2014. For your reference, these analyses have been assigned our service request number K1405570.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3364. You may also contact me via Email at Howard.Holmes@alsglobal.com.

Respectfully submitted,

**ALS Group USA Corp. dba ALS Environmental**

Howard Holmes
Project Manager

HH/mj



RIGHT SOLUTIONS | RIGHT PARTNER

## Acronyms

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| A2LA | American Association for Laboratory Accreditation |
| CARB | California Air Resources Board |
| CAS Number | Chemical Abstract Service registry Number |
| CFC | Chlorofluorocarbon |
| CFU | Colony-Forming Unit |
| DEC | Department of Environmental Conservation |
| DEQ | Department of Environmental Quality |
| DHS | Department of Health Services |
| DOE | Department of Ecology |
| DOH | Department of Health |
| EPA | U. S. Environmental Protection Agency |
| ELAP | Environmental Laboratory Accreditation Program |
| GC | Gas Chromatography |
| GC/MS | Gas Chromatography/Mass Spectrometry |
| LOD | Limit of Detection |
| LOQ | Limit of Quantitation |
| LUFT | Leaking Underground Fuel Tank |
| M | Modified |
| MCL | Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA. |
| MDL | Method Detection Limit |
| MPN | Most Probable Number |
| MRL | Method Reporting Limit |
| NA | Not Applicable |
| NC | Not Calculated |
| NCASI | National Council of the Paper Industry for Air and Stream Improvement |
| ND | Not Detected |
| NIOSH | National Institute for Occupational Safety and Health |
| PQL | Practical Quantitation Limit |
| RCRA | Resource Conservation and Recovery Act |
| SIM | Selected Ion Monitoring |
| TPH | Total Petroleum Hydrocarbons |
| tr | Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL. |

## Inorganic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards. |
| E | The result is an estimate amount because the value exceeded the instrument calibration range. |
| J | The result is an estimated value. |
| U | The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.<br>*DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution. |
| i | The MRL/MDL or LOQ/LOD is elevated due to a matrix interference. |
| X | See case narrative. |
| Q | See case narrative. One or more quality control criteria was outside the limits. |
| H | The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory. |

## Metals Data Qualifiers

| | |
|---|---|
| # | The control limit criteria is not applicable. See case narrative. |
| J | The result is an estimated value. |
| E | The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample. |
| M | The duplicate injection precision was not met. |
| N | The Matrix Spike sample recovery is not within control limits. See case narrative. |
| S | The reported value was determined by the Method of Standard Additions (MSA). |
| U | The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.<br>*DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution. |
| W | The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance. |
| i | The MRL/MDL or LOQ/LOD is elevated due to a matrix interference. |
| X | See case narrative. |
| + | The correlation coefficient for the MSA is less than 0.995. |
| Q | See case narrative. One or more quality control criteria was outside the limits. |

## Organic Data Qualifiers

| | |
|---|---|
| * | The result is an outlier. See case narrative. |
| # | The control limit criteria is not applicable. See case narrative. |
| A | A tentatively identified compound, a suspected aldol-condensation product. |
| B | The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards. |
| C | The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data. |
| D | The reported result is from a dilution. |
| E | The result is an estimated value. |
| J | The result is an estimated value. |
| N | The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed. |
| P | The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results. |
| U | The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.<br>*DOD-QSM 4.2 definition* : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution. |
| i | The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference. |
| X | See case narrative. |
| Q | See case narrative. One or more quality control criteria was outside the limits. |

## Additional Petroleum Hydrocarbon Specific Qualifiers

| | |
|---|---|
| F | The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard. |
| L | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard. |
| H | The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard. |
| O | The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard. |
| Y | The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard. |
| Z | The chromatographic fingerprint does not resemble a petroleum product. |

**ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso**
**State Certifications, Accreditations, and Licenses**

| Agency | Web Site | Number |
|---|---|---|
| Alaska DEC UST | http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx | UST-040 |
| Arizona DHS | http://www.azdhs.gov/lab/license/env.htm | AZ0339 |
| Arkansas - DEQ | http://www.adeq.state.ar.us/techsvs/labcert.htm | 88-0637 |
| California DHS (ELAP) | http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx | 2286 |
| DOD ELAP | http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm | L12-28 |
| Florida DOH | http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm | E87412 |
| Georgia DNR | http://www.gaepd.org/Documents/techguide_pcb.html#cel | 881 |
| Hawaii DOH | Not available | - |
| Idaho DHW | http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx | - |
| ISO 17025 | http://www.pjlabs.com/ | L12-27 |
| Louisiana DEQ | http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx | 3016 |
| Maine DHS | Not available | WA0035 |
| Michigan DEQ | http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html | 9949 |
| Minnesota DOH | http://www.health.state.mn.us/accreditation | 053-999-457 |
| Montana DPHHS | http://www.dphhs.mt.gov/publichealth/ | CERT0047 |
| Nevada DEP | http://ndep.nv.gov/bsdw/labservice.htm | WA35 |
| New Jersey DEP | http://www.nj.gov/dep/oqa/ | WA005 |
| North Carolina DWQ | http://www.dwqlab.org/ | 605 |
| Oklahoma DEQ | http://www.deq.state.ok.us/CSDnew/labcert.htm | 9801 |
| Oregon – DEQ (NELAP) | http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx | WA200001 |
| South Carolina DHEC | http://www.scdhec.gov/environment/envserv/ | 61002 |
| Texas CEQ | http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html | 4704427-08-TX |
| Washington DOE | http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html | C1203 |
| Wisconsin DNR | http://dnr.wi.gov/ | 998386840 |
| Wyoming (EPA Region 8) | http://www.epa.gov/region8/water/dwhome/wyomingdi.html | - |
| Kelso Laboratory Website | www.alsglobal.com | NA |

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.ALSGlobal.com or at the accreditation bodies web site.
Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

M1405240

# ALS Environmental
## Field Chain-of-Custody Record

Method 1632

CoC #: 1

Page 1 of 1

Client Name & Address:
MWH Americas
2890 E Cottonwood Pkwy, Suite 300
Salt Lake City, UT 84121

Project Name & No.: FMC Hydro Study

ALS Quote No: e-mail w/ Kevin Griffiths 5/15/14

Report to: Betty Van Pelt

Phone: 801-617-3243

Report to e-mail: betty.vanpelt@mwhglobal.com

e-mail: betty.vanpelt@mwhglobal.com

Bill to: corporate

Analyses Requested: Arsenic Speciation + 3/45

Matrix Codes: W) Water, B) Bulk, L) Liquid, F) Filter, S) Soil, G) Wipe, C) Solid, M) Media

Preservation Codes: 1) Cool to 4°C; 2) HCl to pH<2, 4°C; 3) $H_2SO_4$ to pH<2, 4°C; 4) $HNO_3$ to pH<2, 4°C; 5) NaOH to pH>12, 4°C; 6) ZnOAc/NaOH to pH>9, 4°C

| Field Sample Number | Date | Time | Depth | ALS Sample Number | No. of Containers | Sample for Matrix QC | Arsenic Speciation + 3/45 | Preservation Code | Sample Matrix Code | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 405 Comp | 5/10/14 | 1000 | — | | 1 | W | X | | | |
| 405 Comp Dup | 5/10/14 | 1000 | — | | 1 | W | X | | | |

**Possible Hazard Identification**
- [x] Non-Hazard
- [ ] Skin Irritant
- [ ] Rad
- [ ] Flammable
- [ ] Poison
- [ ] Unknown

**Sample Disposal**
- [ ] Return to Client
- [ ] Archive _____ Months
- [x] Disposal by Lab

(fees assessed for samples retained > 3 months)

**Data Deliverable:**
- [ ] Level 1
- [ ] Level 3
- [ ] Level 2
- [ ] Level 4

EDD Type:

**Requested Turn Around Time**
- [ ] 2 Days (Rush)
- [ ] 7 Days (Rush)
- [ ] 3 Days (Rush)
- [x] 14 Days

(Rush = email data by COB on day due. Surcharges assessed.)

Carrier/Airbill #:

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
|---|---|---|---|---|---|
| [signature] | 6/3/14 | 1600 | Kalla Smith | 6/4/14 | 1010 |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |

**Shipped to:**
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
**Phone:** (800) 356-9135
**Phone:** (801) 266-7700
**FAX:** (801) 268-9992
WEB:www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

ALS

PC 112

# Cooler Receipt and Preservation Form

5570 ~~5538~~

lient / Project: MWH Service Request *K14*

eceived: 6/4/14 Opened: 6/4/14 By: KD Unloaded: 6/4/14 By: KD

Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*

Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* _____ *NA*

Were custody seals on coolers? NA Y N If yes, how many and where? _____

If present, were custody seals intact? Y N If present, were they signed and dated? Y N

| Raw Cooler Temp | Corrected. Cooler Temp | Raw Temp Blank | Corrected Temp Blank | Corr. Factor | Thermometer ID | Cooler/COC ID NA | Tracking Number NA | Filed |
|---|---|---|---|---|---|---|---|---|
| -.5 | -.6 | — | — | -.1 | 316 | 1 | 972367849737 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* _____

Were custody papers properly filled out (ink, signed, etc.)? NA Y N

Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N

Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N

Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N

Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N

0. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N

1. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N

2. Was C12/Res negative? NA Y N

| Sample ID on Bottle | Sample ID on COC | Identified by: |
|---|---|---|
| | | |
| | | |
| | | |

| Sample ID | Bottle Count Bottle Type | Out of Temp | Head-space | Broke | pH | Reagent | Volume added | Reagent Lot Number | Initials | Time |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

*lotes, Discrepancies, & Resolutions:* _____

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | 05/10/14 |
| **Sample Matrix:** | Water | **Date Received:** | 06/04/14 |

Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | 405 Comp | Units: | ug/L (ppb) |
| Lab Code: | K1405570-001 | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/06/14 | 0.068 | |
| Arsenic (V) | None | 1632A | 4.0 | 0.6 | 200 | NA | 06/06/14 | 40.7 | |
| Inorganic Arsenic | None | 1632A | 4.0 | 0.6 | 200 | NA | 06/05/14 | 40.8 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | 05/10/14 |
| **Sample Matrix:** | Water | **Date Received:** | 06/04/14 |

Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | 405 Comp Dup | Units: | ug/L (ppb) |
| Lab Code: | K1405570-002 | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/06/14 | 0.053 | |
| Arsenic (V) | None | 1632A | 4.0 | 0.6 | 200 | NA | 06/06/14 | 40.8 | |
| Inorganic Arsenic | None | 1632A | 4.0 | 0.6 | 200 | NA | 06/05/14 | 40.9 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |

Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | Method Blank | Units: | ug/L (ppb) |
| Lab Code: | K1405570-MB1 | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/06/14 | 0.008 | J |
| Inorganic Arsenic | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/05/14 | 0.008 | J |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |

Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | Method Blank | Units: | ug/L (ppb) |
| Lab Code: | K1405570-MB2 | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/06/14 | 0.007 | J |
| Inorganic Arsenic | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/05/14 | 0.004 | J |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |

Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | Method Blank | Units: | ug/L (ppb) |
| Lab Code: | K1405570-MB3 | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/06/14 | 0.010 | J |
| Inorganic Arsenic | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/05/14 | ND | |

**ALS Group USA, Corp.**
**dba ALS Environmental**
Analytical Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |

Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | Method Blank | Units: | ug/L (ppb) |
| Lab Code: | K1405570-MB4 | Basis: | NA |
| Test Notes: | | | |

| Analyte | Prep Method | Analysis Method | MRL | MDL | Dilution Factor | Date Extracted | Date Analyzed | Result | Result Notes |
|---|---|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/06/14 | ND | |
| Inorganic Arsenic | None | 1632A | 0.02 | 0.003 | 1 | NA | 06/05/14 | ND | |

**ALS Group USA, Corp.**
**dba ALS Environmental**
QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **Sample Matrix:** | Water | **Date Received:** | NA |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 06/06/14 |

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

| | | | | |
|---|---|---|---|---|
| Sample Name: | Batch QC | | Units: | ug/L (ppb) |
| Lab Code: | K1405449-010MS, | K1405449-010MS | Basis: | NA |
| Test Notes: | | | | |

| | | | | Spike Level | | Sample | Spike Result | | Percent Recovery | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Prep Method** | **Analysis Method** | **MRL** | **MS** | **DMS** | **Result** | **MS** | **DMS** | **MS** | **DMS** | **Method Acceptance Limits** | **Relative Percent Difference** | **Result Notes** |
| Arsenic (III) | None | 1632A | 0.02 | 0.2 | 0.2 | 0.011 | 0.194 | 0.170 | 92 | 80 | 30-170 | 13 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**
QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | 05/10/14 |
| **Sample Matrix:** | Water | **Date Received:** | 06/04/14 |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 06/05/14 |

Matrix Spike/Duplicate Matrix Spike Summary
Total Metals

| | | | |
|---|---|---|---|
| Sample Name: | 405 Comp | Units: | ug/L (ppb) |
| Lab Code: | K1405570-001MS, K1405570-001MSD | Basis: | NA |
| Test Notes: | | | |

| | | | | | | | | | Percent Recovery | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Spike Level | | Sample | Spike Result | | | | Method | Relative | |
| **Analyte** | **Prep Method** | **Analysis Method** | **MRL** | **MS** | **DMS** | **Result** | **MS** | **DMS** | **MS** | **DMS** | **Acceptance Limits** | **Percent Difference** | **Result Notes** |
| Inorganic Arsenic | None | 1632A | 4.0 | 40 | 40 | 40.8 | 82.9 | 83.2 | 105 | 106 | 50-150 | <1 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **LCS Matrix:** | Water | **Date Received:** | NA |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 06/05,06/14 |

Calibration Verification (CALVER) Sample Summary
Total Metals

Sample Name: CALVER 1

Units: ug/L (ppb)
Basis: NA

Test Notes:

| Analyte | Prep Method | Analysis Method | True Value | Result | Percent Recovery | CAS Percent Recovery Acceptance Limits | Result Notes |
|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.200 | 0.189 | 94 | 70-130 | |
| Inorganic Arsenic | None | 1632A | 0.200 | 0.185 | 92 | 80-120 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **LCS Matrix:** | Water | **Date Received:** | NA |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 06/05,06/14 |

Calibration Verification (CALVER) Sample Summary
Total Metals

Sample Name: CALVER 2

Units: ug/L (ppb)
Basis: NA

Test Notes:

| Analyte | Prep Method | Analysis Method | True Value | Result | Percent Recovery | CAS Percent Recovery Acceptance Limits | Result Notes |
|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.200 | 0.171 | 86 | 70-130 | |
| Inorganic Arsenic | None | 1632A | 0.200 | 0.174 | 87 | 80-120 | |

**ALS Group USA, Corp.**
**dba ALS Environmental**

QA/QC Report

| | | | |
|---|---|---|---|
| **Client:** | Montgomery Watson Americas, Incorporated | **Service Request:** | K1405570 |
| **Project:** | FMC Hydro Study | **Date Collected:** | NA |
| **LCS Matrix:** | Water | **Date Received:** | NA |
| | | **Date Extracted:** | NA |
| | | **Date Analyzed:** | 06/05,06/14 |

Calibration Verification (CALVER) Sample Summary
Total Metals

Sample Name: CALVER 3

Units: ug/L (ppb)
Basis: NA

Test Notes:

| Analyte | Prep Method | Analysis Method | True Value | Result | Percent Recovery | CAS Percent Recovery Acceptance Limits | Result Notes |
|---|---|---|---|---|---|---|---|
| Arsenic (III) | None | 1632A | 0.200 | 0.193 | 96 | 70-130 | |
| Inorganic Arsenic | None | 1632A | 0.200 | 0.204 | 102 | 80-120 | |

# Case Narrative

**Analysis:** ICP Metals
**Preparation SOP#:** IS-SW-3015, Rev. 10
**Analysis SOP#:** IP-SW-6010C, Rev. 2

**Client:** MWH Americas
**Matrix:** Water
**ALS WorkOrder ID#:** 1420598

**General Set Information:** Ten samples were analyzed for arsenic and phosphorus in water.

**Method Summary:** A thoroughly mixed 15-mL portion of sample and 30-mL of ASTM TYPE II $H_2O$ is heated with nitric acid in a microwave. The resulting digest was analyzed using an iCAP 6500 Dual View analyzer with an ASXpress Plus automation system.

**Sample Preparation:** All samples were prepared in accordance with published procedures.

**Instrument Calibration:** Instrument calibration was performed in accordance with published procedures.

**Initial and Continuing Calibration Data:** Initial and continuing calibrations were performed in accordance with published procedures.

**Dilutions:** The samples were prepared with a dilution due to limited sample volume.

**Method and Sample QC Data:** The method blank concentrations were less than the reporting limits. The LCS results were within control limits.

**Matrix Duplicate Analysis:** No matrix duplicate was performed due to limited provided sample volume.

**Matrix Spike and Matrix Spike Duplicate Analysis:** No matrix spike or matrix spike duplicate were performed due to limited provided sample volume.

**Post-Digestion Spike analysis:** The post digestion spike recoveries are within control limits.

**Serial Dilution:** The relative percent differences between the parent sample and the serial dilution are within control limits.

**NC/CAR:** None were required.

**Flagging Codes:** Refer to the last page of the report for all applicable flagging codes.

**Sample Calculation:**

Method 3010/6010C: $C \times \frac{Vf}{Vi} \times DF = Concentration(ug/L)$

Where,
C = Instrument value in µg/L (The average of all replicate integrations).
Vf = Final digestion volume (L)
Vi = Initial Volume (L)
DF = Dilution Factor

**Miscellaneous Comments:** None were required.

07/24/2004

Neil Edwards Date

# ANALYTICAL REPORT

Report Date: July 24, 2014

Anna Boguslarsky
MWH Americas
2890 East Cottonwood Parkway
Suite 300
Salt Lake City, UT 84121

Phone: (949) 232-2024

E-mail: anna.boguslavsky@mwhglobal.com

Workorder: **34-1420598**
Project ID: FMC Hydro Study
Purchase Order: FMC Hydro Study

| Client Sample ID | Lab ID | Collect Date | Receive Date | Sampling Site |
|---|---|---|---|---|
| FMC TS Step 1 Alum 10M | 1420598001 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 Alum 20M | 1420598002 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 Alum 30M | 1420598003 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 Alum 40M | 1420598004 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 Alum 50M | 1420598005 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 FeCl3 5M | 1420598006 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 FeCl3 10M | 1420598007 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 FeCl3 20M | 1420598008 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 FeCl3 30M | 1420598009 | 07/23/14 | 07/23/14 | FMC Hydro Study |
| FMC TS Step 1 FeCl3 40M | 1420598010 | 07/23/14 | 07/23/14 | FMC Hydro Study |

# ANALYTICAL REPORT

**Workorder:** 34-1420598
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step 1 Alum 10M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598001 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:28 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **47.5** | 11 | 30 | 1 | |
| Phosphorus | **3100** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 Alum 20M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598002 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:31 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | 28.3 | 11 | 30 | 1 | J |
| Phosphorus | **2140** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 Alum 30M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598003 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:34 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | 23.9 | 11 | 30 | 1 | J |
| Phosphorus | **1520** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 Alum 40M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598004 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:37 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | 23.1 | 11 | 30 | 1 | J |
| Phosphorus | **1350** | 50 | 150 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1420598
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step 1 Alum 50M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598005 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:40 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | 25.7 | 11 | 30 | 1 | J |
| Phosphorus | **1360** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 FeCl3 5M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598006 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:43 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **41.5** | 11 | 30 | 1 | |
| Phosphorus | **3210** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 FeCl3 10M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598007 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:52 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **34.3** | 11 | 30 | 1 | |
| Phosphorus | **2660** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 FeCl3 20M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598008 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:55 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | 26.2 | 11 | 30 | 1 | J |
| Phosphorus | **1700** | 50 | 150 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1420598
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step 1 FeCl3 30M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598009 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 14:58 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | ND | 11 | 30 | 1 | U |
| Phosphorus | **1250** | 50 | 150 | 1 | |

Sample ID: **FMC TS Step 1 FeCl3 40M** | Sampling Site: FMC Hydro Study | Collected: 07/23/2014
Lab ID: 1420598010 | Media: 250 mL Nalgene | Received: 07/23/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | SW-846, EPA 3015 Water Prep | **Weight/Volume** | **Analysis:** | SW 6010C, Water | **Instrument ID:** ICP08 |
| **Batch:** | EIPX/4989 (HBN: 131111) | **Initial:** 15 mL | **Batch:** | EICP/4603 (HBN: 131143) | **Percent Solid:** NA |
| **Prepared:** | 07/24/2014 | **Final:** 50 mL | **Analyzed:** | 07/24/2014 15:02 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | ND | 11 | 30 | 1 | U |
| Phosphorus | **1170** | 50 | 150 | 1 | |

## Report Authorization

| Method | Analyst | Peer Review |
|---|---|---|
| **SW 6010C** | Neil A. Edwards | Peter P. Steen |

## Laboratory Contact Information

ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

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# ANALYTICAL REPORT

**Workorder:** 34-1420598
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

## Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< This testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

## Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420598**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | SW-846, EPA 3015 Water Prep | **Analysis:** | SW 6010C |
| **Basis:** | ALS Laboratory Group | **Batch:** | EIPX/4989 (HBN: 131111) | **Batch:** | EICP/4603 (HBN: 131143) |
| | | **Prepared By:** | Kelsey Lockwood | **Analyzed By:** | Neil A. Edwards |

## Blank

**MB:** 401326
**Analyzed:** 07/24/2014 14:19
**Units:** ug/L

| Analyte | Result | MDL | RL |
|---|---|---|---|
| Arsenic | ND | 3.7 | 10.0 |
| Phosphorus | ND | 16.7 | 50.0 |

## Laboratory Control Sample - Laboratory Control Sample Duplicate

**LCS:** 401327
**Analyzed:** 07/24/2014 14:22
**Dilution:** 1
**Units:** ug/L

**LCSD:** 401328
**Analyzed:** 07/24/2014 14:25
**Dilution:** 1
**Units:** ug/L

| Analyte | Result | Target | % Rec | QC Limits | | Result | % Rec | RPD | QC Limits | |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 2000 | 2000 | 100 | 85.3 | 110.5 | 1990 | 99.3 | 0.501 | 0.0 | 20.0 |
| Phosphorus | 2010 | 2000 | 100 | 84.7 | 122.5 | 2000 | 99.8 | 0.499 | 0.0 | 20.0 |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420598**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** SW-846, EPA 3015 Water Prep
**Batch:** EIPX/4989 (HBN: 131111)
**Prepared By:** Kelsey Lockwood

**Analysis:** SW 6010C
**Batch:** EICP/4603 (HBN: 131143)
**Analyzed By:** Neil A. Edwards

## Initial Calibration Verification

**ICV:** 401447
**Analyzed:** 07/24/2014 11:57
**Units:** ug/L
**Criteria:** ± 10%

| Analyte | Result | Target | % Rec. |
|---|---|---|---|
| Arsenic | 1970 | 2000 | 98.5 |
| Phosphorus | 1980 | 2000 | 98.8 |

## Continuing Calibration Verification

| CCV: 401451 | | | | CCV: 401453 | | | CCV: 401455 | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyzed: 07/24/2014 12:11 | | | | Analyzed: 07/24/2014 12:48 | | | Analyzed: 07/24/2014 13:32 | | |
| Units: ug/L | | | | Units: ug/L | | | Units: ug/L | | |
| Criteria: ± 10% | | | | Criteria: ± 10% | | | Criteria: ± 10% | | |
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 5020 | 5000 | 100 | 4970 | 5000 | 99.5 | 4960 | 5000 | 99.1 |
| Phosphorus | 25400 | 25000 | 102 | 25200 | 25000 | 101 | 25100 | 25000 | 100 |

| CCV: 401457 | | | | CCV: 401459 | | | CCV: 401461 | | |
|---|---|---|---|---|---|---|---|---|---|
| Analyzed: 07/24/2014 14:10 | | | | Analyzed: 07/24/2014 14:46 | | | Analyzed: 07/24/2014 15:11 | | |
| Units: ug/L | | | | Units: ug/L | | | Units: ug/L | | |
| Criteria: ± 10% | | | | Criteria: ± 10% | | | Criteria: ± 10% | | |
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 4810 | 5000 | 96.3 | 4930 | 5000 | 98.5 | 4930 | 5000 | 98.7 |
| Phosphorus | 24500 | 25000 | 98.1 | 25200 | 25000 | 101 | 25200 | 25000 | 101 |

## Low Level Calibration Verification

**LLICV:** 401449
**Analyzed:** 07/24/2014 12:02
**Units:** ug/L
**Criteria:** ± 30%

| Analyte | Result | Target | % Rec. | Qual. |
|---|---|---|---|---|
| Arsenic | 8.20 | 10.0 | 82.0 | J |
| Phosphorus | 97.2 | 100 | 97.2 | J |

## Initial Calibration Blank

**ICB:** 401448
**Analyzed:** 07/24/2014 11:59
**Units:** ug/L

| Analyte | Result | Qual. |
|---|---|---|
| Arsenic | ND | U |
| Phosphorus | ND | U |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420598**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** SW-846, EPA 3015 Water Prep
**Batch:** EIPX/4989 (HBN: 131111)
**Prepared By:** Kelsey Lockwood

**Analysis:** SW 6010C
**Batch:** EICP/4603 (HBN: 131143)
**Analyzed By:** Neil A. Edwards

## Continuing Calibration Blank

| CCB: 401452<br>Analyzed: 07/24/2014 12:14<br>Units: ug/L | | | CCB: 401454<br>Analyzed: 07/24/2014 12:51<br>Units: ug/L | | CCB: 401456<br>Analyzed: 07/24/2014 13:35<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U | ND | U |
| Phosphorus | ND | U | ND | U | ND | U |

| CCB: 401458<br>Analyzed: 07/24/2014 14:13<br>Units: ug/L | | | CCB: 401460<br>Analyzed: 07/24/2014 14:49<br>Units: ug/L | | CCB: 401462<br>Analyzed: 07/24/2014 15:14<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U | ND | U |
| Phosphorus | ND | U | ND | U | ND | U |

## Interference Check Sample

| ICSA: 401467<br>Analyzed:<br>Units:<br>Criteria: ± 10 | | | | ICSAB: 401450<br>Analyzed: 07/24/2014 12:09<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | | | | 497 | 500 | 99.5 |
| Phosphorus | | | | 497 | 500 | 99.4 |

## Serial Dilution

| Sample: 1420598010<br>Analyzed: 07/24/2014 15:02<br>Dilution: 1<br>Units: ug/L | | SD: 401416<br>Analyzed: 07/24/2014 15:08<br>Dilution: 1<br>Units: ug/L | | | |
|---|---|---|---|---|---|
| **Analyte** | **Result** | **Result** | **RPD** | **QC Limits** | |
| Arsenic | ND | ND | NA | 0.0 | 20.0 |
| Phosphorus | 351 | 350 | NA | 0.0 | 20.0 |

## Post Digestion Spike

| Sample: 1420598010<br>Analyzed: 07/24/2014 15:02<br>Dilution: 1<br>Units: ug/L | | PDS: 401415<br>Analyzed: 07/24/2014 15:05<br>Dilution: 1<br>Units: ug/L | | | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Result** | **Target** | **% Recovery** | **QC Limits** | |
| Arsenic | ND | 996 | 1000 | 99.6 | 75.0 | 125.0 |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420598**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | SW-846, EPA 3015 Water Prep | **Analysis:** | SW 6010C |
| **Basis:** | ALS Laboratory Group | **Batch:** | EIPX/4989 (HBN: 131111) | **Batch:** | EICP/4603 (HBN: 131143) |
| | | **Prepared By:** | Kelsey Lockwood | **Analyzed By:** | Neil A. Edwards |

## QC Data Approved and Reviewed by

| | | |
|---|---|---|
| Neil A. Edwards | Peter P. Steen | 7/24/2014 |
| **Analyst** | **Peer Review** | **Date** |

## Symbols and Definitions

* - Analyte above reporting limit or outside of control limits
▲ - Sample result is greater than 4 times the spike added
◓ - Sample and Matrix Duplicate less than 5 times the reporting limit

RPD - Relative % Difference (Spike / Spike Duplicate)
ND - Not Detected (U - Qualifier also flags analyte as not detected)
NA - Not Applicable
QC results are not adjusted for moisture correction, where applicable

ALS W 1420598

13228/#1

dy Record

CoC #: 1

1420598

Page 1 of 1

| Client Name & Address: | Project Name & No.: |
|---|---|
| MWH Americas<br>2890 E. Cottonwood Pkwy<br>Suite 300<br>Salt Lake City, UT 84121 | FMC Hydro Study |
| | ALS Quote No: |
| | Report to: Anna Bogusiavsky |
| Phone: 949 232-2024 | Report to e-mail: annabogusiavsky@mwhglobal.com |
| e-mail: annabogusiavsky@mwhglobal.com | Bill to: corporate |

Matrix Codes: W) Water, B) Bulk, L) Liquid, F) Filter, S) Soil, G) Wipe, C) Solid, M) Media

Preservation Codes: 1) Cool to 4°C; 2) HCl to pH<2, 4°C; 3) $H_2SO_4$ to pH<2, 4°C; 4) $HNO_3$ to pH<2, 4°C; 5) NaOH to pH>12, 4°C; 6) ZnOAc/NaOH to pH>9, 4°C

| Field Sample Number | Date | Time | Depth | ALS Sample Number | No. of Containers | Sample for Matrix QC | Analyses Requested: As, P, SW 6010C | | | | | | | | Preservation Code | Sample Matrix Code | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FMC TS Step 1 Alum | 7/23/14 | 1500 | — | | 5 | W | X | | | | | | | | | | 10m, 20m, 30m, 40m, 50m |
| FMC TS Step 1 $FeCl_3$ | 7/23/14 | 1500 | — | | 5 | W | X | | | | | | | | | | 5m, 10m, 20m, 30m, 4 |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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as per MWH 5 samples per each L & L-2-3-4-5 KV

| Possible Hazard Identification | Sample Disposal | Data Deliverable: | Requested Turn Around Time |
|---|---|---|---|
| ☒ Non-Hazard ☐ Skin Irritant ☐ Rad<br>☐ Flammable ☐ Poison ☐ Unknown | ☐ Return to Client ☐ Archive _____ Months<br>☒ Disposal by Lab<br>(fees assessed for samples retained > 3 months) | ☐ Level 1 ☐ Level 3<br>☐ Level 2 ☐ Level 4<br>EDD Type: | ☐ 2 Days (Rush) ☐ 7 Days (Rush)<br>☐ 3 Days (Rush) ☒ 14 Days as per mwh 24hr TAT KV<br>(Rush = email data by COB on day due. Surcharges assessed.) |
| | | Carrier/Airbill #: | |

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
|---|---|---|---|---|---|
| [signature] | 7/23/14 | 1500 | Kevin [signature] | 7-23-14 | 15:25 |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |

Shipped to:
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
Phone: (800) 356-9135
Phone: (801) 266-7700
FAX: (801) 268-9992
WEB:www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

ALSCoC 121013

12/12/2013

# ALS Environmental

## CHAIN-OF-CUSTODY

| Project / Job / Task: FMC Hydro Study | Split: | Workorder ID: 1420598 | Level: ENV_LVL3 |
|---|---|---|---|
| Client: MWH | | Account: 8001 | Type: 250Poly |
| Comments: | | | Preservatives: HNO3 |

| Item | Collect Date/Time | Sample ID | Lab ID | QC | Matrix | Containers ID(s) | Containers Count | Requested Analysis: SW 6010C Water |
|---|---|---|---|---|---|---|---|---|
| 1 | 07/23/2014 15:00 | FMC TS Step 1 Alum 10M | 1420598001 | | Water | A | 1 | A |
| 2 | 07/23/2014 15:00 | FMC TS Step 1 Alum 20M | 1420598002 | | Water | A | 1 | A |
| 3 | 07/23/2014 15:00 | FMC TS Step 1 Alum 30M | 1420598003 | | Water | A | 1 | A |
| 4 | 07/23/2014 15:00 | FMC TS Step 1 Alum 40M | 1420598004 | | Water | A | 1 | A |
| 5 | 07/23/2014 15:00 | FMC TS Step 1 Alum 50M | 1420598005 | | Water | A | 1 | A |
| 6 | 07/23/2014 15:00 | FMC TS Step 1 FeCl3 5M | 1420598006 | | Water | A | 1 | A |
| 7 | 07/23/2014 15:00 | FMC TS Step 1 FeCl3 10M | 1420598007 | | Water | A | 1 | A |
| 8 | 07/23/2014 15:00 | FMC TS Step 1 FeCl3 20M | 1420598008 | | Water | A | 1 | A |
| 9 | 07/23/2014 15:00 | FMC TS Step 1 FeCl3 30M | 1420598009 | | Water | A | 1 | A |
| 10 | 07/23/2014 15:00 | FMC TS Step 1 FeCl3 40M | 1420598010 | | Water | A | 1 | A |

### ORIGINAL FIELD SAMPLE CHAIN-OF-CUSTODY

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| Warath, Julie | 07/23/2014 15:25 | ALS Sample Receiving | Sample Login |
| Julie Warath | 7/24/14 0940 | 13C | Storage |
| 13C KL | 7/24/14 1050 | metlab KL | metals |
| (R) all samples used | up during | ~~digestion~~ | digestion |
| | | KL 7/24/14 | |

### SAMPLE PREPARATION / ANALYSIS CHAIN-OF-CUSTODY

Sample Prep / Analysis for: _____ Lab Notebook No.: _____

Prepared / Analyzed by: _____ Date / Time: _____

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| | | | |

# ALS LABORATORY GROUP SALT LAKE CITY-RELATED INFORMATION REPORT (CRIR)

## COOLER OR CONTAINER INFORMATION CHECKLIST (Fill In or Circle)

1420598

Client Name: MWH

Project/Task/Site: FMC Hydro Study

Date/Time of Receipt: 7-23-14 / 15:25

Number of Coolers Received: 1

| | | | |
|---|---|---|---|
| Condition of Coolers: | Acceptable/Unacceptable | Temperature Control: | Present/Not Included |
| Cooler Custody Seals: | Present/Absent/NA<br>Intact/Broken/NA | Location Temp Taken: | Control/Between Samples |
| Container Custody Seals: | Present/Absent/NA<br>Intact/Broken/NA | Are all temperatures within project specific guidelines? | Yes/No/NA |
| Tamper Evident: | Yes/No/NA | VOA Headspace Present? | Yes/No/NA |
| Ice Present: | Yes/No/NA<br>Frozen/Melted/NA | | |

| pH Check Performed: | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Metals | Yes/No/NA | Total Phenolics | Yes/No/NA | NO3/NO2 | Yes/No/NA |
| | Cyanide | Yes/No/NA | TPH – 418.1 | Yes/No/NA | Oil & Grease | Yes/No/NA |
| | Sulfide | Yes/No/NA | COD | Yes/No/NA | Total Phosphorous | Yes/No/NA |
| | Ammonia | Yes/No/NA | TKN | Yes/No/NA | TOC Preserved | Yes/No/NA |

| Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. |
|---|---|---|---|---|---|---|---|---|
| 1 | C14 | 3 °C | 4 | C14 | °C | 7 | C14 | °C |
| 2 | C14 | °C | 5 | C14 | °C | 8 | C14 | °C |
| 3 | C14 | °C | 6 | C14 | °C | 9 | C14 | °C |

Taken By: Kevin Griffiths (Signature) Kevin Griffiths (Printed Name) 7-23-14 (Date)

## CLIENT-RELATED INFORMATION

- ☐ Missing Cooler
- ☐ Cooler Conditions
- ☐ Missing Paperwork
- ☐ Missing/Incorrect Bottle Labels
- ☐ Missing Samples/Bottles
- ☐ Broken/Leaking Samples
- ☐ Incorrect Bottle Type
- ☐ Cooler Temperatures Out of Range
- ☐ Incorrect Preservation
- ☐ pH Criteria Not Met
- ☐ Residual Chlorine Present
- ☐ Head Space in Bottles
- ☐ Insufficient Sample Volume
- ☐ Chain of Custody Problems
- ☐ Other:

BRIEFLY DESCRIBE THE PROBLEM AND THE ACTION TAKEN:

E-mailed to Client? YES ☐ NO ☐

**Response Required Within 24 Hours**

## PROJECT MANAGEMENT

PROJECT MANAGER COMMENTS:

ALS Project Manager: _____ (Printed Name) Returned to Sample Receipt by: _____ (Signature) Date: _____

# Case Narrative

| | | | |
|---|---|---|---|
| **Method:** | 6020 | **Client:** | MWH |
| **Analysis:** | ICP-MS | **Account:** | 8001 |
| **Preparation SOP #:** | IP-SW-3010, Rev. 10 | **Matrix:** | Water |
| **Analysis SOP #:** | IP-SW-6020, Rev. 9 | | |
| **ALS Work Order ID:** | 1420812 | | |

**General Set Information:** There are twelve field samples in this workorder. The samples were analyzed for arsenic and phosphorus in water by ICP-MS.

**Method Summary:** A thoroughly mixed 50 mL portion of sample is heated in a block digester in the presence of nitric acid. After heating, samples are brought to a 50 mL final volume with ASTM Type II water. The resulting digest is analyzed using an Agilent 7700x ICP Mass Spectrometer.

**Sample Preparation:** All samples were prepared in accordance with published procedures.

**Hold Times:** Samples were prepared and analyzed within method hold times.

**Dilutions:** No sample dilutions were done.

**Method QC (MB, LCS/LCSD):** No method analyte was found in the method blank samples at levels above the RL. Two quality control sample were prepared and analyzed with this set. All analytes are within quality control limits.

**Matrix QC (MD, MS):** Due to limited sample volumes no matrix duplicate, matrix spike or matrix spike duplicate were prepared or analyzed with this work order.

**Instrument QC (ICV, CCV, etc):** Recoveries of the analytes in all initial and continuing calibration verification samples are within quality control limits. No method analytes were found in any initial or continuing calibration blank sample at levels above the PQL.

**Flagging Codes:** See report for flagging code definitions.

**Serial Dilution:** A serial dilution was prepared and analyzed with this batch. Sample results are within control limits.

**Post Digestion Spike Analysis:** A post digestion spike was prepared with this batch. Results are within limits for arsenic and not in control for phosphorus.

**NC/CAR:** None required.

**Sample Calculation:** The final results are calculated in µg/L by the equation (A) x (B) x (C) where:

A = Analyte concentration from instrument determination (µg/L)

B = $\frac{\text{[Final Volume of Digestate (L)]}}{\text{[Initial Volume of Sample Used in Digestion (L)]}}$

C = Dilution performed at time of analysis.

**Miscellaneous Comments:** None required.

Kristie Bitner 07/29/14

**Name:** Kristie Bitner Date

# ANALYTICAL REPORT

Report Date: July 29, 2014

Anna Boguslarsky
MWH Americas
2890 East Cottonwood Parkway
Suite 300
Salt Lake City, UT 84121

Phone: (949) 232-2024

E-mail: Anna.boguslavsky@mwhglobal.com

Workorder: **34-1420812**
Project ID: FMC Hydro Study
Purchase Order: FMC Hydro Study

| Client Sample ID | Lab ID | Collect Date | Receive Date | Sampling Site |
|---|---|---|---|---|
| FMC TS Step 2 FeCl3 10M M2 | 1420812001 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 FeCl3 20M M2 | 1420812002 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 FeCl3 30M M2 | 1420812003 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 Alum 50M M2 | 1420812004 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 Alum 60M M2 | 1420812005 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 Alum 70M M2 | 1420812006 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 FeCl3 10M M3 | 1420812007 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 FeCl3 20M M3 | 1420812008 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 FeCl3 30M M3 | 1420812009 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 Alum 50M M3 | 1420812010 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 Alum 60M M3 | 1420812011 | 07/25/14 | 07/25/14 | FMC Hydro Study |
| FMC TS Step 2 Alum 70M M3 | 1420812012 | 07/25/14 | 07/25/14 | FMC Hydro Study |

# ANALYTICAL REPORT

**Workorder:** 34-1420812
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step 2 FeCl3 10M M2** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812001 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 19:15 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **52** | 0.15 | 1.0 | 1 | |
| Phosphorus | **3000** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 FeCl3 20M M2** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812002 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 19:28 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **39** | 0.15 | 1.0 | 1 | |
| Phosphorus | **2100** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 FeCl3 30M M2** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812003 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 19:32 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **24** | 0.15 | 1.0 | 1 | |
| Phosphorus | **1300** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 Alum 50M M2** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812004 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 19:37 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **28** | 0.15 | 1.0 | 1 | |
| Phosphorus | **830** | NA | 50 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1420812
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step 2 Alum 60M M2** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812005 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:03 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **22** | 0.15 | 1.0 | 1 | |
| Phosphorus | **690** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 Alum 70M M2** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812006 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:07 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **19** | 0.15 | 1.0 | 1 | |
| Phosphorus | **970** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 FeCl3 10M M3** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812007 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:12 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **44** | 0.15 | 1.0 | 1 | |
| Phosphorus | **2800** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 FeCl3 20M M3** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812008 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:16 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **38** | 0.15 | 1.0 | 1 | |
| Phosphorus | **2600** | NA | 50 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1420812
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step 2 FeCl3 30M M3** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812009 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:20 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **23** | 0.15 | 1.0 | 1 | |
| Phosphorus | **1200** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 Alum 50M M3** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812010 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:25 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **25** | 0.15 | 1.0 | 1 | |
| Phosphorus | **740** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 Alum 60M M3** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812011 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:29 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **25** | 0.15 | 1.0 | 1 | |
| Phosphorus | **740** | NA | 50 | 1 | |

Sample ID: **FMC TS Step 2 Alum 70M M3** | Sampling Site: FMC Hydro Study | Collected: 07/25/2014
Lab ID: 1420812012 | Media: 250 mL Nalgene | Received: 07/25/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3809 (HBN: 131331) | **Initial:** 50 mL | **Batch:** | EMS/3811 (HBN: 131436) | **Percent Solid:** NA |
| **Prepared:** | 07/28/2014 | **Final:** 50 mL | **Analyzed:** | 07/28/2014 20:34 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **16** | 0.15 | 1.0 | 1 | |
| Phosphorus | **600** | NA | 50 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1420812
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Comments

**Quality Control: SW 6020 - (HBN: 131436)**

ICP-MS: The post digestion spike recovery for phosphorus is not in control at 137% recovery, possible matrix issue. Due to lack of sample volume, no matrix duplicate or matrix spike were done with these samples.

## Report Authorization

| Method | Analyst | Peer Review |
|---|---|---|
| **SW 6020** | Kristie F. Bitner | John T Kershisnik |

## Laboratory Contact Information


ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

Phone: (801) 266-7700
Email: alslt.lab@ALSGlobal.com
Web: www.alsslc.com


## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

# ANALYTICAL REPORT

**Workorder:** 34-1420812
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< This testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

## Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420812**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3809 (HBN: 131331)
**Prepared By:** Kristie F. Bitner

**Analysis:** SW 6020
**Batch:** EMS/3811 (HBN: 131436)
**Analyzed By:** Kristie F. Bitner

## Blank

**MB:** 401987
**Analyzed:** 07/28/2014 18:31
**Units:** ug/L

| Analyte | Result | MDL | RL |
|---|---|---|---|
| Arsenic | ND | 0.15 | 1.00 |
| Phosphorus | ND | NA | 50.0 |

## Laboratory Control Sample - Laboratory Control Sample Duplicate

**LCS:** 401988
**Analyzed:** 07/28/2014 19:01
**Dilution:** 1
**Units:** ug/L

**LCSD:** 401989
**Analyzed:** 07/28/2014 19:06
**Dilution:** 1
**Units:** ug/L

| Analyte | Result | Target | % Rec | QC Limits | | Result | % Rec | RPD | QC Limits | |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 25.6 | 25.0 | 102 | 86.6 | 113.8 | 24.1 | 96.3 | 5.98 | 0.0 | 20.0 |
| Phosphorus | 264 | 250 | 105 | 80.0 | 120.0 | 265 | 106 | 0.525 | 0.0 | 20.0 |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420812**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3809 (HBN: 131331)
**Prepared By:** Kristie F. Bitner

**Analysis:** SW 6020
**Batch:** EMS/3811 (HBN: 131436)
**Analyzed By:** Kristie F. Bitner

### Initial Calibration Verification

| ICV: 402186<br>Analyzed: 07/28/2014 17:16<br>Units: ug/L<br>Criteria: ± 10% | | | | ICV: 402188<br>Analyzed: 07/28/2014 17:25<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 22.6 | 25.0 | 90.5 | 227 | 250 | 90.9 |
| Phosphorus | 22.8 | 25.0 | 91.4 | 243 | 250 | 97.1 |

### Continuing Calibration Verification

| CCV: 402192<br>Analyzed: 07/28/2014 17:47<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 402194<br>Analyzed: 07/28/2014 17:56<br>Units: ug/L<br>Criteria: ± 20% | | | CCV: 402196<br>Analyzed: 07/28/2014 18:44<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 23.4 | 25.0 | 93.7 | | | | 24.4 | 25.0 | 97.4 |
| Phosphorus | | | | 202 | 200 | 101 | | | |

| CCV: 402198<br>Analyzed: 07/28/2014 18:53<br>Units: ug/L<br>Criteria: ± 20% | | | | CCV: 402200<br>Analyzed: 07/28/2014 19:45<br>Units: ug/L<br>Criteria: ± 10% | | | CCV: 402202<br>Analyzed: 07/28/2014 19:54<br>Units: ug/L<br>Criteria: ± 20% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | | | | 24.9 | 25.0 | 99.6 | | | |
| Phosphorus | 196 | 200 | 98.0 | | | | 198 | 200 | 98.8 |

| CCV: 402205<br>Analyzed: 07/28/2014 20:47<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 402207<br>Analyzed: 07/28/2014 20:56<br>Units: ug/L<br>Criteria: ± 20% | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 25.6 | 25.0 | 102 | | | |
| Phosphorus | | | | 195 | 200 | 97.7 |

### Low Level Calibration Verification

| LLICV: 402185<br>Analyzed: 07/28/2014 17:12<br>Units: ug/L<br>Criteria: ± 30% | | | | | LLCCV: 402204<br>Analyzed: 07/28/2014 20:42<br>Units: ug/L<br>Criteria: ± 30% | | | |
|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Qual.** | **Result** | **Target** | **% Rec.** | **Qual.** |
| Arsenic | 0.944 | 1.00 | 94.4 | J | 1.01 | 1.00 | 101 | |
| Phosphorus | 45.0 | 50.0 | 90.0 | | 49.7 | 50.0 | 99.4 | |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420812**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | EPA 3010, SW 6020 Water Prep | **Analysis:** | SW 6020 |
| **Basis:** | ALS Laboratory Group | **Batch:** | EMS/3809 (HBN: 131331) | **Batch:** | EMS/3811 (HBN: 131436) |
| | | **Prepared By:** | Kristie F. Bitner | **Analyzed By:** | Kristie F. Bitner |

### Initial Calibration Blank

| **ICB:** 402187<br>**Analyzed:** 07/28/2014 17:21<br>**Units:** ug/L | | | **ICB:** 402189<br>**Analyzed:** 07/28/2014 17:29<br>**Units:** ug/L | |
|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U |
| Phosphorus | ND | U | ND | U |

### Continuing Calibration Blank

| **CCB:** 402193<br>**Analyzed:** 07/28/2014 17:51<br>**Units:** ug/L | | | **CCB:** 402195<br>**Analyzed:** 07/28/2014 18:00<br>**Units:** ug/L | | **CCB:** 402197<br>**Analyzed:** 07/28/2014 18:48<br>**Units:** ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | | | ND | U |
| Phosphorus | | | ND | U | | |

| **CCB:** 402199<br>**Analyzed:** 07/28/2014 18:57<br>**Units:** ug/L | | | **CCB:** 402201<br>**Analyzed:** 07/28/2014 19:50<br>**Units:** ug/L | | **CCB:** 402203<br>**Analyzed:** 07/28/2014 19:59<br>**Units:** ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | | | ND | U | | |
| Phosphorus | ND | U | | | ND | U |

| **CCB:** 402206<br>**Analyzed:** 07/28/2014 20:51<br>**Units:** ug/L | | | **CCB:** 402208<br>**Analyzed:** 07/28/2014 21:00<br>**Units:** ug/L | |
|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | | |
| Phosphorus | | | ND | U |

### Interference Check Sample

| **ICSA:** 402190<br>**Analyzed:**<br>**Units:**<br>**Criteria:** ± 20 | | | | **ICSAB:** 402191<br>**Analyzed:** 07/28/2014 17:38<br>**Units:** ug/L<br>**Criteria:** ± 20% | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | | | | 109 | 100 | 109 |
| Phosphorus | 101000 | 100000 | 101 | 95800 | 100000 | 95.8 |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1420812**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3809 (HBN: 131331)
**Prepared By:** Kristie F. Bitner

**Analysis:** SW 6020
**Batch:** EMS/3811 (HBN: 131436)
**Analyzed By:** Kristie F. Bitner

### Serial Dilution

**Sample:** 1420812001
**Analyzed:** 07/28/2014 19:15
**Dilution:** 1
**Units:** ug/L

**SD:** 402184
**Analyzed:** 07/28/2014 19:23
**Dilution:** 1
**Units:** ug/L

| Analyte | Result | Result | RPD | QC Limits | |
|---|---|---|---|---|---|
| Arsenic | 52.3 | 49.1 | 6.15 | 0.0 | 10.0 |
| Phosphorus | 3030 | 3240 | 6.76 | 0.0 | 10.0 |

### Post Digestion Spike

**Sample:** 1420812001
**Analyzed:** 07/28/2014 19:15
**Dilution:** 1
**Units:** ug/L

**PDS:** 402183
**Analyzed:** 07/28/2014 19:19
**Dilution:** 1
**Units:** ug/L

| Analyte | Result | Result | Target | % Recovery | QC Limits | |
|---|---|---|---|---|---|---|
| Arsenic | 52.3 | 62.9 | 10.0 | 106 | 75.0 | 125.0 |
| Phosphorus | 3030 | 3370 | 250 | * 137 | 75.0 | 125.0 |

## Comments

ICP-MS: The post digestion spike recovery for phosphorus is not in control at 137% recovery, possible matrix issue. Due to lack of sample volume, no matrix duplicate or matrix spike were done with these samples.

## QC Data Approved and Reviewed by

| Kristie F. Bitner | John T Kershisnik | 7/29/2014 |
|---|---|---|
| **Analyst** | **Peer Review** | **Date** |

## Symbols and Definitions

* - Analyte above reporting limit or outside of control limits
▲ - Sample result is greater than 4 times the spike added
- Sample and Matrix Duplicate less than 5 times the reporting limit

RPD - Relative % Difference (Spike / Spike Duplicate)
ND - Not Detected (U - Qualifier also flags analyte as not detected)
NA - Not Applicable
QC results are not adjusted for moisture correction, where applicable

13228/#2

W 1420812

# Record

CoC #: 2

1420812



Client Name & Address:
MWH Americas
2890 E. Cottonwood Pkwy
Suite 300
Salt Lake City, UT 84121

Phone: (949) 232-2024

e-mail: anna.boguslavsky@mwglobal.com

Project Name & No.: FMC Hydro Study

ALS Quote No:

Report to: Anna Boguslavsky

Report to e-mail: anna.boguslavsky@mwglobal.com

Bill to: corporate

Matrix Codes: W) Water B) Bulk L) Liquid F) Filter S) Soil G) Wipe C) Solid M) Media

Preservation Codes: 1) Cool to 4°C 2) HCl to pH<2, 4°C 3) $H_2SO_4$ to pH<2, 4°C 4) $HNO_3$ to pH<2, 4°C 5) NaOH to pH>12, 4°C 6) ZnOAc/NaOH to pH>9, 4°C

| Field Sample Number | Date | Time | Depth | ALS Sample Number | No. of Containers | Sample for Matrix QC | Analyses Requested: Al, P, SO4 (0020) | | | | | | | | Preservation Code | Sample Matrix Code | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FMC TS Step 2 $FeCl_3$ 10M $M_2$ | 7/25/14 | 1500 | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 $FeCl_3$ 20M $M_2$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 $FeCl_3$ 30M $M_2$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 Alum 50M $M_2$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 Alum 60M $M_2$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 Alum 70M $M_2$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 $FeCl_3$ 10M $M_3$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 $FeCl_3$ 20M $M_3$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 $FeCl_3$ 30M $M_3$ | | | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 Alum 50M $M_3$ | | | — | | 1 | W | X | | | | | | | | | | |

**Possible Hazard Identification**
- [x] Non-Hazard
- [ ] Flammable
- [ ] Skin Irritant
- [ ] Poison
- [ ] Rad
- [ ] Unknown

**Sample Disposal**
- [ ] Return to Client
- [ ] Archive _____ Months
- [x] Disposal by Lab

(fees assessed for samples retained > 3 months)

**Data Deliverable:**
- [ ] Level 1
- [ ] Level 2
- [ ] Level 3
- [ ] Level 4

**EDD Type:**

**Requested Turn Around Time**
- [ ] 2 Days (Rush)
- [ ] 3 Days (Rush)
- [ ] 7 Days (Rush)
- [x] 14 Days

1 day

(Rush = email data by COB on day due. Surcharges assessed.)

**Carrier/Airbill #:**

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
|---|---|---|---|---|---|
| [signature] | 7/25/14 | 1500 | [signature] | 7-25-14 | 15:05 |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |

Shipped to:
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
Phone: (800) 356-9135
Phone: (801) 266-7700
FAX: (801) 268-9992
WEB:www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

# ALS Environmental
## Field Chain-of-Custody Record

CoC #: 2



**Client Name & Address:**
MWH Americas
2890 E. Cottonwood Pkwy
Suite 300
Salt Lake City, UT 84121

**Phone:** (949) 232-2024

**e-mail:** annabogus@mwhglobal.com

**Project Name & No.:** FMC Hydro Study

**ALS Quote No:**

**Report to:** Anna Boguslavsky

**Report to e-mail:** anna.boguslavsky@mwhglobal.com

**Bill to:** corporate

| Field Sample Number | Date | Time | Depth | ALS Sample Number | No. of Containers | Sample for Matrix QC | Analyses Requested: As, P SW6020 | | | | | | | | Preservation Code | Sample Matrix Code | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FMC TS Step 2 Alum 60m $m_3$ | 7/25/14 | 1500 | — | | 1 | W | X | | | | | | | | | | |
| FMC TS Step 2 Alum 70m $m_3$ | 7/25/14 | 1500 | — | | 1 | W | X | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

**Matrix Codes:**
W) Water B) Bulk
L) Liquid F) Filter
S) Soil G) Wipe
C) Solid M) Media

**Preservation Codes:**
1) Cool to 4°C
2) HCl to pH<2, 4°C
3) $H_2SO_4$ to pH<2, 4°C
4) $HNO_3$ to pH<2, 4°C
5) NaOH to pH>12, 4°C
6) ZnOAc/NaOH to pH>9, 4°C

**Possible Hazard Identification**
☒ Non-Hazard ☐ Skin Irritant ☐ Rad
☐ Flammable ☐ Poison ☐ Unknown

**Sample Disposal**
☐ Return to Client ☐ Archive _____ Months
☒ Disposal by Lab
(fees assessed for samples retained > 3 months)

**Data Deliverable:**
☐ Level 1 ☐ Level 3
☐ Level 2 ☐ Level 4
**EDD Type:**

**Requested Turn Around Time**
☐ 2 Days (Rush) ☐ 7 Days (Rush)
☐ 3 Days (Rush) ☒ 14 Days
(Rush = email data by COB on day due. Surcharges assessed.)
1 day

**Carrier/Airbill #:**

| Relinquished by: *(Signature)* | Date | Time | Received by: (Signature) | Date | Time |
|---|---|---|---|---|---|
| [signature] | 7/25/14 | 1500 | Kevin [signature] | 7-25-14 | 15:05 |
| Relinquished by: *(Signature)* | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |
| Relinquished by: *(Signature)* | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |

**Shipped to:**
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
**Phone:** (800) 356-9135
**Phone:** (801) 266-7700
**FAX:** (801) 268-9992
WEB:www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

# ALS Environmental

## CHAIN-OF-CUSTODY

| Project / Job / Task: FMC Hydro Study | Split: | Workorder ID: 1420812 | Level: ENV_LVL3 |
|---|---|---|---|
| Client: MWH | | Account: 8001 | Type: 250Poly |
| Comments: | | | Preservatives: HNO3 |

| Item | Collect Date/Time | Sample ID | Lab ID | QC | Matrix | Containers ID(s) | Containers Count | Requested Analysis: SW6020 |
|---|---|---|---|---|---|---|---|---|
| 1 | 07/25/2014 15:00 | FMC TS Step 2 FeCl3 10M M2 | 1420812001 | | Water | A | 1 | A |
| 2 | 07/25/2014 15:00 | FMC TS Step 2 FeCl3 20M M2 | 1420812002 | | Water | A | 1 | A |
| 3 | 07/25/2014 15:00 | FMC TS Step 2 FeCl3 30M M2 | 1420812003 | | Water | A | 1 | A |
| 4 | 07/25/2014 15:00 | FMC TS Step 2 Alum 50M M2 | 1420812004 | | Water | A | 1 | A |
| 5 | 07/25/2014 15:00 | FMC TS Step 2 Alum 60M M2 | 1420812005 | | Water | A | 1 | A |
| 6 | 07/25/2014 15:00 | FMC TS Step 2 Alum 70M M2 | 1420812006 | | Water | A | 1 | A |
| 7 | 07/25/2014 15:00 | FMC TS Step 2 FeCl3 10M M3 | 1420812007 | | Water | A | 1 | A |
| 8 | 07/25/2014 15:00 | FMC TS Step 2 FeCl3 20M M3 | 1420812008 | | Water | A | 1 | A |
| 9 | 07/25/2014 15:00 | FMC TS Step 2 FeCl3 30M M3 | 1420812009 | | Water | A | 1 | A |
| 10 | 07/25/2014 15:00 | FMC TS Step 2 Alum 50M M3 | 1420812010 | | Water | A | 1 | A |

### ORIGINAL FIELD SAMPLE CHAIN-OF-CUSTODY

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| Warath, Julie | 07/25/2014 15:05 | ALS Sample Receiving | Sample Login |
| Julie Wrath | 7/26/14 1100 | 5C | Storage |
| R-33-1 KB | 07/28/14 10:05 | ICP-MS Lab KB | 6026 |

### SAMPLE PREPARATION / ANALYSIS CHAIN-OF-CUSTODY

Sample Prep / Analysis for: _____ Lab Notebook No.: _____

Prepared / Analyzed by: _____ Date / Time: _____

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| | | | |



Sat, 07/26/14 10:51 AM

ALSCOCV2.6

# ALS Environmental

## CHAIN-OF-CUSTODY

Project / Job / Task: FMC Hydro Study | Split: | Workorder ID: 1420812 | Level: ENV_LVL3

Client: MWH | Account: 8001

Comments:

| Item | Collect Date/Time | Sample ID | Lab ID | QC | Matrix | Containers ID(s) | Containers Count | Preservatives HNO3 | Requested Analysis SW6020 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Type: 250Poly | | | |
| 11 | 07/25/2014 15:00 | FMC TS Step 2 Alum 60M M3 | 1420812011 | | Water | A | 1 | A | |
| 12 | 07/25/2014 15:00 | FMC TS Step 2 Alum 70M M3 | 1420812012 | | Water | A | 1 | A | |
| 13 | | | | | | | | | |
| 14 | | | | | | | | | |
| 15 | | | | | | | | | |
| 16 | | | | | | | | | |
| 17 | | | | | | | | | |
| 18 | | | | | | | | | |
| 19 | | | | | | | | | |
| 20 | | | | | | | | | |

### ORIGINAL FIELD SAMPLE CHAIN-OF-CUSTODY

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| Warath, Julie | 07/25/2014 15:05 | ALS Sample Receiving | Sample Login |
| Julie Warath | 7/26/14 100 | SC | Storage |
| R-33-1 KB | 07/28/14 10:05 | ICP-MS Lab KB | 6020 |

### SAMPLE PREPARATION / ANALYSIS CHAIN-OF-CUSTODY

Sample Prep / Analysis for: _____ Lab Notebook No.: _____

Prepared / Analyzed by: _____ Date / Time: _____

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| | | | |



Sat, 07/26/14 10:51 AM

ALSCOCV2.6

## ALS LABORATORY GROUP SALT LAKE CITY-RELATED INFORMATION REPORT (CRIR)

### COOLER OR CONTAINER INFORMATION CHECKLIST (Fill In or Circle)

Client Name: MWH Americas

Project/Task/Site: 1426812

Date/Time of Receipt: 07/25/14 1505

Number of Coolers Received: 1

| | | | |
|---|---|---|---|
| Condition of Coolers: | Acceptable/Unacceptable | Temperature Control: | Present/Not Included |
| Cooler Custody Seals: | Present/Absent/NA<br>Intact/Broken/NA | Location Temp Taken: | Control/Between Samples |
| Container Custody Seals: | Present/Absent/NA<br>Intact/Broken/NA | Are all temperatures within project specific guidelines? | Yes/No/NA |
| Tamper Evident: | Yes/No/NA | VOA Headspace Present? | Yes/No/NA |
| Ice Present: | Yes/No/NA<br>Frozen/Melted/NA | | |

| pH Check Performed: | | | | | | |
|---|---|---|---|---|---|---|
| | Metals | Yes/No/NA | Total Phenolics | Yes/No/NA | NO3/NO2 | Yes/No/NA |
| | Cyanide | Yes/No/NA | TPH – 418.1 | Yes/No/NA | Oil & Grease | Yes/No/NA |
| | Sulfide | Yes/No/NA | COD | Yes/No/NA | Total Phosphorous | Yes/No/NA |
| | Ammonia | Yes/No/NA | TKN | Yes/No/NA | TOC Preserved | Yes/No/NA |

| Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. |
|---|---|---|---|---|---|---|---|---|
| 1 | C14 5300 | 8 °C | 4 | C14 | °C | 7 | C14 | °C |
| 2 | C14 | °C | 5 | C14 | °C | 8 | C14 | °C |
| 3 | C14 | °C | 6 | C14 | °C | 9 | C14 | °C |

Taken By: [signature] Signature [signature] Printed Name 07/25/14 Date

### CLIENT-RELATED INFORMATION

- ☐ Missing Cooler
- ☐ Cooler Conditions
- ☐ Missing Paperwork
- ☐ Missing/Incorrect Bottle Labels
- ☐ Missing Samples/Bottles
- ☐ Broken/Leaking Samples
- ☐ Incorrect Bottle Type
- ☐ Cooler Temperatures Out of Range
- ☐ Incorrect Preservation
- ☐ pH Criteria Not Met
- ☐ Residual Chlorine Present
- ☐ Head Space in Bottles
- ☐ Insufficient Sample Volume
- ☐ Chain of Custody Problems
- ☐ Other:

**BRIEFLY DESCRIBE THE PROBLEM AND THE ACTION TAKEN:**

E-mailed to Client? YES ☐ NO ☐

**Response Required Within 24 Hours**

### PROJECT MANAGEMENT

**PROJECT MANAGER COMMENTS:**

ALS Project Manager: _____ Printed Name

Returned to Sample Receipt by: _____ Signature

Date: _____

# Case Narrative

| | | | |
|---|---|---|---|
| **Method:** | 6020 | **Client:** | MWH |
| **Analysis:** | ICP-MS | **Account:** | 8001 |
| **Preparation SOP #:** | IP-SW-3010, Rev. 10 | **Matrix:** | Water |
| **Analysis SOP #:** | IP-SW-6020, Rev. 9 | | |
| **ALS Work Order ID:** | 1421253 | | |

**General Set Information:** There are twelve field samples in this workorder. The samples were analyzed for arsenic and phosphorus in water by ICP-MS.

**Method Summary:** A thoroughly mixed 25 or 50 mL portion of sample is heated in a block digester in the presence of nitric acid. After heating, samples are brought to a 25 or 50 mL final volume with ASTM Type II water. The resulting digest is analyzed using an Agilent 7700x ICP Mass Spectrometer.

**Sample Preparation:** All samples were prepared in accordance with published procedures.

**Hold Times:** Samples were prepared and analyzed within method hold times.

**Dilutions:** No sample dilutions were done.

**Method QC (MB, LCS/LCSD):** No method analyte was found in the method blank samples at levels above the RL. Two quality control sample were prepared and analyzed with this set. All analytes are within quality control limits.

**Matrix QC (MD, MS):** Due to limited sample volumes no matrix duplicate, matrix spike or matrix spike duplicate were prepared or analyzed with this work order.

**Instrument QC (ICV, CCV, etc):** Recoveries of the analytes in all initial and continuing calibration verification samples are within quality control limits. No method analytes were found in any initial or continuing calibration blank sample at levels above the PQL.

**Flagging Codes:** See report for flagging code definitions.

**Serial Dilution:** A serial dilution was prepared and analyzed with this batch. Sample results are within control limits.

**Post Digestion Spike Analysis:** A post digestion spike was prepared with this batch. Results are within limits.

**NC/CAR:** None required.

**Sample Calculation:** The final results are calculated in µg/L by the equation (A) x (B) x (C) where:

A = Analyte concentration from instrument determination (µg/L)

B = [Final Volume of Digestate (L)] / [Initial Volume of Sample Used in Digestion (L)]

C = Dilution performed at time of analysis.

**Miscellaneous Comments:** None required.

Kristie Bitner 08/01/14

**Name:** Kristie Bitner Date

# ANALYTICAL REPORT

Report Date: August 01, 2014

Anna Boguslarsky
MWH Americas
2890 East Cottonwood Parkway
Suite 300
Salt Lake City, UT 84121

Phone: (949) 232-2024

E-mail: Anna.boguslavsky@mwhglobal.com

Workorder: **34-1421253**
Project ID: FMC Hydro Study
Purchase Order: FMC Hydro Study

| Client Sample ID | Lab ID | Collect Date | Receive Date | Sampling Site |
|---|---|---|---|---|
| FMC TS Step1 FeCl3 50M M, | 1421253001 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step1 FeCl3 60M M, | 1421253002 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step1 FeCl3 70M M, | 1421253003 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step1 FeCl3 80M M, | 1421253004 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 20M M, | 1421253005 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 20M M,1.2u | 1421253006 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 20M M,25u | 1421253007 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 20M M, 8u | 1421253008 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 40M M, | 1421253009 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 40M M,1.2u | 1421253010 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 40M M,25u | 1421253011 | 07/30/14 | 07/30/14 | FMC Hydro Study |
| FMC TS Step3 FeCl3 40M M,8um | 1421253012 | 07/30/14 | 07/30/14 | FMC Hydro Study |

# ANALYTICAL REPORT

**Workorder:** 34-1421253
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step1 FeCl3 50M M,** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253001 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 25 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 25 mL | **Analyzed:** | 07/31/2014 23:54 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **4.8** | 0.15 | 1.0 | 1 | |
| Phosphorus | **420** | NA | 50 | 1 | |

Sample ID: **FMC TS Step1 FeCl3 60M M,** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253002 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 25 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 25 mL | **Analyzed:** | 07/31/2014 23:59 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **3.8** | 0.15 | 1.0 | 1 | |
| Phosphorus | **370** | NA | 50 | 1 | |

Sample ID: **FMC TS Step1 FeCl3 70M M,** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253003 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 25 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 25 mL | **Analyzed:** | 08/01/2014 00:03 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **3.1** | 0.15 | 1.0 | 1 | |
| Phosphorus | **330** | NA | 50 | 1 | |

Sample ID: **FMC TS Step1 FeCl3 80M M,** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253004 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 25 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 25 mL | **Analyzed:** | 08/01/2014 00:07 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **3.1** | 0.15 | 1.0 | 1 | |
| Phosphorus | **330** | NA | 50 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1421253
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step3 FeCl3 20M M,** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253005 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:11 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **31** | 0.15 | 1.0 | 1 | |
| Phosphorus | **1800** | NA | 50 | 1 | |

Sample ID: **FMC TS Step3 FeCl3 20M M,1.2um** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253006 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:33 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **30** | 0.15 | 1.0 | 1 | |
| Phosphorus | **1700** | NA | 50 | 1 | |

Sample ID: **FMC TS Step3 FeCl3 20M M,25um** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253007 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:37 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **31** | 0.15 | 1.0 | 1 | |
| Phosphorus | **1700** | NA | 50 | 1 | |

Sample ID: **FMC TS Step3 FeCl3 20M M, 8um** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253008 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:41 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **31** | 0.15 | 1.0 | 1 | |

**Results Continued on Next Page**

# ANALYTICAL REPORT

**Workorder:** 34-1421253
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC TS Step3 FeCl3 20M M, 8um** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253008 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:41 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Phosphorus | **1700** | NA | 50 | 1 | |

Sample ID: **FMC TS Step3 FeCl3 40M M,** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253009 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:46 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **10** | 0.15 | 1.0 | 1 | |
| Phosphorus | **640** | NA | 50 | 1 | |

Sample ID: **FMC TS Step3 FeCl3 40M M,1.2um** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253010 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:50 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **10** | 0.15 | 1.0 | 1 | |
| Phosphorus | **660** | NA | 50 | 1 | |

Sample ID: **FMC TS Step3 FeCl3 40M M,25um** | Sampling Site: FMC Hydro Study | Collected: 07/30/2014
Lab ID: 1421253011 | Media: 250 mL Nalgene | Received: 07/30/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:54 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **46** | 0.15 | 1.0 | 1 | |
| Phosphorus | **3200** | NA | 50 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1421253
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

| | | | | | |
|---|---|---|---|---|---|
| Sample ID: | FMC TS Step3 FeCl3 40M M,8um | Sampling Site: | FMC Hydro Study | Collected: | 07/30/2014 |
| Lab ID: | 1421253012 | Media: | 250 mL Nalgene | Received: | 07/30/2014 |
| Matrix: | Water | Sampling Parameter: | NA | | |

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3819 (HBN: 131676) | **Initial:** 50 mL | **Batch:** | EMS/3824 (HBN: 131803) | **Percent Solid:** NA |
| **Prepared:** | 07/31/2014 | **Final:** 50 mL | **Analyzed:** | 08/01/2014 00:59 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **43** | 0.15 | 1.0 | 1 | |
| Phosphorus | **3000** | NA | 50 | 1 | |

## Report Authorization

| Method | Analyst | Peer Review |
|---|---|---|
| **SW 6020** | Kristie F. Bitner | John T Kershisnik |

## Laboratory Contact Information


ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

Phone: (801) 266-7700
Email: alslt.lab@ALSGlobal.com
Web: www.alsslc.com

# ANALYTICAL REPORT

**Workorder:** 34-1421253
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

## Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< This testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

## Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421253**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | EPA 3010, SW 6020 Water Prep | **Analysis:** | SW 6020 |
| **Basis:** | ALS Laboratory Group | **Batch:** | EMS/3819 (HBN: 131676) | **Batch:** | EMS/3824 (HBN: 131803) |
| | | **Prepared By:** | Kristie F. Bitner | **Analyzed By:** | Kristie F. Bitner |

## Blank

**MB:** 402899
**Analyzed:** 07/31/2014 23:33
**Units:** ug/L

| Analyte | Result | MDL | RL |
|---|---|---|---|
| Arsenic | 0.169 | 0.15 | 1.00 |
| Phosphorus | ND | NA | 50.0 |

## Laboratory Control Sample - Laboratory Control Sample Duplicate

**LCS:** 402900
**Analyzed:** 07/31/2014 23:41
**Dilution:** 1
**Units:** ug/L

**LCSD:** 402901
**Analyzed:** 07/31/2014 23:46
**Dilution:** 1
**Units:** ug/L

| Analyte | Result | Target | % Rec | QC Limits | | Result | % Rec | RPD | QC Limits | |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 25.1 | 25.0 | 100 | 86.6 | 113.8 | 25.2 | 101 | 0.636 | 0.0 | 20.0 |
| Phosphorus | 276 | 250 | 111 | 80.0 | 120.0 | 270 | 108 | 2.25 | 0.0 | 20.0 |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421253**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | EPA 3010, SW 6020 Water Prep | **Analysis:** | SW 6020 |
| **Basis:** | ALS Laboratory Group | **Batch:** | EMS/3819 (HBN: 131676) | **Batch:** | EMS/3824 (HBN: 131803) |
| | | **Prepared By:** | Kristie F. Bitner | **Analyzed By:** | Kristie F. Bitner |

### Initial Calibration Verification

| ICV: 403259<br>Analyzed: 07/31/2014 19:02<br>Units: ug/L<br>Criteria: ± 10% | | | | ICV: 403261<br>Analyzed: 07/31/2014 19:11<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 24.8 | 25.0 | 99.2 | 240 | 250 | 96.0 |
| Phosphorus | 23.7 | 25.0 | 94.8 | 246 | 250 | 98.5 |

### Continuing Calibration Verification

| CCV: 403265<br>Analyzed: 07/31/2014 19:41<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 403267<br>Analyzed: 07/31/2014 19:49<br>Units: ug/L<br>Criteria: ± 10% | | | CCV: 403269<br>Analyzed: 07/31/2014 20:50<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 23.9 | 25.0 | 95.6 | 188 | 200 | 94.2 | 24.1 | 25.0 | 96.4 |
| Phosphorus | | | | 195 | 200 | 97.3 | | | |

| CCV: 403271<br>Analyzed: 07/31/2014 20:58<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 403273<br>Analyzed: 07/31/2014 21:54<br>Units: ug/L<br>Criteria: ± 10% | | | CCV: 403275<br>Analyzed: 07/31/2014 22:03<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 188 | 200 | 94.2 | 25.2 | 25.0 | 101 | 196 | 200 | 97.9 |
| Phosphorus | 194 | 200 | 96.8 | | | | 198 | 200 | 98.9 |

| CCV: 403277<br>Analyzed: 07/31/2014 23:07<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 403279<br>Analyzed: 07/31/2014 23:15<br>Units: ug/L<br>Criteria: ± 10% | | | CCV: 403281<br>Analyzed: 08/01/2014 00:16<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 24.7 | 25.0 | 99.0 | 188 | 200 | 94.2 | 24.4 | 25.0 | 97.5 |
| Phosphorus | | | | 197 | 200 | 98.4 | | | |

| CCV: 403283<br>Analyzed: 08/01/2014 00:24<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 403286<br>Analyzed: 08/01/2014 01:20<br>Units: ug/L<br>Criteria: ± 10% | | | CCV: 403288<br>Analyzed: 08/01/2014 01:29<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 186 | 200 | 92.8 | 24.9 | 25.0 | 99.7 | 191 | 200 | 95.3 |
| Phosphorus | 200 | 200 | 100 | | | | 209 | 200 | 104 |

### Low Level Calibration Verification

| LLICV: 403258<br>Analyzed: 07/31/2014 18:53<br>Units: ug/L<br>Criteria: ± 30% | | | | | LLCCV: 403285<br>Analyzed: 08/01/2014 01:16<br>Units: ug/L<br>Criteria: ± 30% | | | |
|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Qual.** | **Result** | **Target** | **% Rec.** | **Qual.** |
| Arsenic | 1.04 | 1.00 | 104 | | 1.04 | 1.00 | 104 | |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421253**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3819 (HBN: 131676)
**Prepared By:** Kristie F. Bitner

**Analysis:** SW 6020
**Batch:** EMS/3824 (HBN: 131803)
**Analyzed By:** Kristie F. Bitner

### Low Level Calibration Verification

**LLICV:** 403258
**Analyzed:** 07/31/2014 18:53
**Units:** ug/L
**Criteria:** ± 30%

**LLCCV:** 403285
**Analyzed:** 08/01/2014 01:16
**Units:** ug/L
**Criteria:** ± 30%

| Analyte | Result | Target | % Rec. | Qual. | Result | Target | % Rec. | Qual. |
|---|---|---|---|---|---|---|---|---|
| Phosphorus | ND | 50.0 | NA | U | 55.6 | 50.0 | 111 | |

### Initial Calibration Blank

| ICB: 403260<br>Analyzed: 07/31/2014 19:06<br>Units: ug/L | | | ICB: 403262<br>Analyzed: 07/31/2014 19:15<br>Units: ug/L | |
|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U |
| Phosphorus | ND | U | ND | U |

### Continuing Calibration Blank

| CCB: 403266<br>Analyzed: 07/31/2014 19:45<br>Units: ug/L | | | CCB: 403268<br>Analyzed: 07/31/2014 19:54<br>Units: ug/L | | CCB: 403270<br>Analyzed: 07/31/2014 20:54<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U | ND | U |
| Phosphorus | | | ND | U | | |

| CCB: 403272<br>Analyzed: 07/31/2014 21:02<br>Units: ug/L | | | CCB: 403274<br>Analyzed: 07/31/2014 21:58<br>Units: ug/L | | CCB: 403276<br>Analyzed: 07/31/2014 22:07<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U | ND | U |
| Phosphorus | ND | U | | | ND | U |

| CCB: 403278<br>Analyzed: 07/31/2014 23:11<br>Units: ug/L | | | CCB: 403280<br>Analyzed: 07/31/2014 23:20<br>Units: ug/L | | CCB: 403282<br>Analyzed: 08/01/2014 00:20<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | 0.463 | J | 0.372 | J | ND | U |
| Phosphorus | | | ND | U | | |

| CCB: 403284<br>Analyzed: 08/01/2014 00:29<br>Units: ug/L | | | CCB: 403287<br>Analyzed: 08/01/2014 01:25<br>Units: ug/L | | CCB: 403289<br>Analyzed: 08/01/2014 01:33<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U | ND | U |
| Phosphorus | ND | U | | | ND | U |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421253**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3819 (HBN: 131676)
**Prepared By:** Kristie F. Bitner

**Analysis:** SW 6020
**Batch:** EMS/3824 (HBN: 131803)
**Analyzed By:** Kristie F. Bitner

### Interference Check Sample

| ICSA: 403263 | | | | ICSAB: 403264 | | |
|---|---|---|---|---|---|---|
| Analyzed: | | | | Analyzed: 07/31/2014 19:32 | | |
| Units: | | | | Units: ug/L | | |
| Criteria: ± 20 | | | | Criteria: ± 20% | | |
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | | | | 91.5 | 100 | 91.5 |
| Phosphorus | 93100 | 100000 | 93.1 | 92900 | 100000 | 92.9 |

### Serial Dilution

| Sample: 1421253012 | | SD: 403221 | | | |
|---|---|---|---|---|---|
| Analyzed: 08/01/2014 00:59 | | Analyzed: 08/01/2014 01:07 | | | |
| Dilution: 1 | | Dilution: 1 | | | |
| Units: ug/L | | Units: ug/L | | | |
| **Analyte** | **Result** | **Result** | **RPD** | **QC Limits** | |
| Arsenic | 42.7 | 44.6 | 4.24 | 0.0 | 10.0 |
| Phosphorus | 2950 | 2990 | 1.40 | 0.0 | 10.0 |

### Post Digestion Spike

| Sample: 1421253012 | | PDS: 403220 | | | | |
|---|---|---|---|---|---|---|
| Analyzed: 08/01/2014 00:59 | | Analyzed: 08/01/2014 01:03 | | | | |
| Dilution: 1 | | Dilution: 1 | | | | |
| Units: ug/L | | Units: ug/L | | | | |
| **Analyte** | **Result** | **Result** | **Target** | **% Recovery** | **QC Limits** | |
| Arsenic | 42.7 | 52.1 | 10.0 | 93.9 | 75.0 | 125.0 |
| Phosphorus | 2950 | 3240 | 250 | 115 | 75.0 | 125.0 |

## QC Data Approved and Reviewed by

| Kristie F. Bitner | John T Kershisnik | 8/1/2014 |
|---|---|---|
| **Analyst** | **Peer Review** | **Date** |

## Symbols and Definitions

* - Analyte above reporting limit or outside of control limits
▲ - Sample result is greater than 4 times the spike added
● - Sample and Matrix Duplicate less than 5 times the reporting limit

RPD - Relative % Difference (Spike / Spike Duplicate)
ND - Not Detected (U - Qualifier also flags analyte as not detected)
NA - Not Applicable
QC results are not adjusted for moisture correction, where applicable

ALS

1421253

Record

13228/#2

CoC #: 1

1421253

Page 1 of 2

| Client Name & Address: | Project Name & No.: |
|---|---|
| MWH Americas<br>2890 E. Cottonwood Pkwy<br>Suite 300<br>Salt Lake City, UT 84121 | FMC Hydro Study |
| | ALS Quote No: |
| | Report to: Anna Boguslavsky |
| Phone: (949) 230-2024 | Report to e-mail: anna.boguslavsky@mwhglobal.com |
| e-mail: anna.boguslavsky@mwhglobal.com | Bill to: Corporate |

Analyses Requested: 537.0 PFAS

Matrix Codes: W) Water, B) Bulk, L) Liquid, F) Filter, S) Soil, G) Wipe, C) Solid, M) Media

Preservation Codes: 1) Cool to 4°C; 2) HCl to pH<2, 4°C; 3) $H_2SO_4$ to pH<2, 4°C; 4) $HNO_3$ to pH<2, 4°C; 5) NaOH to pH>12, 4°C; 6) ZnOAc/NaOH to pH>9, 4°C

| Field Sample Number | Date | Time | Depth | ALS Sample Number | No. of Containers | Sample for Matrix QC | 537.0 PFAS | Preservation Code | Sample Matrix Code | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| FMC TS Step1 FeCl3 5mM | 7/30/14 | 16:45 | — | | 1 | W | X | | | |
| FMC TS Step1 FeCl3 6mM | | | — | | 1 | W | X | | | |
| FMC TS Step1 FeCl3 7mM | | | — | | 1 | W | X | | | |
| FMC TS Step1 FeCl3 8mM | | | — | | 1 | W | X | | | |
| FMC TS Step 3 FeCl3 20mM, 0.2um | | | — | | 1 | W | X | | | |
| FMC TS Step3 FeCl3 20mM, 1.2um | | | — | | 1 | W | X | | | |
| FMC TS Step3 FeCl3 20mM, 2.5um | | | — | | 1 | W | X | | | |
| FMC TS Step3 FeCl3 20mM, 8um | | | — | | 1 | W | X | | | |
| FMC TS Step 3 FeCl3 40mM | | | — | | 1 | W | X | | | |
| FMC TS Step 3 FeCl3 40mM, 12um | | | — | | 1 | W | X | | | |

**Possible Hazard Identification**
☑ Non-Hazard ☐ Skin Irritant ☐ Rad
☐ Flammable ☐ Poison ☐ Unknown

**Sample Disposal**
☐ Return to Client ☐ Archive _____ Months
☑ Disposal by Lab
(fees assessed for samples retained > 3 months)

**Data Deliverable:**
☐ Level 1 ☐ Level 3
☐ Level 2 ☐ Level 4
EDD Type:

**Requested Turn Around Time**
☑ 2 Days (Rush) ☐ 7 Days (Rush)
☐ 3 Days (Rush) ~~☐ 14 Days~~ AB
(Rush = email data by COB on day due. Surcharges assessed.)

Carrier/Airbill #:

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
|---|---|---|---|---|---|
| [signature] | 7/30/14 | 16:45 | [signature] | 07/30 | 16:45 |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |

Shipped to:
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
Phone: (800) 356-9135
Phone: (801) 266-7700
FAX: (801) 268-9992
WEB: www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

ALSCoC 121013

12/12/2013

**ALS Environmental**
# Field Chain-of-Custody Record

CoC #: 1



Client Name & Address:
MWH Americas
2890 E. Cottonwood Pkwy
Suite 500
SLC, UT 84121

Project Name & No.: FMC Hydro Study

ALS Quote No:

Report to: Anna Boguslavsky

Phone: 949 232-2024

Report to e-mail: anna-boguslavsky@mwhglobal.com

e-mail: anna.boguslavsky@mwhglobal.com

Bill to: Corporate

Matrix Codes: W) Water, B) Bulk, L) Liquid, F) Filter, S) Soil, G) Wipe, C) Solid, M) Media

Preservation Codes: 1) Cool to 4°C; 2) HCl to pH<2, 4°C; 3) $H_2SO_4$ to pH<2, 4°C; 4) $HNO_3$ to pH<2, 4°C; 5) NaOH to pH>12, 4°C; 6) ZnOAc/NaOH to pH>9, 4°C

| Field Sample Number | Date | Time | Depth | ALS Sample Number | No. of Containers | Sample for Matrix QC | Analyses Requested: As, P SW6020 | | | | | | | Preservation Code | Sample Matrix Code | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FMC TS Step 3 $FeCl_3$ 40mM, 25um | 7/30/14 | 16:45 | | | 1 | W | X | | | | | | | | | |
| FMC TS Step 3 $FeCl_3$ 40mM, 8um | ↓ | 16:45 | | | 1 | W | X | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
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**Possible Hazard Identification**
☒ Non-Hazard ☐ Skin Irritant ☐ Rad
☐ Flammable ☐ Poison ☐ Unknown

**Sample Disposal**
☐ Return to Client ☐ Archive _____ Months
☒ Disposal by Lab
(fees assessed for samples retained > 3 months)

**Data Deliverable:**
☐ Level 1 ☐ Level 3
☐ Level 2 ☐ Level 4
EDD Type:

**Requested Turn Around Time**
☒ 2 Days (Rush) ☐ 7 Days (Rush)
☐ 3 Days (Rush) ~~☐ 14 Days~~
(Rush = email data by COB on day due. Surcharges assessed.)

Carrier/Airbill #:

| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
|---|---|---|---|---|---|
| [signature] | 7/30/14 | 16:45 | [signature] | 07/30 | 16:45 |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |
| Relinquished by: (Signature) | Date | Time | Received by: (Signature) | Date | Time |
| | | | | | |

Shipped to:
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
Phone: (800) 356-9135
Phone: (801) 266-7700
FAX: (801) 268-9992
WEB: www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

# ALS Environmental

## CHAIN-OF-CUSTODY

| Project / Job / Task: FMC Hydro Study | Split: | Workorder ID: 1421253 | Level: ENV_LVL3 |
|---|---|---|---|
| Client: MWH | | Account: 8001 | Type: 250Poly |
| Comments: | | | Preservatives: HNO3 |

| Item | Collect Date/Time | Sample ID | Lab ID | QC | Matrix | Containers ID(s) | Containers Count | Requested Analysis: SW8020 |
|---|---|---|---|---|---|---|---|---|
| 1 | 07/30/2014 16:45 | FMC TS Step1 FeCl3 50M M, | 1421253001 | | Water | A | 1 | A |
| 2 | 07/30/2014 16:45 | FMC TS Step1 FeCl3 60M M, | 1421253002 | | Water | A | 1 | A |
| 3 | 07/30/2014 16:45 | FMC TS Step1 FeCl3 70M M, | 1421253003 | | Water | A | 1 | A |
| 4 | 07/30/2014 16:45 | FMC TS Step1 FeCl3 80M M, | 1421253004 | | Water | A | 1 | A |
| 5 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 20M M, | 1421253005 | | Water | A | 1 | A |
| 6 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 20M | 1421253006 | | Water | A | 1 | A |
| 7 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 20M | 1421253007 | | Water | A | 1 | A |
| 8 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 20M M, | 1421253008 | | Water | A | 1 | A |
| 9 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 40M M, | 1421253009 | | Water | A | 1 | A |
| 10 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 40M | 1421253010 | | Water | A | 1 | A |

### ORIGINAL FIELD SAMPLE CHAIN-OF-CUSTODY

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| Warath, Julie | 07/30/2014 16:45 | ALS Sample Receiving | Sample Login |
| Julie Warath | 7/31/14 0845 | Cart | Storage |
| R-33-1 KB | 7/31/14 08:40 | ICP-MS lab KB | 6020 |
| | | | |
| | | | |
| | | | |
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| | | | |

### SAMPLE PREPARATION / ANALYSIS CHAIN-OF-CUSTODY

Sample Prep / Analysis for: _____ Lab Notebook No.: _____

Prepared / Analyzed by: _____ Date / Time: _____

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| | | | |
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# ALS Environmental

## CHAIN-OF-CUSTODY

| Project / Job / Task: FMC Hydro Study | Split: | Workorder ID: 1421253 | Level: ENV_LVL3 |
|---|---|---|---|
| Client: MWH | | Account: 8001 | Type: 250Poly |
| Comments: | | | Preservatives: HNO3 |

| Item | Collect Date/Time | Sample ID | Lab ID | QC | Matrix | Containers ID(s) | Containers Count | Requested Analysis: SW6020 |
|---|---|---|---|---|---|---|---|---|
| 11 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 40M | 1421253011 | | Water | A | 1 | A |
| 12 | 07/30/2014 16:45 | FMC TS Step3 FeCl3 40M | 1421253012 | | Water | A | 1 | A |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | | | | | | | | |
| 16 | | | | | | | | |
| 17 | | | | | | | | |
| 18 | | | | | | | | |
| 19 | | | | | | | | |
| 20 | | | | | | | | |

### ORIGINAL FIELD SAMPLE CHAIN-OF-CUSTODY

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| Warath, Julie | 07/30/2014 16:45 | ALS Sample Receiving | Sample Login |
| Julie Warath | 7/31/14 0885 | CoA | Storage |
| R-33-1 KB | 7/31/14 08:40 | ICP-MS lab KB | 6020 |
| | | | |
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### SAMPLE PREPARATION / ANALYSIS CHAIN-OF-CUSTODY

Sample Prep / Analysis for: _____ Lab Notebook No.: _____

Prepared / Analyzed by: _____ Date / Time: _____

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| | | | |
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# ALS LABORATORY GROUP SALT LAKE CITY-RELATED INFORMATION REPORT (CRIR)

## COOLER OR CONTAINER INFORMATION CHECKLIST (Fill In or Circle)

1421253

Client Name: MWH Americas

Project/Task/Site: FMC Hydro Study

Date/Time of Receipt: 07/30/14 16:45

Number of Coolers Received: 1 Bucket

| | | | |
|---|---|---|---|
| Condition of Coolers: | Acceptable/Unacceptable | Temperature Control: | Present/Not Included |
| Cooler Custody Seals: | Present/Absent/NA<br>Intact/Broken/NA | Location Temp Taken: | Control/Between Samples |
| Container Custody Seals: | Present/Absent/NA<br>Intact/Broken/NA | Are all temperatures within project specific guidelines? | Yes/No/NA |
| Tamper Evident: | Yes/No/NA | VOA Headspace Present? | Yes/No/NA |
| Ice Present: | Yes/No/NA<br>Frozen/Melted/NA | | |

07/30/14

| pH Check Performed: | | | | | | |
|---|---|---|---|---|---|---|
| | Metals | Yes/No/NA | Total Phenolics | Yes/No/NA | NO3/NO2 | Yes/No/NA |
| | Cyanide | Yes/No/NA | TPH – 418.1 | Yes/No/NA | Oil & Grease | Yes/No/NA |
| | Sulfide | Yes/No/NA | COD | Yes/No/NA | Total Phosphorous | Yes/No/NA |
| | Ammonia | Yes/No/NA | TKN | Yes/No/NA | TOC Preserved | Yes/No/NA |

| Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. |
|---|---|---|---|---|---|---|---|---|
| 1 | C14 533246 | °C | 4 | C14 | °C | 7 | C14 | °C |
| 2 | C14 | °C | 5 | C14 | °C | 8 | C14 | °C |
| 3 | C14 | °C | 6 | C14 | °C | 9 | C14 | °C |

Taken By: [signature] (Signature) Thomas Carlson (Printed Name) 07/30/14 (Date)

## CLIENT-RELATED INFORMATION

- ☐ Missing Cooler
- ☐ Cooler Conditions
- ☐ Missing Paperwork
- ☐ Missing/Incorrect Bottle Labels
- ☐ Missing Samples/Bottles
- ☐ Broken/Leaking Samples
- ☐ Incorrect Bottle Type
- ☐ Cooler Temperatures Out of Range
- ☐ Incorrect Preservation
- ☐ pH Criteria Not Met
- ☐ Residual Chlorine Present
- ☐ Head Space in Bottles
- ☐ Insufficient Sample Volume
- ☐ Chain of Custody Problems
- ☐ Other:

BRIEFLY DESCRIBE THE PROBLEM AND THE ACTION TAKEN:

Client walk in

E-mailed to Client? YES ☐ NO ☐

**Response Required Within 24 Hours**

## PROJECT MANAGEMENT

PROJECT MANAGER COMMENTS:

ALS Project Manager: _____ (Printed Name) Returned to Sample Receipt by: _____ (Signature) Date: _____

# Case Narrative

| | | | |
|---|---|---|---|
| **Method:** | 6020 | **Client:** | MWH |
| **Analysis:** | ICP-MS | **Account:** | 8001 |
| **Preparation SOP #:** | IP-SW-3010, Rev. 10 | **Matrix:** | Water |
| **Analysis SOP #:** | IP-SW-6020, Rev. 9 | | |
| **ALS Work Order ID:** | 1421670 | | |

**General Set Information:** There are six field samples in this workorder. The samples were analyzed for arsenic and phosphorus in water by ICP-MS.

**Method Summary:** A thoroughly mixed 50 mL portion of sample is heated in a block digester in the presence of nitric acid. After heating, samples are brought to a 50 mL final volume with ASTM Type II water. The resulting digest is analyzed using an Agilent 7700x ICP Mass Spectrometer.

**Sample Preparation:** All samples were prepared in accordance with published procedures.

**Hold Times:** Samples were prepared and analyzed within method hold times.

**Dilutions:** No sample dilutions were done.

**Method QC (MB, LCS/LCSD):** No method analyte was found in the method blank samples at levels above the RL. Two quality control sample were prepared and analyzed with this set. All analytes are within quality control limits.

**Matrix QC (MD, MS):** Due to limited sample volumes no matrix duplicate, matrix spike or matrix spike duplicate were prepared or analyzed with this work order.

**Instrument QC (ICV, CCV, etc):** Recoveries of the analytes in all initial and continuing calibration verification samples are within quality control limits. No method analytes were found in any initial or continuing calibration blank sample at levels above the PQL.

**Flagging Codes:** See report for flagging code definitions.

**Serial Dilution:** A serial dilution was prepared and analyzed with this batch. Sample results are within control limits.

**Post Digestion Spike Analysis:** A post digestion spike was prepared with this batch. Results are within limits.

**NC/CAR:** None required.

**Sample Calculation:** The final results are calculated in µg/L by the equation (A) x (B) x (C) where:

A = Analyte concentration from instrument determination (µg/L)

B = [Final Volume of Digestate (L)] / [Initial Volume of Sample Used in Digestion (L)]

C = Dilution performed at time of analysis.

**Miscellaneous Comments:** None required.

Kristie Bitner 08/06/14

**Name:** Kristie Bitner Date

# ANALYTICAL REPORT

Report Date: August 06, 2014

Anna Boguslarsky
MWH Americas
2890 East Cottonwood Parkway
Suite 300
Salt Lake City, UT 84121

Phone: (949) 232-2024

E-mail: Anna.boguslavsky@mwhglobal.com

Workorder: **34-1421670**
Project ID: FMC Hydro Study
Purchase Order: FMC Hydro Study

| Client Sample ID | Lab ID | Collect Date | Receive Date | Sampling Site |
|---|---|---|---|---|
| FMC Step3.5,FeCl3,80M,pH6 | 1421670001 | 08/04/14 | 08/04/14 | FMC Hydro Study |
| FMC Step3.5,FeCl3,40M,pH5 | 1421670002 | 08/04/14 | 08/04/14 | FMC Hydro Study |
| FMC Step3.5,FeCl3,40M,pH6 | 1421670003 | 08/04/14 | 08/04/14 | FMC Hydro Study |
| FMC Step3.5,FeCl3,40M,pH7 | 1421670004 | 08/04/14 | 08/04/14 | FMC Hydro Study |
| FMC Step3.5,FeCl3,80M,pH5 | 1421670005 | 08/04/14 | 08/04/14 | FMC Hydro Study |
| FMC Step3.5,FeCl3,80M,pH7 | 1421670006 | 08/04/14 | 08/04/14 | FMC Hydro Study |

# ANALYTICAL REPORT

**Workorder:** 34-1421670
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC Step3.5,FeCl3,80M,pH6** | Sampling Site: FMC Hydro Study | Collected: 08/04/2014
Lab ID: 1421670001 | Media: 250 mL Nalgene | Received: 08/04/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3831 (HBN: 131987) | **Initial:** 0.05 L | **Batch:** | EMS/3836 (HBN: 132205) | **Percent Solid:** NA |
| **Prepared:** | 08/05/2014 | **Final:** 0.05 L | **Analyzed:** | 08/06/2014 12:25 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **3.0** | 0.15 | 1.0 | 1 | |
| Phosphorus | **260** | NA | 50 | 1 | |

Sample ID: **FMC Step3.5,FeCl3,40M,pH5** | Sampling Site: FMC Hydro Study | Collected: 08/04/2014
Lab ID: 1421670002 | Media: 250 mL Nalgene | Received: 08/04/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3831 (HBN: 131987) | **Initial:** 0.05 L | **Batch:** | EMS/3836 (HBN: 132205) | **Percent Solid:** NA |
| **Prepared:** | 08/05/2014 | **Final:** 0.05 L | **Analyzed:** | 08/06/2014 12:29 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **50** | 0.15 | 1.0 | 1 | |
| Phosphorus | **3200** | NA | 50 | 1 | |

Sample ID: **FMC Step3.5,FeCl3,40M,pH6** | Sampling Site: FMC Hydro Study | Collected: 08/04/2014
Lab ID: 1421670003 | Media: 250 mL Nalgene | Received: 08/04/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3831 (HBN: 131987) | **Initial:** 0.05 L | **Batch:** | EMS/3836 (HBN: 132205) | **Percent Solid:** NA |
| **Prepared:** | 08/05/2014 | **Final:** 0.05 L | **Analyzed:** | 08/06/2014 12:33 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **4.6** | 0.15 | 1.0 | 1 | |
| Phosphorus | **390** | NA | 50 | 1 | |

Sample ID: **FMC Step3.5,FeCl3,40M,pH7** | Sampling Site: FMC Hydro Study | Collected: 08/04/2014
Lab ID: 1421670004 | Media: 250 mL Nalgene | Received: 08/04/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3831 (HBN: 131987) | **Initial:** 0.05 L | **Batch:** | EMS/3836 (HBN: 132205) | **Percent Solid:** NA |
| **Prepared:** | 08/05/2014 | **Final:** 0.05 L | **Analyzed:** | 08/06/2014 12:37 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **9.9** | 0.15 | 1.0 | 1 | |
| Phosphorus | **680** | NA | 50 | 1 | |

# ANALYTICAL REPORT

**Workorder:** 34-1421670
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC Step3.5,FeCl3,80M,pH5** | Sampling Site: FMC Hydro Study | Collected: 08/04/2014
Lab ID: 1421670005 | Media: 250 mL Nalgene | Received: 08/04/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3831 (HBN: 131987) | **Initial:** 0.05 L | **Batch:** | EMS/3836 (HBN: 132205) | **Percent Solid:** NA |
| **Prepared:** | 08/05/2014 | **Final:** 0.05 L | **Analyzed:** | 08/06/2014 13:03 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **50** | 0.15 | 1.0 | 1 | |
| Phosphorus | **3200** | NA | 50 | 1 | |

Sample ID: **FMC Step3.5,FeCl3,80M,pH7** | Sampling Site: FMC Hydro Study | Collected: 08/04/2014
Lab ID: 1421670006 | Media: 250 mL Nalgene | Received: 08/04/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6020**

| | | | | | |
|---|---|---|---|---|---|
| **Preparation:** | EPA 3010, SW 6020 Water Prep | **Weight/Volume** | **Analysis:** | SW 6020A, Water | **Instrument ID:** ICPM04 |
| **Batch:** | EMS/3831 (HBN: 131987) | **Initial:** 0.05 L | **Batch:** | EMS/3836 (HBN: 132205) | **Percent Solid:** NA |
| **Prepared:** | 08/05/2014 | **Final:** 0.05 L | **Analyzed:** | 08/06/2014 13:07 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **3.5** | 0.15 | 1.0 | 1 | |
| Phosphorus | **330** | NA | 50 | 1 | |

## Report Authorization

| Method | Analyst | Peer Review |
|---|---|---|
| **SW 6020** | Kristie F. Bitner | John T Kershisnik |

## Laboratory Contact Information

ALS Environmental
960 W Levoy Drive
Salt Lake City, Utah 84123

Phone: (801) 266-7700
Email: alslt.lab@ALSGlobal.com
Web: www.alsslc.com

# ANALYTICAL REPORT

**Workorder:** 34-1421670
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

## Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< This testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

## Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421670**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | EPA 3010, SW 6020 Water Prep | **Analysis:** | SW 6020 |
| **Basis:** | ALS Laboratory Group | **Batch:** | EMS/3831 (HBN: 131987) | **Batch:** | EMS/3836 (HBN: 132205) |
| | | **Prepared By:** | Kristie F. Bitner | **Analyzed By:** | Kristie F. Bitner |

## Blank

**MB:** 403749
**Analyzed:** 08/06/2014 12:03
**Units:** ug/L

| Analyte | Result | MDL | RL |
|---|---|---|---|
| Arsenic | ND | 0.15 | 1.00 |
| Phosphorus | ND | NA | 50.0 |

## Laboratory Control Sample - Laboratory Control Sample Duplicate

**LCS:** 403750
**Analyzed:** 08/06/2014 12:12
**Dilution:** 1
**Units:** ug/L

**LCSD:** 403751
**Analyzed:** 08/06/2014 12:16
**Dilution:** 1
**Units:** ug/L

| Analyte | Result | Target | % Rec | QC Limits | | Result | % Rec | RPD | QC Limits | |
|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 28.0 | 25.0 | 112 | 86.6 | 113.8 | 28.4 | 113 | 1.42 | 0.0 | 20.0 |
| Phosphorus | 285 | 250 | 114 | 80.0 | 120.0 | 285 | 114 | 0.126 | 0.0 | 20.0 |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421670**

**Limits:** Historical/Performance
**Basis:** ALS Laboratory Group

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3831 (HBN: 131987)
**Prepared By:** Kristie F. Bitner

**Analysis:** SW 6020
**Batch:** EMS/3836 (HBN: 132205)
**Analyzed By:** Kristie F. Bitner

### Initial Calibration Verification

| ICV: 404446<br>Analyzed: 08/06/2014 11:17<br>Units: ug/L<br>Criteria: ± 10% | | | | ICV: 404448<br>Analyzed: 08/06/2014 11:25<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 26.0 | 25.0 | 104 | 257 | 250 | 103 |
| Phosphorus | 24.3 | 25.0 | 97.1 | 249 | 250 | 99.7 |

### Continuing Calibration Verification

| CCV: 404452<br>Analyzed: 08/06/2014 11:55<br>Units: ug/L<br>Criteria: ± 10% | | | | CCV: 404454<br>Analyzed: 08/06/2014 12:54<br>Units: ug/L<br>Criteria: ± 10% | | | CCV: 404457<br>Analyzed: 08/06/2014 13:37<br>Units: ug/L<br>Criteria: ± 10% | | |
|---|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | 218 | 200 | 109 | 207 | 200 | 103 | 207 | 200 | 103 |
| Phosphorus | 209 | 200 | 104 | 197 | 200 | 98.3 | 199 | 200 | 99.6 |

### Low Level Calibration Verification

| LLICV: 404445<br>Analyzed: 08/06/2014 11:12<br>Units: ug/L<br>Criteria: ± 30% | | | | | LLCCV: 404456<br>Analyzed: 08/06/2014 13:24<br>Units: ug/L<br>Criteria: ± 30% | | | |
|---|---|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Target** | **% Rec.** | **Qual.** | **Result** | **Target** | **% Rec.** | **Qual.** |
| Arsenic | 1.14 | 1.00 | 114 | | 1.04 | 1.00 | 104 | |
| Phosphorus | ND | 50.0 | NA | U | 51.8 | 50.0 | 104 | |

### Initial Calibration Blank

| ICB: 404447<br>Analyzed: 08/06/2014 11:21<br>Units: ug/L | | | ICB: 404449<br>Analyzed: 08/06/2014 11:29<br>Units: ug/L | |
|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U |
| Phosphorus | ND | U | ND | U |

### Continuing Calibration Blank

| CCB: 404453<br>Analyzed: 08/06/2014 11:59<br>Units: ug/L | | | CCB: 404455<br>Analyzed: 08/06/2014 12:59<br>Units: ug/L | | CCB: 404458<br>Analyzed: 08/06/2014 13:41<br>Units: ug/L | |
|---|---|---|---|---|---|---|
| **Analyte** | **Result** | **Qual.** | **Result** | **Qual.** | **Result** | **Qual.** |
| Arsenic | ND | U | ND | U | ND | U |
| Phosphorus | ND | U | ND | U | ND | U |

# Quality Control Sample
# Batch Report

## Analysis Information

**Workorder: 1421670**

| | | | | | |
|---|---|---|---|---|---|
| **Limits:** | Historical/Performance | **Preparation:** | EPA 3010, SW 6020 Water Prep | **Analysis:** | SW 6020 |
| **Basis:** | ALS Laboratory Group | **Batch:** | EMS/3831 (HBN: 131987) | **Batch:** | EMS/3836 (HBN: 132205) |
| | | **Prepared By:** | Kristie F. Bitner | **Analyzed By:** | Kristie F. Bitner |

### Interference Check Sample

| | | | | | | |
|---|---|---|---|---|---|---|
| **ICSA:** 404450 | | | | **ICSAB:** 404451 | | |
| **Analyzed:** | | | | **Analyzed:** 08/06/2014 11:38 | | |
| **Units:** | | | | **Units:** ug/L | | |
| **Criteria:** ± 20 | | | | **Criteria:** ± 20% | | |
| **Analyte** | **Result** | **Target** | **% Rec.** | **Result** | **Target** | **% Rec.** |
| Arsenic | | | | 103 | 100 | 103 |
| Phosphorus | 98000 | 100000 | 98.0 | 99600 | 100000 | 99.6 |

### Serial Dilution

| | | | | | |
|---|---|---|---|---|---|
| **Sample:** 1421670006 | | **SD:** 404428 | | | |
| **Analyzed:** 08/06/2014 13:07 | | **Analyzed:** 08/06/2014 13:16 | | | |
| **Dilution:** 1 | | **Dilution:** 1 | | | |
| **Units:** ug/L | | **Units:** ug/L | | | |
| **Analyte** | **Result** | **Result** | **RPD** | **QC Limits** | |
| Arsenic | 3.47 | 3.78 | NA | 0.0 | 10.0 |
| Phosphorus | 335 | 334 | 0.148 | 0.0 | 10.0 |

### Post Digestion Spike

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sample:** 1421670006 | | **PDS:** 404427 | | | | |
| **Analyzed:** 08/06/2014 13:07 | | **Analyzed:** 08/06/2014 13:11 | | | | |
| **Dilution:** 1 | | **Dilution:** 1 | | | | |
| **Units:** ug/L | | **Units:** ug/L | | | | |
| **Analyte** | **Result** | **Result** | **Target** | **% Recovery** | **QC Limits** | |
| Arsenic | 3.47 | 13.2 | 10.0 | 97.3 | 75.0 | 125.0 |
| Phosphorus | 335 | 620 | 250 | 114 | 75.0 | 125.0 |

## QC Data Approved and Reviewed by

| | | |
|---|---|---|
| Kristie F. Bitner | John T Kershisnik | 8/6/2014 |
| **Analyst** | **Peer Review** | **Date** |

## Symbols and Definitions

* - Analyte above reporting limit or outside of control limits
▲ - Sample result is greater than 4 times the spike added
● - Sample and Matrix Duplicate less than 5 times the reporting limit

RPD - Relative % Difference (Spike / Spike Duplicate)
ND - Not Detected (U - Qualifier also flags analyte as not detected)
NA - Not Applicable
QC results are not adjusted for moisture correction, where applicable

W 1421670

# ALS Environmental
## Field Chain-of-Custody Record

13228/#2
1421670

Page _____ of _____

Client Name & Address: MWH Americas, 2890 E. Cottonwood Pkwy, Suite 300, SLC, UT 84121

Phone: 949 233-2024

FAX:

e-mail: anna.boguslavsky@mwhglobal.com

Project No.: FMC Hydro Study

Project Name: FMC Hydro

Sampler: *(Signature)*

Preservation Code | Sample Matrix Code | Sample for Matrix QC | Analyses Requested: ASP 3 (6020) | No. of Containers

Matrix Codes: W) Water, B) Bulk, L) Liquid, F) Filter, S) Soil, G) Wipe, C) Solid, M) Media

Preservation Codes: 1) Cool to 4°C; 2) HCl to pH<2, 4°C; 3) $H_2SO_4$ to pH<2, 4°C; 4) $HNO_3$ to pH<2, 4°C; 5) NaOH to pH>12, 4°C; 6) ZnOAc/NaOH to pH>9, 4°C

| Field Sample Number | Site ID | Date | Time | Depth | ALS Sample Number | Preservation Code | Sample Matrix Code | Sample for Matrix QC | ASP 3 (6020) | | | | | | | No. of Containers | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FMC Step 3.5, $FeCl_3$ 80 m, pH6 | | 8/4/14 | 15:20 | — | | | W | W | X | | | | | | | | |
| FMC Step 3.5, $FeCl_3$ 40 m, pH5 | | ↓ | ↓ | — | | | W | W | X | | | | | | | | |
| FMC Step 3.5 $FeCl_3$ 40 m, pH6 | | | | — | | | W | W | X | | | | | | | | |
| FMC Step 3.5 $FeCl_3$ 40 m, pH7 | | | | — | | | W | W | X | | | | | | | | |
| FMC Step 3.5 $FeCl_3$ 80 m, pH5 | | | | — | | | W | W | X | | | | | | | | |
| FMC Step 3.5 $FeCl_3$ 80 m, pH7 | | | | — | | | W | W | X | | | | | | | | |

**Possible Hazard Identification**
☒ Non-Hazard ☐ Skin Irritant ☐ Rad
☐ Flammable ☐ Poison ☐ Unknown

**Sample Disposal**
☐ Return to Client ☐ Archive for _____ Months
☒ Disposal by Lab
(fees may be assessed if samples are retained longer than 3 months)

**Requested Turn Around Time**
☒ 2 Days (Rush) ☐ 7 Days (Rush) ☐ 21 Days
☐ 3 Days (Rush) ☐ 14 Days ☐ Other
(Rush = email data by COB on day due. Surcharges assessed.)

**Carrier/Airbill #:**

| Relinquished by: *(Signature)* | Received by: *(Signature)* | Date | Time |
|---|---|---|---|
| [signature] | [signature] | 8/4/14 | 15:20 |
| Relinquished by: *(Signature)* | Received by: *(Signature)* | Date | Time |
| Relinquished by: *(Signature)* | Received by: *(Signature)* | Date | Time |

**Shipped to:**
ALS Environmental
960 West LeVoy Drive
Salt Lake City, UT 84123
**Phone:** (800) 356-9135
**Phone:** (801) 266-7700
**FAX:** (801) 268-9992
WEB:www.alsglobal.com

*White - Laboratory Copy* *Yellow - Client Copy*

# ALS Environmental

## CHAIN-OF-CUSTODY

| Project / Job / Task: FMC Hydro Study | Split: | Workorder ID: 1421670 | Level: ENV_LVL3 |
|---|---|---|---|
| Client: MWH | | Account: 8001 | Type: 250Poly |
| Comments: | | | Preservatives: HNO3 |

| Item | Collect Date/Time | Sample ID | Lab ID | QC | Matrix | Containers ID(s) | Containers Count | Requested Analysis: SW6020 |
|---|---|---|---|---|---|---|---|---|
| 1 | 08/04/2014 15:20 | FMC Step3.5,FeCl3,80M,pH6 | 1421670001 | | Water | A | 1 | A |
| 2 | 08/04/2014 15:20 | FMC Step3.5,FeCl3,40M,pH5 | 1421670002 | | Water | A | 1 | A |
| 3 | 08/04/2014 15:20 | FMC Step3.5,FeCl3,40M,pH6 | 1421670003 | | Water | A | 1 | A |
| 4 | 08/04/2014 15:20 | FMC Step3.5,FeCl3,40M,pH7 | 1421670004 | | Water | A | 1 | A |
| 5 | 08/04/2014 15:20 | FMC Step3.5,FeCl3,80M,pH5 | 1421670005 | | Water | A | 1 | A |
| 6 | 08/04/2014 15:20 | FMC Step3.5,FeCl3,80M,pH7 | 1421670006 | | Water | A | 1 | A |
| 7 | | | | | | | | |
| 8 | | | | | | | | |
| 9 | | | | | | | | |
| 10 | | | | | | | | |

### ORIGINAL FIELD SAMPLE CHAIN-OF-CUSTODY

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| Warath, Julie | 08/04/2014 15:20 | ALS Sample Receiving | Sample Login |
| [illegible] | 8/4/14 1700 | SC | Storage |
| R-33-1 LB | 08/05/14 10:35 | ICP-MS Lab LB | 6020 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

### SAMPLE PREPARATION / ANALYSIS CHAIN-OF-CUSTODY

Sample Prep / Analysis for: _____ Lab Notebook No.: _____

Prepared / Analyzed by: _____ Date / Time: _____

| Relinquished By: (Signature) | Date / Time | Received By: (Signature) | Reason for Transfer / Storage Location |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
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| | | | |
| | | | |

# ALS LABORATORY GROUP SALT LAKE CITY-RELATED INFORMATION REPORT (CRIR)

## COOLER OR CONTAINER INFORMATION CHECKLIST (Fill In or Circle)

Client Name: MWH Americas

Project/Task/Site: 1421670 FMC Hydro Study

Date/Time of Receipt: 08/04/14 @ 15:20

Number of Coolers Received: 1 Bucket

Condition of Coolers: Acceptable/Unacceptable

Cooler Custody Seals: Present/Absent/NA
Intact/Broken/NA

Container Custody Seals: Present/Absent/NA
Intact/Broken/NA

Tamper Evident: Yes/No/NA

Ice Present: Yes/No/NA
Frozen/Melted/NA

Temperature Control: Present/Not Included

Location Temp Taken: Control/Between Samples

Are all temperatures within project specific guidelines? Yes/No/NA

VOA Headspace Present? Yes/No/NA

| pH Check Performed: | | | | | | |
|---|---|---|---|---|---|---|
| | Metals | Yes/No/NA | Total Phenolics | Yes/No/NA | NO3/NO2 | Yes/No/NA |
| | Cyanide | Yes/No/NA | TPH – 418.1 | Yes/No/NA | Oil & Grease | Yes/No/NA |
| | Sulfide | Yes/No/NA | COD | Yes/No/NA | Total Phosphorous | Yes/No/NA |
| | Ammonia | Yes/No/NA | TKN | Yes/No/NA | TOC Preserved | Yes/No/NA |

| Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. | Cooler Received | ALS Cooler No. | Temp. |
|---|---|---|---|---|---|---|---|---|
| 1 | C14 5346 | 3 °C | 4 | C14 | °C | 7 | C14 | °C |
| 2 | C14 | °C | 5 | C14 | °C | 8 | C14 | °C |
| 3 | C14 | °C | 6 | C14 | °C | 9 | C14 | °C |

Taken By: [signature] (Signature) Thomas Carlson (Printed Name) 08/04/14 (Date)

## CLIENT-RELATED INFORMATION

- ☐ Missing Cooler
- ☐ Cooler Conditions
- ☐ Missing Paperwork
- ☐ Missing/Incorrect Bottle Labels
- ☐ Missing Samples/Bottles
- ☐ Broken/Leaking Samples
- ☐ Incorrect Bottle Type
- ☐ Cooler Temperatures Out of Range
- ☐ Incorrect Preservation
- ☐ pH Criteria Not Met
- ☐ Residual Chlorine Present
- ☐ Head Space in Bottles
- ☐ Insufficient Sample Volume
- ☐ Chain of Custody Problems
- ☐ Other:

**BRIEFLY DESCRIBE THE PROBLEM AND THE ACTION TAKEN:**

E-mailed to Client? YES ☐ NO ☐

**Response Required Within 24 Hours**

## PROJECT MANAGEMENT

**PROJECT MANAGER COMMENTS:**

ALS Project Manager: _____ (Printed Name) Returned to Sample Receipt by: _____ (Signature) Date: _____

# ANALYTICAL REPORT

Report Date: September 02, 2014

Anna Boguslarsky
MWH Americas
2890 East Cottonwood Parkway
Suite 300
Salt Lake City, UT 84121

Phone: (949) 232-2024

E-mail: Anna.boguslavsky@mwhglobal.com

Workorder: **34-1423004**
Project ID: 10505409.010102 FMC
Purchase Order: 10505409.010102

| Client Sample ID | Lab ID | Collect Date | Receive Date | Sampling Site |
|---|---|---|---|---|
| FMC Step 4 FeCl3 80M, | 1423004001 | 08/13/14 | 08/14/14 | FMC Hydro Study |
| FMC Step 4 FeCl3 80M,S4 Solids | 1423004002 | 08/13/14 | 08/14/14 | FMC Hydro Study |

# ANALYTICAL REPORT

**Workorder:** 34-1423004
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

| | | | | | |
|---|---|---|---|---|---|
| Sample ID: | FMC Step 4 FeCl3 80M, | Sampling Site: | FMC Hydro Study | Collected: | 08/13/2014 |
| Lab ID: | 1423004001 | Media: | 125 mL Nalgene | Received: | 08/14/2014 |
| Matrix: | Water | Sampling Parameter: | NA | | |

### Analysis Method - EPA 300.0/SW 9056

**Preparation:** Not Applicable
**Analysis:** EPA 300.0/SW 9056, Water
**Batch:** EIC/1489 (HBN: 133607)
**Analyzed:** 08/14/2014 19:27
**Instrument ID:** IC01
**Percent Solid:** NA
**Report Basis:** Wet

| Analyte | mg/L | MDL (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Chloride | **250** | 3.0 | 10 | 100 | |
| Sulfate | **230** | 3.0 | 10 | 100 | |

### Analysis Method - EPA 300.0/SW 9056

**Preparation:** Not Applicable
**Analysis:** EPA 300.0/SW 9056, Water
**Batch:** EIC/1489 (HBN: 133607)
**Analyzed:** 08/14/2014 20:59
**Instrument ID:** IC01
**Percent Solid:** NA
**Report Basis:** Wet

| Analyte | mg/L | MDL (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Fluoride | ND | 0.30 | 1.0 | 10 | U |
| Nitrate Ion | **46** | 0.30 | 1.0 | 10 | |
| Nitrate-N | **10** | 0.068 | 0.23 | 10 | |

### Analysis Method - EPA 335.4

**Preparation:** Not Applicable
**Analysis:** EPA 335.4 w/ Micro Dist, Water
**Batch:** EWC/5248 (HBN: 133562)
**Analyzed:** 08/26/2014 18:07
**Instrument ID:** WET01
**Percent Solid:** NA
**Report Basis:** Wet

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Cyanide | **23.4** | 5.0 | 10 | 1 | |

### Analysis Method - EPA 350.1

**Preparation:** Not Applicable
**Analysis:** EPA 350.1, Water
**Batch:** EWC/5229 (HBN: 133093)
**Analyzed:** 08/20/2014 19:15
**Instrument ID:** WET01
**Percent Solid:** NA
**Report Basis:** Wet

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Ammonia as Nitrogen | **340** | 23 | 50 | 1 | |

### Analysis Method - SW 6020

**Preparation:** EPA 3010, SW 6020 Water Prep
**Batch:** EMS/3853 (HBN: 133034)
**Prepared:** 08/20/2014
**Weight/Volume**
**Initial:** 50 mL
**Final:** 50 mL
**Analysis:** SW 6020A, Water
**Batch:** EMS/3866 (HBN: 133670)
**Analyzed:** 08/26/2014 16:38
**Instrument ID:** ICPM02
**Percent Solid:** NA
**Report Basis:** Wet

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | **4.6** | 0.15 | 1.0 | 1 | |
| Cadmium | ND | 0.15 | 1.0 | 1 | U |
| Copper | **3.4** | 0.60 | 2.0 | 1 | |
| Nickel | **27** | 0.15 | 1.0 | 1 | |
| Lead | ND | 0.45 | 1.0 | 1 | U |
| Selenium | **14** | 0.75 | 5.0 | 1 | |
| Silver | ND | 0.33 | 1.0 | 1 | U |
| Zinc | **12** | 1.7 | 2.0 | 1 | |
| Potassium | **85000** | 15 | 50 | 1 | |
| Phosphorus | **350** | NA | 50 | 1 | |

**Results Continued on Next Page**

# ANALYTICAL REPORT

**Workorder:** 34-1423004
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## Analytical Results

Sample ID: **FMC Step 4 FeCl3 80M,** | Sampling Site: FMC Hydro Study | Collected: 08/13/2014
Lab ID: 1423004001 | Media: 1000 mL Nalgene | Received: 08/14/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 7470**

| | | | |
|---|---|---|---|
| **Preparation:** SW 7470A, Water Prep | **Weight/Volume** | **Analysis:** SW 7470A, Water | **Instrument ID:** AACV02 |
| **Batch:** EHG/5508 (HBN: 133684) | **Initial:** 50 mL | **Batch:** EHG/5510 (HBN: 133804) | **Percent Solid:** NA |
| **Prepared:** 08/28/2014 | **Final:** 50 mL | **Analyzed:** 08/29/2014 11:00 | **Report Basis:** Wet |

| Analyte | ug/L | MDL (ug/L) | RL (ug/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Mercury | 0.068 | 0.036 | 0.10 | 1 | J |

Sample ID: **FMC Step 4 FeCl3 80M,S4 Solids** | Sampling Site: FMC Hydro Study | Collected: 08/13/2014
Lab ID: 1423004002 | Media: 4 oz Amber Glass Jar | Received: 08/14/2014
Matrix: Water | Sampling Parameter: NA

**Analysis Method - SW 6010C**

| | | | |
|---|---|---|---|
| **Preparation:** EPA 3010 SPLP/TCLP, Prep | **Weight/Volume** | **Analysis:** SW 6010C SPLP/TCLP, Water | **Instrument ID:** ICP08 |
| **Batch:** EIPX/5055 (HBN: 133266) | **Initial:** 50 mL | **Batch:** EICP/4669 (HBN: 133554) | **Percent Solid:** NA |
| **Prepared:** 08/22/2014 | **Final:** 50 mL | **Analyzed:** 08/26/2014 12:55 | **Report Basis:** Wet |

| Analyte | mg/L | Reg. Limit (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Arsenic | ND | 5.0 | 0.30 | 1 | |
| Barium | 0.199 | 100 | 0.020 | 1 | |
| Cadmium | ND | 1.0 | 0.010 | 1 | |
| Chromium | ND | 5.0 | 0.020 | 1 | |
| Lead | ND | 5.0 | 0.10 | 1 | |
| Selenium | ND | 1.0 | 0.30 | 1 | |
| Silver | ND | 5.0 | 0.020 | 1 | |

**Analysis Method - SW 7470**

| | | | |
|---|---|---|---|
| **Preparation:** SW 7470A SPLP/TCLP, Water Prep | **Weight/Volume** | **Analysis:** SW 7470A SPLP/TCLP, Water | **Instrument ID:** AACV02 |
| **Batch:** EHG/5509 (HBN: 133725) | **Initial:** 25 mL | **Batch:** EHG/5511 (HBN: 133806) | **Percent Solid:** NA |
| **Prepared:** 08/28/2014 | **Final:** 50 mL | **Analyzed:** 08/29/2014 11:15 | **Report Basis:** Wet |

| Analyte | mg/L | Reg. Limit (mg/L) | RL (mg/L) | Dilution | Qual. |
|---|---|---|---|---|---|
| Mercury | ND | 0.20 | 0.00020 | 1 | |

## Comments

**Quality Control: SW 7470 - (HBN: 133804)**

Mercury recoveries in the matrix spike and post digestion spike indicate matrix effects are present.

**Quality Control: SW 7470 - (HBN: 133806)**

TCLP extracts for mercury analysis were diluted 2-fold prior to sample digestion by taking 25mL initial sample volume to 50mL final volume with ASTM Type II water. This was done in order to reduce potential matrix effects. The reporting limit was also raised by the dilution factor.

# ANALYTICAL REPORT

**Workorder:** 34-1423004
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

**Report Authorization** (/S/ is an electronic signature that complies with 21 CFR Part 11)

| Method | Analyst | Peer Review |
|---|---|---|
| **EPA 300.0/SW 9056** | /S/ Thomas T. McKay<br>08/27/2014 11:08 | /S/ Thomas Bosch<br>08/27/2014 11:08 |
| **EPA 335.4** | /S/ Christopher R. Hansen<br>08/27/2014 08:08 | /S/ Whitney Redd<br>08/28/2014 14:08 |
| **EPA 350.1** | /S/ Brittney Austin<br>08/21/2014 08:08 | /S/ Whitney Redd<br>08/21/2014 11:08 |
| **SW 6010C** | /S/ Neil A. Edwards<br>08/27/2014 12:08 | /S/ Whitney Redd<br>08/28/2014 14:08 |
| **SW 6020** | /S/ John T Kershisnik<br>08/27/2014 14:08 | /S/ Kristie F. Bitner<br>08/27/2014 16:08 |
| **SW 7470** | /S/ Christopher R. Hansen<br>08/29/2014 13:08 | /S/ Kristie F. Bitner<br>09/02/2014 11:09 |
| **SW 7470** | /S/ Christopher R. Hansen<br>08/29/2014 13:08 | /S/ Neil A. Edwards<br>08/29/2014 14:08 |

## Laboratory Contact Information

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# ANALYTICAL REPORT

**Workorder:** 34-1423004
**Client:** MWH
**Project Manager:** Kevin W. Griffiths

## General Lab Comments

The results provided in this report relate only to the items tested.
Samples were received in acceptable condition unless otherwise noted.
Samples have not been blank corrected unless otherwise noted.
This test report shall not be reproduced, except in full, without written approval of ALS.

ALS provides professional analytical services for all samples submitted. ALS is not in a position to interpret the data and assumes no responsibility for the quality of the samples submitted.

All quality control samples processed with the samples in this report yielded acceptable results unless otherwise noted.

ALS is accredited for specific fields of testing (scopes) in the following testing sectors. The quality system implemented at ALS conforms to accreditation requirements and is applied to all analytical testing performed by ALS. The following table lists testing sector, accreditation body, accreditation number and website. Please contact these accrediting bodies or your ALS project manager for the current scope of accreditation that applies to your analytical testing.

| Testing Sector | Accreditation Body (Standard) | Certificate Number | Website |
|---|---|---|---|
| Environmental | ACLASS (DoD ELAP) | ADE-1420 | http://www.aclasscorp.com |
| | Utah (NELAC) | DATA1 | http://health.utah.gov/lab/labimp/ |
| | Nevada | UT00009 | http://ndep.nv.gov/bsdw/labservice.htm |
| | Oklahoma | UT00009 | http://www.deq.state.ok.us/CSDnew/ |
| | Iowa | IA# 376 | http://www.iowadnr.gov/InsideDNR/RegulatoryWater.aspx |
| | Florida (TNI) | E871067 | http://www.dep.state.fl.us/labs/bars/sas/qa/ |
| | Texas (TNI) | T104704456-11-1 | http://www.tceq.texas.gov/field/qa/lab_accred_certif.html |
| Industrial Hygiene | AIHA (ISO 17025 & AIHA IHLAP/ELLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Lead Testing: | | | |
| CPSC | ACLASS (ISO 17025, CPSC) | ADE-1420 | http://www.aclasscorp.com |
| Soil, Dust, Paint ,Air | AIHA (ISO 17025, AIHA ELLAP and NLLAP) | 101574 | http://www.aihaaccreditedlabs.org |
| Dietary Supplements | ACLASS (ISO 17025) | ADE-1420 | http://www.aclasscorp.com |

## Result Symbol Definitions

MDL = Method Detection Limit, a statistical estimate of method/media/instrument sensitivity.
RL = Reporting Limit, a verified value of method/media/instrument sensitivity.
CRDL = Contract Required Detection Limit
Reg. Limit = Regulatory Limit.
ND = Not Detected, testing result not detected above the MDL or RL.
< This testing result is less than the numerical value.
** No result could be reported, see sample comments for details.

## Qualifier Symbol Definitions

U = Qualifier indicates that the analyte was not detected above the MDL.
J = Qualifier Indicates that the analyte value is between the MDL and the RL. It is also used to indicate an estimated value for tentatively identified compounds in mass spectrometry where a 1:1 response is assumed.
B = Qualifier indicates that the analyte was detected in the blank.
E = Qualifier indicates that the analyte result exceeds calibration range.
P = Qualifier indicates that the RPD between the two columns is greater than 40%.

# Attachment E

# Parsons Technical Memorandum

PARSONS

301 Plainfield Road, Suite 350, Syracuse, New York 13212 • (315) 451-9560 • Fax (315) 451-9570 • www.parsons.com

# TECHNICAL MEMORANDUM

October 6, 2014

To: Michael Steiner; FMC

From: Jamie Fettig and Ted Schoenberg; Parsons

Subject: FMC Pocatello Treatability Testing Results

## 1.0 SUMMARY

Parsons performed a groundwater treatability study for the FMC facility in Pocatello, Idaho in accordance with our June 12, 2014 work plan and in parallel with similar testing conducted by MWH. The treatability study focused on evaluating chemical precipitation as a means to treat arsenic (As) and phosphorous (P) to below their respective treatment targets of 10 µg/L and 0.3 mg/L.

Testing was conducted in the Parsons Treatability Laboratory in Syracuse, New York. The test groundwater sample was collected during an on-site pump test in June 2014 and received by Parsons on June 20th, 2014.

The treatability study consisted of the following tests:

1. Alkalinity and acidity titrations
2. Chemical precipitation jar testing
3. Toxicity Characteristic Leaching Procedure (TCLP) analysis

The following summarizes the major findings and conclusions from the study:

- The groundwater exhibited low-to-moderate buffering with an alkalinity of 330 mg/L as $CaCO_3$.
- Ferric chloride ($FeCl_3$) was effective as a coagulant for treating both arsenic and phosphorus to below their treatment targets.
  - An $FeCl_3$ dose as low as 20 mg Fe/L reduced both arsenic and phosphorus to below the treatment targets of 10 µg/L and 0.3 mg/L, respectively. Additional reductions in both parameters were observed at progressively higher doses. Based on this performance, the optimum $FeCl_3$ dose for achieving target removals of both arsenic and phosphorus with a reasonable margin of safety was 20 – 40 mg Fe/L.

- Testing at pH 7.5 provided better removals than at pH 9.0. This pH coincides with the minimum solubility of ferric hydroxide ($Fe(OH)_3$), which forms from $FeCl_3$ addition and which co-precipitates arsenic and phosphorus. This results in lower chemical requirements since the pH of the water drops below 7.5 upon addition of $FeCl_3$, requiring only minimal caustic to re-adjust the pH to 7.5.
- Addition of anionic polymer at 1 mg/L improved removal compared to the absence of polymer, and was also more effective than filtration at 1.5 µm nominal pore size.

- Supernatant solids concentrations following $FeCl_3$ and anionic polymer treatments were negligible with effluent TSS only marginally detectable.
- Sludge generated during treatment at 40 mg Fe/L plus 1 mg/L polymer settled to approximately 1.2% of the original treated volume. The dry solids produced would be approximately 835 lb dry solids per million gallons (MG) treated. The following summarizes the sludge quantities at different stages of solids management per MG treated:
  - Thin (settled) sludge in reactor: 12,000 gallons @ 0.8% solids
  - Gravity-thickened to nominal 3% dry solids: 3,200 gallons
  - Dewatered to nominal 20% dry solids: 2.0 Tons
- The sludge generated during treatment was below toxicity characteristic thresholds for RCRA 8 metals.

## 2.0 INTRODUCTION

FMC is evaluating on-site treatment followed by discharge to an evaporation/infiltration basin as a management option for groundwater extracted on-site. Parsons is working with FMC to assess the treatment of target parameters using conventional chemical precipitation, which is being concurrently tested by MWH under the auspices of the Environmental Protection Agency (EPA). Parsons testing is being conducted in parallel with MWH testing and to assist with overall process development that could potentially contribute to the design basis of an on-site treatment system.

This memorandum presents the results of testing conducted by Parsons on the treatment of the primary target parameters as determined from initial characterization.

## 3.0 INITIAL SAMPLING AND CHARACTERIZATION

Parsons received two 5-gallon plastic containers of ground water from the FMC Pocatello site that was collected during a pumping test in June 2014. Samples from the bulk groundwater sample volume were sent to Pace Analytical Services, Minneapolis, MN for initial

characterization. The initial characterization results are shown in Table 1. These results demonstrated that only arsenic and phosphorus were parameters to be targeted during treatability testing.

**Table 1: Initial Groundwater Sample Characterization**

| Parameter | Concentration | Units |
|---|---|---|
| Antimony | 0.25 | µg/L |
| Arsenic | 53.8 | µg/L |
| Beryllium | ND | µg/L |
| Cadmium | 0.065 | µg/L |
| Chromium | 0.62 | µg/L |
| Chromium$^{(VI)}$ | ND | mg/L |
| Copper | 3.2 | µg/L |
| Lead | 0.34 | µg/L |
| Nickel | 3.2 | µg/L |
| Selenium | 15.0 | µg/L |
| Silver | ND | µg/L |
| Thallium | 0.17 | µg/L |
| Zinc | 45.8 | µg/L |
| Mercury | ND | µg/L |
| Total P | 3.6 | mg/L |
| Ortho P | 3.0 | mg/L |
| Toluene | 0.15 | µg/L |
| Trichloroethene | 0.46 | µg/L |

The remaining water from the 10 gallon sample volume received was used for treatability tests at the Parsons Treatability Laboratory. The groundwater containers were stored refrigerated at 4°C until used in testing.

## 4.0 TITRATIONS

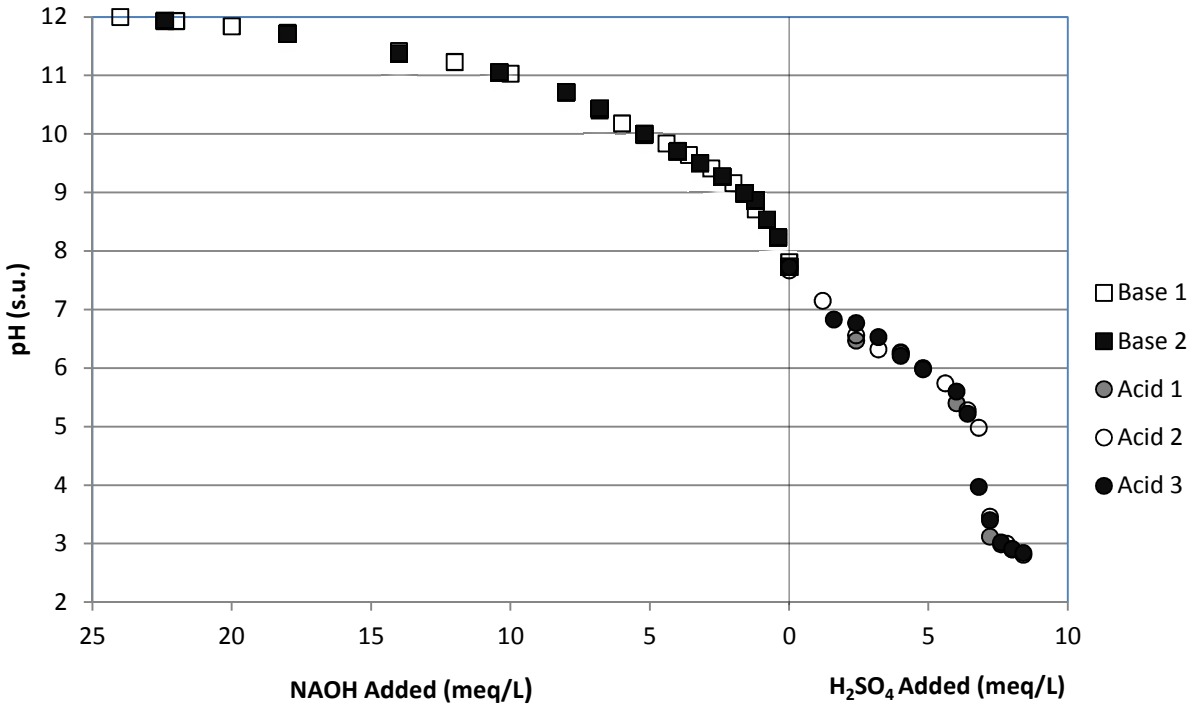
Acid (alkalinity) titrations were performed in accordance with Standard Methods 2320B using 1.0N sulfuric acid as the titrant and 250mL aliquots of groundwater sample. The stabilized pH was read after each incremental addition of acid using an Orion Dual-Star bench-top pH meter and multi-element probe. This was repeated until an endpoint of approximately 3 s.u. was

attained. The acid titrations were carried out in triplicate. Alkalinity was calculated using the acid consumption at an endpoint of pH 4.5 s.u.

Base (acidity) titrations were performed similarly to the previously described acid titrations in accordance with Standard Methods 2310B using 1.0 N sodium hydroxide (NaOH) to a pH endpoint of approximately 12 s.u. The base titrations were carried out in duplicate. Acidity was calculated using the caustic consumption at an endpoint of 9.7 s.u.

The titration results were used to generate the titration curve shown in Figure 1.

***Figure 1: Acid-Base Titration Curve***




The results show moderate buffering between pH 5 - 7 but relatively low buffering between pH 7 - 8. The alkalinity based on the titration results was 330 mg/L as $CaCO_3$ based on the average calculated from the three triplicate acid titrations. The calculated acidity was approximately 200 mg/L as $CaCO_3$ based on the average calculated from the duplicate base titrations.

## 5.0 CHEMICAL PRECIPITATION JAR TESTING

All chemical precipitation jar tests were performing using ferric chloride (FeCl3) as the coagulant. The following sets of jar tests were performed:

- Range-finding tests; and
- Optimization tests.

Jar tests were performed with 800 mL sample aliquots (range-finding tests) and 1,500 mL aliquots (optimization tests). Mixing was accomplished using a Phipps & Bird six-place gang stirrer. The general test protocol included the following mixing phases:

- Chemical augmentation and pH adjustment during sample agitation (100 rpm)
- 1 minute rapid mix phase (200 rpm)
- 5 minute slow flocculation phase (50 rpm)
- 5 minute slow flocculation phase (30 rpm)
- 5 minute slow flocculation phase (10 rpm)
- 30 minute settling phase

During the flocculation and settling phases, visual observations regarding floc structure, settling, turbidity and other pertinent factors were recorded. Photographs of select treatment were also taken. Once the settling phase was completed, supernatant from the control sample and other test samples were decanted, using care not to disturb the settled sludge. The decanted supernatant was transferred to the appropriate sample bottles for analysis of the following parameters:

- Total arsenic;
- Total phosphorus; and
- Total suspended solids

Total arsenic and total phosphorus samples were shipped to Pace Analytical Services, Minneapolis, MN for analysis. Total suspended solids analyses were performed at Parsons Treatability Laboratory, Syracuse. The specific test conditions applied for each set of jar test experiments are described in the following sections.

## 5.1 Range-Finding Chemical Precipitation Jar Tests

***Test Conditions***

Range-finding jar tests were performed at a range of doses from 0 – 80 mg Fe/L at two different pH values:

- Test 1A: pH 7.5
- Test 1B: pH 9.0

The pH in each jar was adjusted using 1N sodium hydroxide (NaOH) following $FeCl_3$ dosing. Each jar for the range-finding tests was also dosed with 1.0 mg/L anionic polymer (KemTron KAN-FLOC 500). A summary of the jar test conditions is presented in Table 2.

***Table 2: Summary of Test Parameters – Jar Test #1***

| Test #1A | | | |
|---|---|---|---|
| **Jar #** | **$FeCl_3$ Dose (mg Fe/L)** | **Target pH** | **Polymer Dose (mg/L)** |
| 1 | 0[(1)] | 7.5 | 1.0 |
| 2 | 10 | | |
| 3 | 20 | | |
| 4 | 40 | | |
| 5 | 80 | | |
| **Test #1B** | | | |
| 1 | 0[(1)] | 9.0 | 1.0 |
| 2 | 10 | | |
| 3 | 20 | | |
| 4 | 40 | | |
| 5 | 80 | | |

[(1)] Undosed control (pH adjustment only)

***Test Results***

Following settling, the sample jars were decanted and the supernatant sent to Pace Analytical for total arsenic and total phosphorus analysis. Total arsenic results are presented in Figure 2, while total phosphorus results are presented in Figure 3. Total suspended solids results are presented in Table 3 (pH 7.5).

***Figure 2: Arsenic Concentrations vs. $FeCl_3$ Dose***

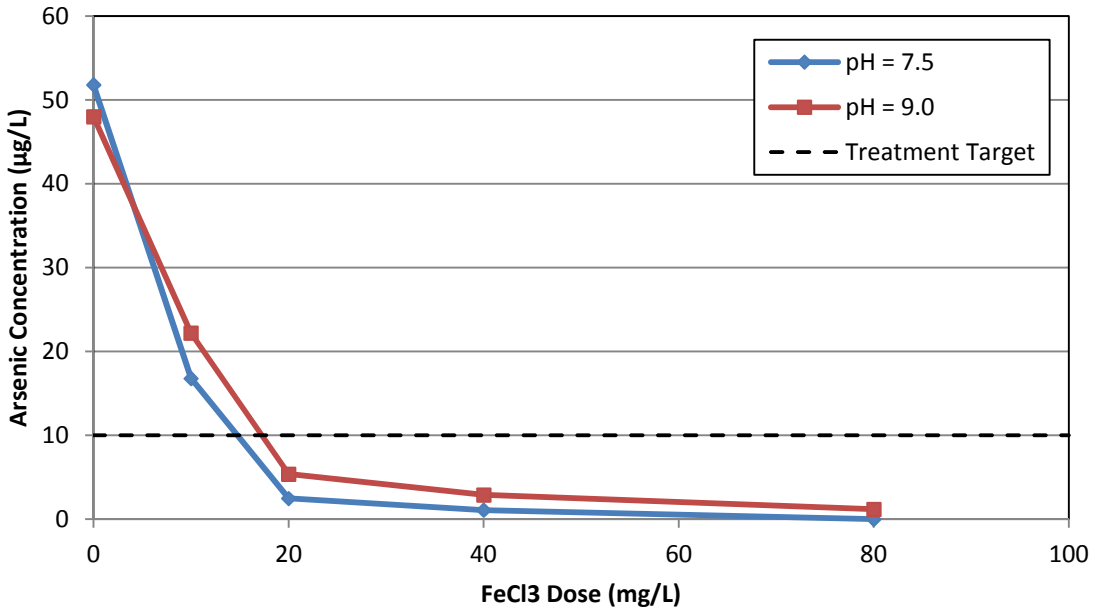



***Figure 3: Total Phosphorus vs. $FeCl_3$ Dose***

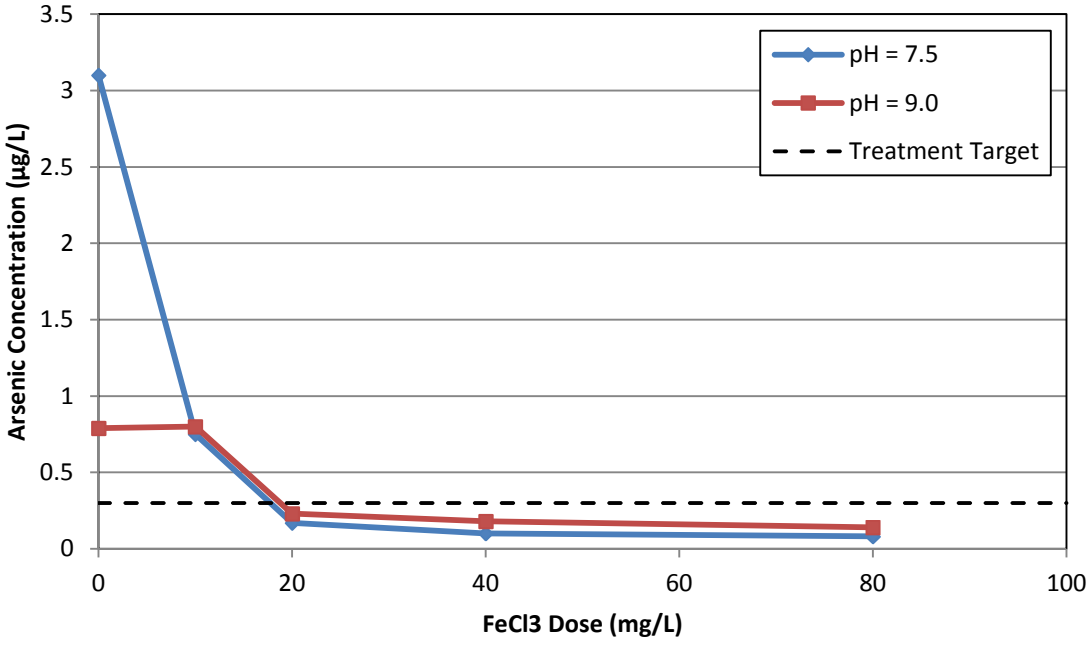


***Table 3: Supernatant TSS[(1)]***

| $FeCl_3$ Dose (mg Fe/L) | pH | TSS (mg/L)[(2)] |
|---|---|---|
| 0 | 7.5 | < 1.0 |
| | 9.0 | 1.7 |
| 10 | 7.5 | 2.7 |
| | 9.0 | < 1.0 |
| 20 | 7.5 | 1.3 |
| | 9.0 | < 1.0 |
| 40 | 7.5 | < 1.0 |
| | 9.0 | < 1.0 |
| 80 | 7.5 | 3.3 |
| | 9.0 | < 1.0 |

(1) All with 1 mg/L anionic polymer
(2) Average of two test jars

The following summarize the major findings from the range-finding tests based on these results:

- $FeCl_3$ dosed at 20 mg Fe/L and higher combined with anionic polymer dosed at 1 mg/L reduced the arsenic concentration to below the treatment target of 10 µg/L.
- $FeCl_3$ at 20 mg Fe/L plus anionic polymer at 1 mg/L also lowered total phosphorus to below the treatment target of 0.3 mg/L. The pH 9.0 control (no $FeCl_3$) may have removed phosphorus similarly to 10 mg/L unless this represents analytical error; but this was still higher than the treatment target of 0.3 mg/L.
- Additional removals of both arsenic and phosphorus were observed at progressively higher $FeCl_3$ doses.
- Removal of both arsenic and phosphorus was slightly more effective at pH 7.5 than 9.0. The addition of $FeCl_3$ to the sample water lowered the pH to below 7.5 in all tests; therefore, less caustic addition is required to reach a target ph of 7.5 than target pH of 9.0.
- TSS concentrations were negligible (all < 5 mg/L)

## 5.2 Optimization Chemical Precipitation Jar Test

The purpose of the optimization jar tests was to verify the optimal dose and also determine the separate effects of polymer addition and filtration on arsenic and total phosphorus removal.

### *Test Conditions*

Optimization jar tests were performed at pH 7.5 using $FeCl_3$ doses of 40, 80, and 120 mg Fe/L. Two jars were set up at each dose: (1) 1 mg/L anionic polymer, and (2) no polymer addition. Following $FeCl_3$ addition, the pH of each jar was readjusted to the target pH of 7.5 using 1N NaOH. A summary of the test parameters is shown in Table 4.

***Table 4: Summary of Test Parameters – Jar Test #2***

| Jar # | $FeCl_3$ Dose (mg/L) | Polymer Dose (mg/L) |
|---|---|---|
| 1 | 40 | 1.0 |
| 2 | | None |
| 3 | 80 | 1.0 |
| 4 | | None |
| 5 | 120 | 1 |
| 6 | | None |

Furthermore, the supernatant from the non-polymer amended jars was split into filtered and non-filtered fractions. The filtered fractions were filtered through Whatman® 934-AH glass fiber filters with a nominal pore size of 1.5 µm. The following summarizes the overall test comparisons:

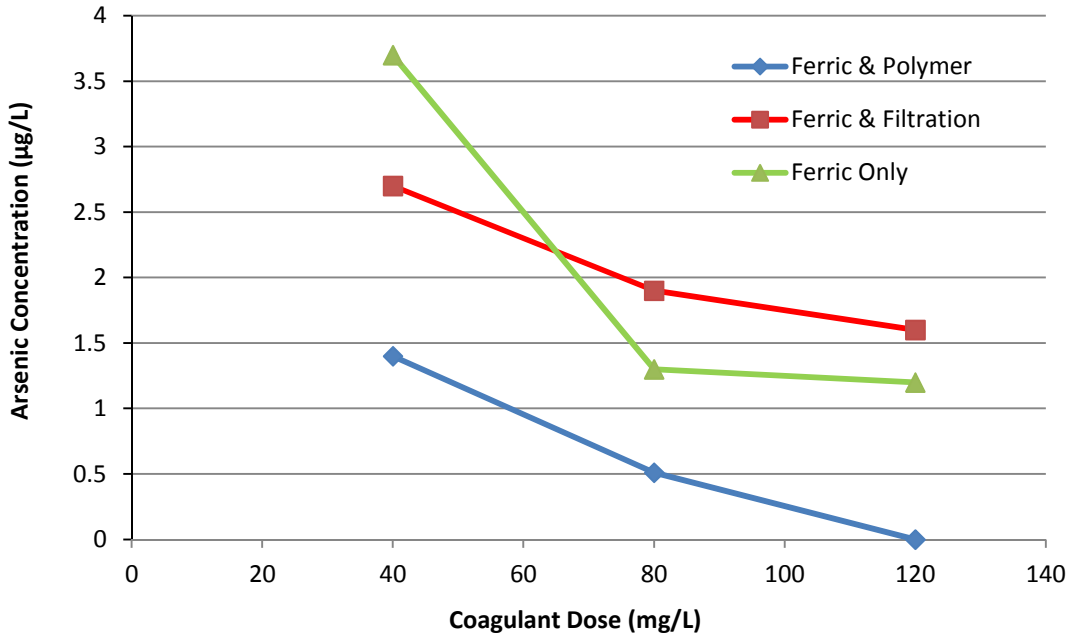
- $FeCl_3$ only
- FeCl3 + Filtration
- $FeCl_3$ + Polymer (no filtration)

The use of 1.5 um filters was an additional range-finding measure in that, if filtration at 1.5 um were to significantly improve removal of target parameters compared to no filtration as well as polymer, then an optimal filtration pore size would be evaluated.

### *Test Results*

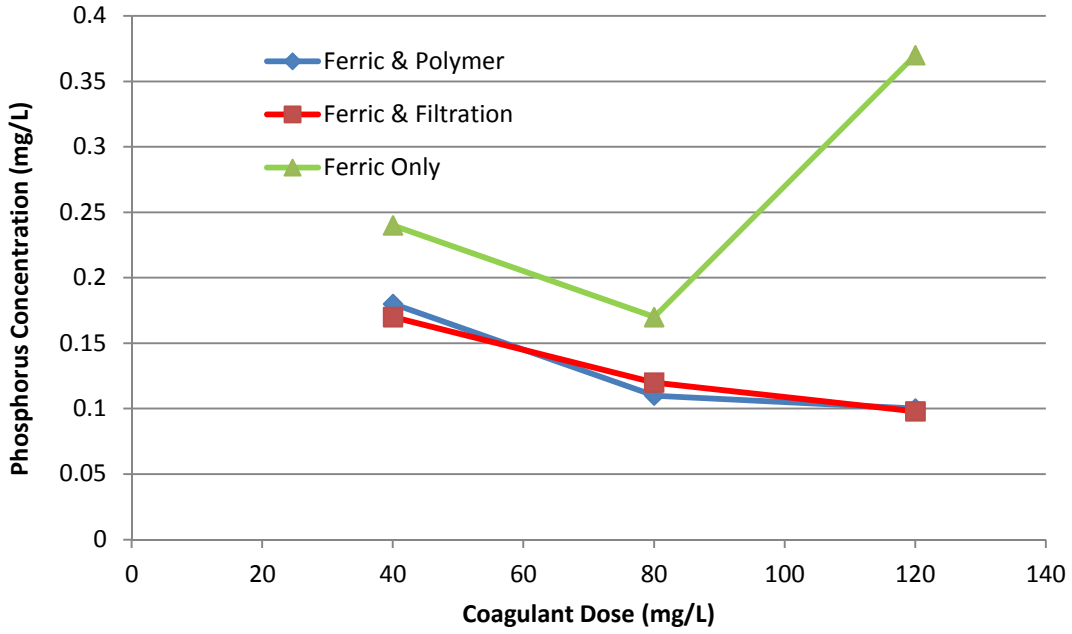
Filtered and non-filtered (polymer; no polymer) supernatant samples were sent to Pace Analytical Services, Minneapolis, MN for total arsenic and total phosphorus analysis. In addition, fluoride analysis was performed as an analytical check for 0 and 80 mg Fe/L doses amended with 1 mg/L anionic polymer. The results for total arsenic and total phosphorus are summarized in Figure 4 and Figure 5, respectively.

***Figure 4: Optimization Test Results for Arsenic (pH 7.5)*** [(1)]




[(1)] Values displayed as 0 µg/L on the graph were below the reporting limit of 0.5 µg/L.

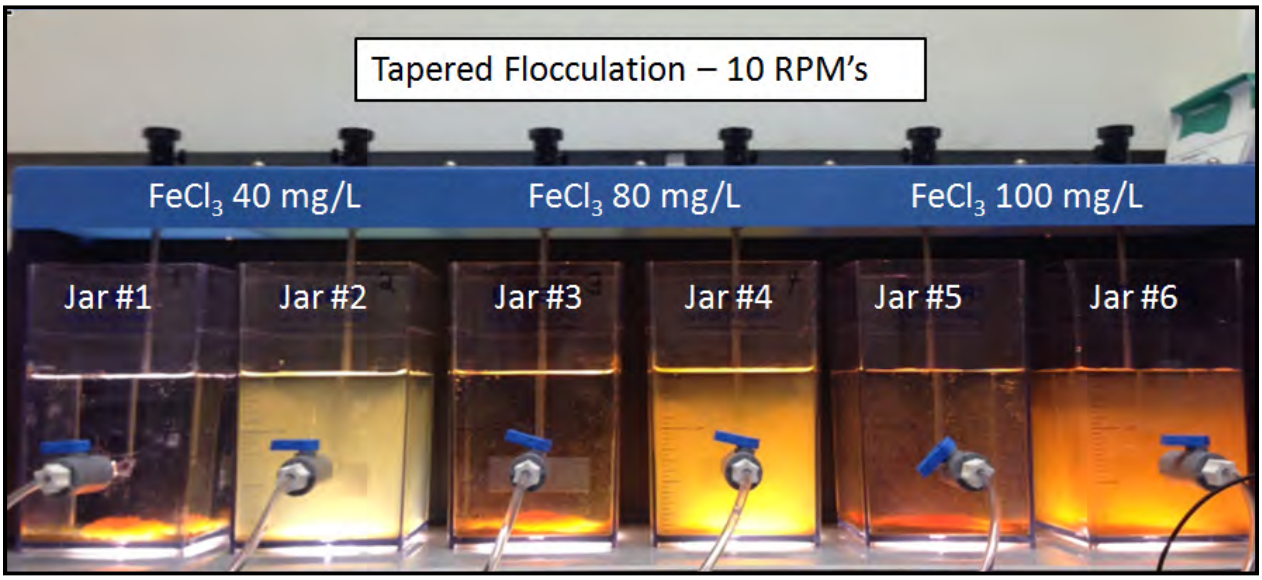
***Figure 5: Optimization Test Results for Phosphorus (pH 7.5)***



The following summarize the major findings from the optimization tests based on these results:

- A majority of arsenic was removed at 40 mg Fe/L, with additional removal at 80 mg Fe/L and 120 mg Fe/L.
- $FeCl_3$ with polymer provided the best treatment performance for arsenic. Filtration did not appreciably improve arsenic removal compared to settling alone.
- $FeCl_3$ followed by settling and filtration did provide noticeably better phosphorus removal compared to settling alone. $FeCl_3$ with polymer provided equally good performance upon settling.
- Polymer addition noticeably decreased solids settling time, final settled (thin sludge) volume, and turbidity. This is most effectively illustrated in the photograph provided in Figure 6.

***Figure 6: Settling Comparison – Polymer vs. No Polymer***




- At 40 mg Fe/L and pH 7.5, the final settled sludge volume was as follows:
  - With 1 mg/L anionic polymer: 1.2% of original treated volume
  - Without polymer: 6.7% of original treated volume
- The fluoride concentration at both 0 and 80 mg Fe/L doses was 0.19 mg/L. This parameter was not expected to change and as such demonstrated consistent laboratory

analytical performance. This fluoride concentration assumed to pose no concern for the site and was not considered further.

Overall, the optimum bench-scale treatment conditions taking settling characteristics into account were 20 - 40 mg Fe/L plus 1 mg/L anionic polymer. At 40 mg Fe/L, approximately 0.10 g of dry solids was generated per liter. Scaling to full-scale treatment, approximately 830 lb dry solids would be generated per MG of groundwater treated, and 12,000 gallons of thin (settled) sludge from the reaction vessel would be produced per MG at 0.8% solids thickness.

## 6.0 SLUDGE CHARACTERISTIC TOXICITY ANALYSIS

A toxicity characteristic leach procedure (TCLP) analysis for "RCRA 8" metals was conducted on sludge generated at the optimum test conditions. Sludge for the TCLP test was prepared by treating an approximately 2 gallon batch of groundwater sample at 80 mg Fe/L and 1 mg/L anionic polymer. Settled and gravity-thickened sludge was sent to Pace Analytical for further processing, application of the TCLP procedure, and analysis of the resulting leachate for RCRA 8 metals. The TCLP results are presented in Table 5.

***Table 5: TCLP Analytical Results***

| Parameter | TCLP Concentration | Units |
|---|---|---|
| Arsenic | ND | mg/L |
| Barium | 0.58 | mg/L |
| Cadmium | ND | mg/L |
| Chromium | ND | mg/L |
| Lead | ND | mg/L |
| Selenium | ND | mg/L |
| Silver | ND | mg/L |
| Mercury | ND | µg/L |

Based on the results from the TCLP analysis, the sludge generated at the optimum test conditions would be considered non-hazardous for disposal purposes.

## 7.0 CONCLUSIONS

The following conclusions have been developed based on the results of bench-scale testing of groundwater sample at the Parsons Syracuse Treatability Laboratory:

1. $FeCl_3$ was effective at treating for both arsenic and total phosphorus

2. The optimum pH for chemical precipitation was 7.5 for both effectiveness and for reducing chemical addition (caustic) requirements to achieve the treatment pH value.

3. An $FeCl_3$ dose as low as 20 mg Fe/L reduced both arsenic and phosphorus to below the treatment targets of 10 µg/L and 0.3 mg/L, respectively. Additional reductions in both parameters were observed at progressively higher doses. Based on this performance, the optimum $FeCl_3$ dose for achieving target removals of both arsenic and phosphorus with a reasonable margin of safety was 20 – 40 mg Fe/L.

4. Polymer provided the best overall performance for removal of arsenic and phosphorus as well as for enhancing solids settling.

    - Filtration was less effective overall particularly for arsenic removal compared to settling alone.

    - Filtration following polymer would appear to be unnecessary for removing additional arsenic and phosphorus, and also because TSS concentrations in decanted liquid from treatment with $FeCl_3$ plus polymer were negligible.

5. Sludge generated during treatment at 40 mg Fe/L plus 1 mg/L polymer settled to 1.2% of the original treated volume. The dry solids produced would be approximately 830 lb dry solids per one million gallons treated. The following summarizes the sludge quantities per one million gallons groundwater treated at different stages of solids management:

    - Thin (settled) sludge in reactor: 12,000 gallons @ 0.8% solids

    - Gravity-thickened to nominal 3% dry solids: 3,200 gallons

    - Dewatered to nominal 20% dry solids: 2.0 Tons

6. The sludge generated during treatment was below toxicity characteristic thresholds for RCRA 8 metals.

* * *

Parsons appreciates the opportunity to provide continued services to FMC on this project. If you have any questions regarding this memorandum, please do not hesitate to contact us at (315) 451-9560.

# Attachment A

# PACE ANALYTICAL RESULTS

**Pace Analytical Services, Inc.**
150 N Ninth Street
Billings, MT 59101
(406)254-7226

July 09, 2014

Mohan Nayak
Parsons
301 Plainfield Rd
STE 350
Syracuse, NY 13212

RE: Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

Dear Mohan Nayak:
Enclosed are the analytical results for sample(s) received by the laboratory on June 27, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kabor Xiong

Kabor Xiong
kabor.xiong@pacelabs.com
Project Manager

Enclosures

cc: Ted Schoenberg, Parsons



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# CERTIFICATIONS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Minnesota Certification IDs**
1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alabama Certification #40770
Alabama Certification #40770
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: 8TMS-L
Florida/NELAP Certification #: E87605
Guam Certification #: Pace
Georgia Certification #: 959
Idaho Certification #: MN00064
Hawaii Certification #MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Kentucky Dept of Envi. Protection - WW #:90062
Louisiana DEQ Certification #: 3086
Louisiana DHH #: LA140001
Maine Certification #: 2013011
Maryland Certification #: 322
Michigan DEPH Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT0092
Nebraska Certification #: Pace
New Jersey Certification #: MN-002
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Carolina State Public Health #: 27700
North Dakota Certification #: R-036
Ohio EPA #: 4150
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Saipan (CNMI) #:MP0003
South Carolina #:74003001
Texas Certification #: T104704192
Tennessee Certification #: 02818
Utah Certification #: MN000642013-4
Virginia DGS Certification #: 251
Virginia/VELAP Certification #: Pace
Washington Certification #: C486
Wisconsin Certification #: 999407970
West Virginia Certification #: 382
West Virginia TO-15 Approval
West Virginia DHHR #:9952C



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## SAMPLE SUMMARY

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

| Lab ID | Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| **10272245001** | **FMC POCATELLO** | Water | 06/26/14 17:45 | 06/27/14 10:00 |
| **10272245002** | **TRIP BLANK** | Water | 06/26/14 00:00 | 06/27/14 10:00 |



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## SAMPLE ANALYTE COUNT

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

| Lab ID | Sample ID | Method | Analysts | Analytes Reported | Laboratory |
|---|---|---|---|---|---|
| **10272245001** | **FMC POCATELLO** | EPA 6020 | TT3 | 12 | PASI-M |
| | | EPA 245.1 | WBS | 1 | PASI-M |
| | | EPA 8260 | LPM | 70 | PASI-M |
| | | SM 3500-Cr D Modified | KEO | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| | | SM 4500-P E | KEO | 1 | PASI-M |
| **10272245002** | **TRIP BLANK** | EPA 8260 | LPM | 70 | PASI-M |



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **EPA 6020**
**Description:** 6020 MET ICPMS
**Client:** FMC
**Date:** July 09, 2014

**General Information:**
1 sample was analyzed for EPA 6020. All samples were received in acceptable condition with any exceptions noted below.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Sample Preparation:**
The samples were prepared in accordance with EPA 3020 with any exceptions noted below.

**Initial Calibrations (including MS Tune as applicable):**
All criteria were within method requirements with any exceptions noted below.

**Continuing Calibration:**
All criteria were within method requirements with any exceptions noted below.

**Internal Standards:**
All internal standards were within QC limits with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

QC Batch: MPRP/47124

B: Analyte was detected in the associated method blank.

- BLANK for HBN 305560 [MPRP/471 (Lab ID: 1724275)
  - Copper

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **EPA 245.1**
**Description:** 245.1 Mercury
**Client:** FMC
**Date:** July 09, 2014

**General Information:**
1 sample was analyzed for EPA 245.1. All samples were received in acceptable condition with any exceptions noted below.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Sample Preparation:**
The samples were prepared in accordance with EPA 245.1 with any exceptions noted below.

**Initial Calibrations (including MS Tune as applicable):**
All criteria were within method requirements with any exceptions noted below.

**Continuing Calibration:**
All criteria were within method requirements with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **EPA 8260**
**Description:** 8260 VOC
**Client:** FMC
**Date:** July 09, 2014

**General Information:**
2 samples were analyzed for EPA 8260. All samples were received in acceptable condition with any exceptions noted below.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Initial Calibrations (including MS Tune as applicable):**
All criteria were within method requirements with any exceptions noted below.

**Continuing Calibration:**
All criteria were within method requirements with any exceptions noted below.

QC Batch: MSV/27635

CL: The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased low.

- BLANK (Lab ID: 1721949)
  - Bromomethane
- FMC POCATELLO (Lab ID: 10272245001)
  - Bromomethane
- LCS (Lab ID: 1721950)
  - Bromomethane
- MS (Lab ID: 1725280)
  - Bromomethane
- MSD (Lab ID: 1725281)
  - Bromomethane
- TRIP BLANK (Lab ID: 10272245002)
  - Bromomethane

**Internal Standards:**
All internal standards were within QC limits with any exceptions noted below.

**Surrogates:**
All surrogates were within QC limits with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

QC Batch: MSV/27635

B: Analyte was detected in the associated method blank.

- BLANK for HBN 305057 [MSV/2763 (Lab ID: 1721949)
  - Naphthalene

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **EPA 8260**
**Description:** 8260 VOC
**Client:** FMC
**Date:** July 09, 2014

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **SM 3500-Cr D Modified**
**Description:** Chromium, Hexavalent
**Client:** FMC
**Date:** July 09, 2014

**General Information:**
1 sample was analyzed for SM 3500-Cr D Modified. All samples were received in acceptable condition with any exceptions noted below.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Initial Calibrations (including MS Tune as applicable):**
All criteria were within method requirements with any exceptions noted below.

**Continuing Calibration:**
All criteria were within method requirements with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **SM 4500-P E**
**Description:** SM4500P-E, Total Phosphorus
**Client:** FMC
**Date:** July 09, 2014

**General Information:**
1 sample was analyzed for SM 4500-P E. All samples were received in acceptable condition with any exceptions noted below.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Sample Preparation:**
The samples were prepared in accordance with SM 4500-P B with any exceptions noted below.

**Initial Calibrations (including MS Tune as applicable):**
All criteria were within method requirements with any exceptions noted below.

**Continuing Calibration:**
All criteria were within method requirements with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**



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# PROJECT NARRATIVE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Method:** **SM 4500-P E**
**Description:** SM4500P-E, Phosphate, Ortho
**Client:** FMC
**Date:** July 09, 2014

**General Information:**
1 sample was analyzed for SM 4500-P E. All samples were received in acceptable condition with any exceptions noted below.

**Hold Time:**
The samples were analyzed within the method required hold times with any exceptions noted below.

**Initial Calibrations (including MS Tune as applicable):**
All criteria were within method requirements with any exceptions noted below.

**Continuing Calibration:**
All criteria were within method requirements with any exceptions noted below.

**Method Blank:**
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

**Laboratory Control Spike:**
All laboratory control spike compounds were within QC limits with any exceptions noted below.

**Matrix Spikes:**
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

**Additional Comments:**

This data package has been reviewed for quality and completeness and is approved for release.



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Sample: FMC POCATELLO** **Lab ID: 10272245001** Collected: 06/26/14 17:45 Received: 06/27/14 10:00 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | | |
| Antimony | **0.25J** | ug/L | 0.50 | 0.25 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-36-0 | |
| Arsenic | **53.8** | ug/L | 0.50 | 0.25 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-38-2 | |
| Beryllium | ND | ug/L | 0.20 | 0.066 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-41-7 | |
| Cadmium | **0.065J** | ug/L | 0.080 | 0.033 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-43-9 | |
| Chromium | **0.62** | ug/L | 0.50 | 0.22 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-47-3 | |
| Copper | **3.2** | ug/L | 1.0 | 0.22 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-50-8 | B |
| Lead | **0.34** | ug/L | 0.10 | 0.046 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7439-92-1 | |
| Nickel | **3.2** | ug/L | 0.50 | 0.23 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-02-0 | |
| Selenium | **15.0** | ug/L | 0.50 | 0.25 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7782-49-2 | |
| Silver | ND | ug/L | 0.50 | 0.056 | 1 | 07/03/14 10:30 | 07/03/14 22:21 | 7440-22-4 | |
| Thallium | **0.17** | ug/L | 0.10 | 0.025 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-28-0 | |
| Zinc | **45.8** | ug/L | 5.0 | 2.5 | 1 | 07/03/14 10:30 | 07/07/14 12:04 | 7440-66-6 | |
| **245.1 Mercury** | Analytical Method: EPA 245.1 Preparation Method: EPA 245.1 | | | | | | | | |
| Mercury | ND | ug/L | 0.20 | 0.026 | 1 | 07/07/14 14:07 | 07/07/14 18:35 | 7439-97-6 | |
| **8260 VOC** | Analytical Method: EPA 8260 | | | | | | | | |
| Acetone | ND | ug/L | 20.0 | 10.0 | 1 | | 07/01/14 21:37 | 67-64-1 | |
| Allyl chloride | ND | ug/L | 4.0 | 0.45 | 1 | | 07/01/14 21:37 | 107-05-1 | |
| Benzene | ND | ug/L | 1.0 | 0.15 | 1 | | 07/01/14 21:37 | 71-43-2 | |
| Bromobenzene | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 21:37 | 108-86-1 | |
| Bromochloromethane | ND | ug/L | 1.0 | 0.12 | 1 | | 07/01/14 21:37 | 74-97-5 | |
| Bromodichloromethane | ND | ug/L | 1.0 | 0.20 | 1 | | 07/01/14 21:37 | 75-27-4 | |
| Bromoform | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 21:37 | 75-25-2 | |
| Bromomethane | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 21:37 | 74-83-9 | CL |
| 2-Butanone (MEK) | ND | ug/L | 5.0 | 2.5 | 1 | | 07/01/14 21:37 | 78-93-3 | |
| n-Butylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 104-51-8 | |
| sec-Butylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 135-98-8 | |
| tert-Butylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 98-06-6 | |
| Carbon tetrachloride | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 21:37 | 56-23-5 | |
| Chlorobenzene | ND | ug/L | 1.0 | 0.066 | 1 | | 07/01/14 21:37 | 108-90-7 | |
| Chloroethane | ND | ug/L | 1.0 | 0.24 | 1 | | 07/01/14 21:37 | 75-00-3 | |
| Chloroform | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 21:37 | 67-66-3 | |
| Chloromethane | ND | ug/L | 4.0 | 0.34 | 1 | | 07/01/14 21:37 | 74-87-3 | |
| 2-Chlorotoluene | ND | ug/L | 1.0 | 0.14 | 1 | | 07/01/14 21:37 | 95-49-8 | |
| 4-Chlorotoluene | ND | ug/L | 1.0 | 0.083 | 1 | | 07/01/14 21:37 | 106-43-4 | |
| 1,2-Dibromo-3-chloropropane | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 21:37 | 96-12-8 | |
| Dibromochloromethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 124-48-1 | |
| 1,2-Dibromoethane (EDB) | ND | ug/L | 1.0 | 0.15 | 1 | | 07/01/14 21:37 | 106-93-4 | |
| Dibromomethane | ND | ug/L | 4.0 | 0.18 | 1 | | 07/01/14 21:37 | 74-95-3 | |
| 1,2-Dichlorobenzene | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 21:37 | 95-50-1 | |
| 1,3-Dichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 541-73-1 | |
| 1,4-Dichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 106-46-7 | |
| Dichlorodifluoromethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 75-71-8 | |
| 1,1-Dichloroethane | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 21:37 | 75-34-3 | |
| 1,2-Dichloroethane | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 21:37 | 107-06-2 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Sample: FMC POCATELLO** **Lab ID: 10272245001** Collected: 06/26/14 17:45 Received: 06/27/14 10:00 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **8260 VOC** | Analytical Method: EPA 8260 | | | | | | | | |
| 1,1-Dichloroethene | ND | ug/L | 1.0 | 0.20 | 1 | | 07/01/14 21:37 | 75-35-4 | |
| cis-1,2-Dichloroethene | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 21:37 | 156-59-2 | |
| trans-1,2-Dichloroethene | ND | ug/L | 1.0 | 0.23 | 1 | | 07/01/14 21:37 | 156-60-5 | |
| Dichlorofluoromethane | ND | ug/L | 1.0 | 0.20 | 1 | | 07/01/14 21:37 | 75-43-4 | |
| 1,2-Dichloropropane | ND | ug/L | 4.0 | 0.14 | 1 | | 07/01/14 21:37 | 78-87-5 | |
| 1,3-Dichloropropane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 142-28-9 | |
| 2,2-Dichloropropane | ND | ug/L | 4.0 | 0.17 | 1 | | 07/01/14 21:37 | 594-20-7 | |
| 1,1-Dichloropropene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 563-58-6 | |
| cis-1,3-Dichloropropene | ND | ug/L | 4.0 | 0.13 | 1 | | 07/01/14 21:37 | 10061-01-5 | |
| trans-1,3-Dichloropropene | ND | ug/L | 4.0 | 0.18 | 1 | | 07/01/14 21:37 | 10061-02-6 | |
| Diethyl ether (Ethyl ether) | ND | ug/L | 4.0 | 0.14 | 1 | | 07/01/14 21:37 | 60-29-7 | |
| Ethylbenzene | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 21:37 | 100-41-4 | |
| Hexachloro-1,3-butadiene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 87-68-3 | |
| Isopropylbenzene (Cumene) | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 98-82-8 | |
| p-Isopropyltoluene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 99-87-6 | |
| Methylene Chloride | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 21:37 | 75-09-2 | |
| 4-Methyl-2-pentanone (MIBK) | ND | ug/L | 5.0 | 2.5 | 1 | | 07/01/14 21:37 | 108-10-1 | |
| Methyl-tert-butyl ether | ND | ug/L | 1.0 | 0.17 | 1 | | 07/01/14 21:37 | 1634-04-4 | |
| Naphthalene | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 21:37 | 91-20-3 | |
| n-Propylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 103-65-1 | |
| Styrene | ND | ug/L | 1.0 | 0.063 | 1 | | 07/01/14 21:37 | 100-42-5 | |
| 1,1,1,2-Tetrachloroethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 630-20-6 | |
| 1,1,2,2-Tetrachloroethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 79-34-5 | |
| Tetrachloroethene | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 21:37 | 127-18-4 | |
| Tetrahydrofuran | ND | ug/L | 10.0 | 2.0 | 1 | | 07/01/14 21:37 | 109-99-9 | |
| Toluene | **0.15J** | ug/L | 1.0 | 0.11 | 1 | | 07/01/14 21:37 | 108-88-3 | |
| 1,2,3-Trichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 87-61-6 | |
| 1,2,4-Trichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 120-82-1 | |
| 1,1,1-Trichloroethane | ND | ug/L | 1.0 | 0.26 | 1 | | 07/01/14 21:37 | 71-55-6 | |
| 1,1,2-Trichloroethane | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 21:37 | 79-00-5 | |
| Trichloroethene | **0.46** | ug/L | 0.40 | 0.091 | 1 | | 07/01/14 21:37 | 79-01-6 | |
| Trichlorofluoromethane | ND | ug/L | 1.0 | 0.22 | 1 | | 07/01/14 21:37 | 75-69-4 | |
| 1,2,3-Trichloropropane | ND | ug/L | 4.0 | 1.2 | 1 | | 07/01/14 21:37 | 96-18-4 | |
| 1,1,2-Trichlorotrifluoroethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 76-13-1 | |
| 1,2,4-Trimethylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 95-63-6 | |
| 1,3,5-Trimethylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 21:37 | 108-67-8 | |
| Vinyl chloride | ND | ug/L | 0.40 | 0.20 | 1 | | 07/01/14 21:37 | 75-01-4 | |
| Xylene (Total) | ND | ug/L | 3.0 | 0.40 | 1 | | 07/01/14 21:37 | 1330-20-7 | |
| ***Surrogates*** | | | | | | | | | |
| 1,2-Dichloroethane-d4 (S) | 101 | %. | 75-125 | | 1 | | 07/01/14 21:37 | 17060-07-0 | |
| Toluene-d8 (S) | 105 | %. | 75-125 | | 1 | | 07/01/14 21:37 | 2037-26-5 | |
| 4-Bromofluorobenzene (S) | 103 | %. | 75-125 | | 1 | | 07/01/14 21:37 | 460-00-4 | |
| **Chromium, Hexavalent** | Analytical Method: SM 3500-Cr D Modified | | | | | | | | |
| Chromium, Hexavalent | ND | mg/L | 0.010 | 0.0028 | 1 | | 06/27/14 16:08 | 18540-29-9 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Sample: FMC POCATELLO** **Lab ID: 10272245001** Collected: 06/26/14 17:45 Received: 06/27/14 10:00 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | | |
| Phosphorus | **3.6** | mg/L | 0.10 | 0.050 | 2 | 07/01/14 11:44 | 07/02/14 13:27 | 7723-14-0 | |
| **SM4500P-E, Phosphate, Ortho** | Analytical Method: SM 4500-P E | | | | | | | | |
| Orthophosphate as P | **3.0** | mg/L | 0.20 | 0.10 | 10 | | 06/27/14 15:36 | | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Sample: TRIP BLANK** **Lab ID: 10272245002** Collected: 06/26/14 00:00 Received: 06/27/14 10:00 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **8260 VOC** | Analytical Method: EPA 8260 | | | | | | | | |
| Acetone | ND | ug/L | 20.0 | 10.0 | 1 | | 07/01/14 20:10 | 67-64-1 | |
| Allyl chloride | ND | ug/L | 4.0 | 0.45 | 1 | | 07/01/14 20:10 | 107-05-1 | |
| Benzene | ND | ug/L | 1.0 | 0.15 | 1 | | 07/01/14 20:10 | 71-43-2 | |
| Bromobenzene | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 20:10 | 108-86-1 | |
| Bromochloromethane | ND | ug/L | 1.0 | 0.12 | 1 | | 07/01/14 20:10 | 74-97-5 | |
| Bromodichloromethane | ND | ug/L | 1.0 | 0.20 | 1 | | 07/01/14 20:10 | 75-27-4 | |
| Bromoform | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 20:10 | 75-25-2 | |
| Bromomethane | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 20:10 | 74-83-9 | CL |
| 2-Butanone (MEK) | ND | ug/L | 5.0 | 2.5 | 1 | | 07/01/14 20:10 | 78-93-3 | |
| n-Butylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 104-51-8 | |
| sec-Butylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 135-98-8 | |
| tert-Butylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 98-06-6 | |
| Carbon tetrachloride | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 20:10 | 56-23-5 | |
| Chlorobenzene | ND | ug/L | 1.0 | 0.066 | 1 | | 07/01/14 20:10 | 108-90-7 | |
| Chloroethane | ND | ug/L | 1.0 | 0.24 | 1 | | 07/01/14 20:10 | 75-00-3 | |
| Chloroform | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 20:10 | 67-66-3 | |
| Chloromethane | ND | ug/L | 4.0 | 0.34 | 1 | | 07/01/14 20:10 | 74-87-3 | |
| 2-Chlorotoluene | ND | ug/L | 1.0 | 0.14 | 1 | | 07/01/14 20:10 | 95-49-8 | |
| 4-Chlorotoluene | ND | ug/L | 1.0 | 0.083 | 1 | | 07/01/14 20:10 | 106-43-4 | |
| 1,2-Dibromo-3-chloropropane | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 20:10 | 96-12-8 | |
| Dibromochloromethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 124-48-1 | |
| 1,2-Dibromoethane (EDB) | ND | ug/L | 1.0 | 0.15 | 1 | | 07/01/14 20:10 | 106-93-4 | |
| Dibromomethane | ND | ug/L | 4.0 | 0.18 | 1 | | 07/01/14 20:10 | 74-95-3 | |
| 1,2-Dichlorobenzene | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 20:10 | 95-50-1 | |
| 1,3-Dichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 541-73-1 | |
| 1,4-Dichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 106-46-7 | |
| Dichlorodifluoromethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 75-71-8 | |
| 1,1-Dichloroethane | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 20:10 | 75-34-3 | |
| 1,2-Dichloroethane | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 20:10 | 107-06-2 | |
| 1,1-Dichloroethene | ND | ug/L | 1.0 | 0.20 | 1 | | 07/01/14 20:10 | 75-35-4 | |
| cis-1,2-Dichloroethene | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 20:10 | 156-59-2 | |
| trans-1,2-Dichloroethene | ND | ug/L | 1.0 | 0.23 | 1 | | 07/01/14 20:10 | 156-60-5 | |
| Dichlorofluoromethane | ND | ug/L | 1.0 | 0.20 | 1 | | 07/01/14 20:10 | 75-43-4 | |
| 1,2-Dichloropropane | ND | ug/L | 4.0 | 0.14 | 1 | | 07/01/14 20:10 | 78-87-5 | |
| 1,3-Dichloropropane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 142-28-9 | |
| 2,2-Dichloropropane | ND | ug/L | 4.0 | 0.17 | 1 | | 07/01/14 20:10 | 594-20-7 | |
| 1,1-Dichloropropene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 563-58-6 | |
| cis-1,3-Dichloropropene | ND | ug/L | 4.0 | 0.13 | 1 | | 07/01/14 20:10 | 10061-01-5 | |
| trans-1,3-Dichloropropene | ND | ug/L | 4.0 | 0.18 | 1 | | 07/01/14 20:10 | 10061-02-6 | |
| Diethyl ether (Ethyl ether) | ND | ug/L | 4.0 | 0.14 | 1 | | 07/01/14 20:10 | 60-29-7 | |
| Ethylbenzene | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 20:10 | 100-41-4 | |
| Hexachloro-1,3-butadiene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 87-68-3 | |
| Isopropylbenzene (Cumene) | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 98-82-8 | |
| p-Isopropyltoluene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 99-87-6 | |
| Methylene Chloride | ND | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 20:10 | 75-09-2 | |
| 4-Methyl-2-pentanone (MIBK) | ND | ug/L | 5.0 | 2.5 | 1 | | 07/01/14 20:10 | 108-10-1 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

**Sample: TRIP BLANK** **Lab ID: 10272245002** Collected: 06/26/14 00:00 Received: 06/27/14 10:00 Matrix: Water

| Parameters | Results | Units | PQL | MDL | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|---|
| **8260 VOC** | Analytical Method: EPA 8260 | | | | | | | | |
| Methyl-tert-butyl ether | ND | ug/L | 1.0 | 0.17 | 1 | | 07/01/14 20:10 | 1634-04-4 | |
| Naphthalene | **2.6J** | ug/L | 4.0 | 2.0 | 1 | | 07/01/14 20:10 | 91-20-3 | B |
| n-Propylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 103-65-1 | |
| Styrene | ND | ug/L | 1.0 | 0.063 | 1 | | 07/01/14 20:10 | 100-42-5 | |
| 1,1,1,2-Tetrachloroethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 630-20-6 | |
| 1,1,2,2-Tetrachloroethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 79-34-5 | |
| Tetrachloroethene | ND | ug/L | 1.0 | 0.16 | 1 | | 07/01/14 20:10 | 127-18-4 | |
| Tetrahydrofuran | ND | ug/L | 10.0 | 2.0 | 1 | | 07/01/14 20:10 | 109-99-9 | |
| Toluene | ND | ug/L | 1.0 | 0.11 | 1 | | 07/01/14 20:10 | 108-88-3 | |
| 1,2,3-Trichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 87-61-6 | |
| 1,2,4-Trichlorobenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 120-82-1 | |
| 1,1,1-Trichloroethane | ND | ug/L | 1.0 | 0.26 | 1 | | 07/01/14 20:10 | 71-55-6 | |
| 1,1,2-Trichloroethane | ND | ug/L | 1.0 | 0.13 | 1 | | 07/01/14 20:10 | 79-00-5 | |
| Trichloroethene | ND | ug/L | 0.40 | 0.091 | 1 | | 07/01/14 20:10 | 79-01-6 | |
| Trichlorofluoromethane | ND | ug/L | 1.0 | 0.22 | 1 | | 07/01/14 20:10 | 75-69-4 | |
| 1,2,3-Trichloropropane | ND | ug/L | 4.0 | 1.2 | 1 | | 07/01/14 20:10 | 96-18-4 | |
| 1,1,2-Trichlorotrifluoroethane | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 76-13-1 | |
| 1,2,4-Trimethylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 95-63-6 | |
| 1,3,5-Trimethylbenzene | ND | ug/L | 1.0 | 0.50 | 1 | | 07/01/14 20:10 | 108-67-8 | |
| Vinyl chloride | ND | ug/L | 0.40 | 0.20 | 1 | | 07/01/14 20:10 | 75-01-4 | |
| Xylene (Total) | ND | ug/L | 3.0 | 0.40 | 1 | | 07/01/14 20:10 | 1330-20-7 | |
| ***Surrogates*** | | | | | | | | | |
| 1,2-Dichloroethane-d4 (S) | 100 | %. | 75-125 | | 1 | | 07/01/14 20:10 | 17060-07-0 | |
| Toluene-d8 (S) | 102 | %. | 75-125 | | 1 | | 07/01/14 20:10 | 2037-26-5 | |
| 4-Bromofluorobenzene (S) | 102 | %. | 75-125 | | 1 | | 07/01/14 20:10 | 460-00-4 | |



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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

QC Batch: MERP/10952 | Analysis Method: EPA 245.1
QC Batch Method: EPA 245.1 | Analysis Description: 245.1 Mercury
Associated Lab Samples: 10272245001

METHOD BLANK: 1726116 | Matrix: Water
Associated Lab Samples: 10272245001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Mercury | ug/L | ND | 0.20 | 07/07/14 18:05 | |

LABORATORY CONTROL SAMPLE: 1726117

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Mercury | ug/L | 5 | 4.9 | 98 | 85-115 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1726118 1726119

| Parameter | Units | 10272937002 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | ug/L | <0.20 | 5 | 5 | 4.9 | 4.7 | 97 | 95 | 70-130 | 3 | 20 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

QC Batch: MPRP/47124
QC Batch Method: EPA 3020
Analysis Method: EPA 6020
Analysis Description: 6020 MET
Associated Lab Samples: 10272245001

METHOD BLANK: 1724275
Matrix: Water
Associated Lab Samples: 10272245001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Antimony | ug/L | ND | 0.50 | 07/03/14 22:13 | |
| Arsenic | ug/L | ND | 0.50 | 07/03/14 22:13 | |
| Beryllium | ug/L | ND | 0.20 | 07/03/14 22:13 | |
| Cadmium | ug/L | ND | 0.080 | 07/03/14 22:13 | |
| Chromium | ug/L | ND | 0.50 | 07/03/14 22:13 | |
| Copper | ug/L | 0.34J | 1.0 | 07/03/14 22:13 | |
| Lead | ug/L | ND | 0.10 | 07/03/14 22:13 | |
| Nickel | ug/L | ND | 0.50 | 07/03/14 22:13 | |
| Selenium | ug/L | ND | 0.50 | 07/03/14 22:13 | |
| Silver | ug/L | ND | 0.50 | 07/03/14 22:13 | |
| Thallium | ug/L | ND | 0.10 | 07/03/14 22:13 | |
| Zinc | ug/L | ND | 5.0 | 07/03/14 22:13 | |

LABORATORY CONTROL SAMPLE: 1724276

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Antimony | ug/L | 80 | 83.9 | 105 | 80-120 | |
| Arsenic | ug/L | 80 | 87.7 | 110 | 80-120 | |
| Beryllium | ug/L | 80 | 84.1 | 105 | 80-120 | |
| Cadmium | ug/L | 80 | 86.4 | 108 | 80-120 | |
| Chromium | ug/L | 80 | 89.0 | 111 | 80-120 | |
| Copper | ug/L | 80 | 90.5 | 113 | 80-120 | |
| Lead | ug/L | 80 | 93.1 | 116 | 80-120 | |
| Nickel | ug/L | 80 | 86.7 | 108 | 80-120 | |
| Selenium | ug/L | 80 | 85.3 | 107 | 80-120 | |
| Silver | ug/L | 80 | 87.0 | 109 | 80-120 | |
| Thallium | ug/L | 80 | 92.6 | 116 | 80-120 | |
| Zinc | ug/L | 80 | 90.2 | 113 | 80-120 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1724277 1724278

| Parameter | Units | 10272245001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | ug/L | 0.25J | 80 | 80 | 84.9 | 87.0 | 106 | 108 | 75-125 | 2 | 20 | |
| Arsenic | ug/L | 53.8 | 80 | 80 | 144 | 146 | 113 | 115 | 75-125 | 1 | 20 | |
| Beryllium | ug/L | ND | 80 | 80 | 89.6 | 82.3 | 112 | 103 | 75-125 | 8 | 20 | |
| Cadmium | ug/L | 0.065J | 80 | 80 | 84.4 | 82.4 | 105 | 103 | 75-125 | 2 | 20 | |
| Chromium | ug/L | 0.62 | 80 | 80 | 87.7 | 87.5 | 109 | 109 | 75-125 | .2 | 20 | |

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## REPORT OF LABORATORY ANALYSIS

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1724277 1724278

| Parameter | Units | 10272245001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Copper | ug/L | 3.2 | 80 | 80 | 90.0 | 88.3 | 108 | 106 | 75-125 | 2 | 20 | |
| Lead | ug/L | 0.34 | 80 | 80 | 85.6 | 85.1 | 107 | 106 | 75-125 | .6 | 20 | |
| Nickel | ug/L | 3.2 | 80 | 80 | 87.2 | 86.0 | 105 | 104 | 75-125 | 1 | 20 | |
| Selenium | ug/L | 15.0 | 80 | 80 | 107 | 99.9 | 115 | 106 | 75-125 | 7 | 20 | |
| Silver | ug/L | ND | 80 | 80 | 74.2 | 73.4 | 93 | 92 | 75-125 | 1 | 20 | |
| Thallium | ug/L | 0.17 | 80 | 80 | 83.5 | 82.9 | 104 | 103 | 75-125 | .7 | 20 | |
| Zinc | ug/L | 45.8 | 80 | 80 | 138 | 136 | 116 | 112 | 75-125 | 2 | 20 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

QC Batch: MSV/27635 | Analysis Method: EPA 8260
QC Batch Method: EPA 8260 | Analysis Description: 8260 MSV 465 W
Associated Lab Samples: 10272245001, 10272245002

METHOD BLANK: 1721949 | Matrix: Water
Associated Lab Samples: 10272245001, 10272245002

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1,1-Trichloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1,2,2-Tetrachloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1,2-Trichloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1,2-Trichlorotrifluoroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1-Dichloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1-Dichloroethene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,1-Dichloropropene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2,3-Trichlorobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2,3-Trichloropropane | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| 1,2,4-Trichlorobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2,4-Trimethylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2-Dibromo-3-chloropropane | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| 1,2-Dibromoethane (EDB) | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2-Dichlorobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2-Dichloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,2-Dichloropropane | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| 1,3,5-Trimethylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,3-Dichlorobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,3-Dichloropropane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 1,4-Dichlorobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 2,2-Dichloropropane | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| 2-Butanone (MEK) | ug/L | ND | 5.0 | 07/01/14 19:56 | |
| 2-Chlorotoluene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 4-Chlorotoluene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| 4-Methyl-2-pentanone (MIBK) | ug/L | ND | 5.0 | 07/01/14 19:56 | |
| Acetone | ug/L | ND | 20.0 | 07/01/14 19:56 | |
| Allyl chloride | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| Benzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Bromobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Bromochloromethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Bromodichloromethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Bromoform | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| Bromomethane | ug/L | ND | 4.0 | 07/01/14 19:56 | CL |
| Carbon tetrachloride | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Chlorobenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Chloroethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Chloroform | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Chloromethane | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| cis-1,2-Dichloroethene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| cis-1,3-Dichloropropene | ug/L | ND | 4.0 | 07/01/14 19:56 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

METHOD BLANK: 1721949 Matrix: Water
Associated Lab Samples: 10272245001, 10272245002

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Dibromochloromethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Dibromomethane | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| Dichlorodifluoromethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Dichlorofluoromethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Diethyl ether (Ethyl ether) | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| Ethylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Hexachloro-1,3-butadiene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Isopropylbenzene (Cumene) | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Methyl-tert-butyl ether | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Methylene Chloride | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| n-Butylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| n-Propylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Naphthalene | ug/L | 2.6J | 4.0 | 07/01/14 19:56 | |
| p-Isopropyltoluene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| sec-Butylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Styrene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| tert-Butylbenzene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Tetrachloroethene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Tetrahydrofuran | ug/L | ND | 10.0 | 07/01/14 19:56 | |
| Toluene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| trans-1,2-Dichloroethene | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| trans-1,3-Dichloropropene | ug/L | ND | 4.0 | 07/01/14 19:56 | |
| Trichloroethene | ug/L | ND | 0.40 | 07/01/14 19:56 | |
| Trichlorofluoromethane | ug/L | ND | 1.0 | 07/01/14 19:56 | |
| Vinyl chloride | ug/L | ND | 0.40 | 07/01/14 19:56 | |
| Xylene (Total) | ug/L | ND | 3.0 | 07/01/14 19:56 | |
| 1,2-Dichloroethane-d4 (S) | %. | 96 | 75-125 | 07/01/14 19:56 | |
| 4-Bromofluorobenzene (S) | %. | 103 | 75-125 | 07/01/14 19:56 | |
| Toluene-d8 (S) | %. | 101 | 75-125 | 07/01/14 19:56 | |

LABORATORY CONTROL SAMPLE: 1721950

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | ug/L | 20 | 21.7 | 108 | 75-125 | |
| 1,1,1-Trichloroethane | ug/L | 20 | 23.2 | 116 | 73-125 | |
| 1,1,2,2-Tetrachloroethane | ug/L | 20 | 20.3 | 102 | 74-125 | |
| 1,1,2-Trichloroethane | ug/L | 20 | 21.6 | 108 | 75-125 | |
| 1,1,2-Trichlorotrifluoroethane | ug/L | 20 | 26.0 | 130 | 56-133 | |
| 1,1-Dichloroethane | ug/L | 20 | 21.7 | 108 | 75-125 | |
| 1,1-Dichloroethene | ug/L | 20 | 21.4 | 107 | 70-125 | |
| 1,1-Dichloropropene | ug/L | 20 | 20.2 | 101 | 73-125 | |
| 1,2,3-Trichlorobenzene | ug/L | 20 | 18.4 | 92 | 75-125 | |
| 1,2,3-Trichloropropane | ug/L | 20 | 18.8 | 94 | 75-125 | |
| 1,2,4-Trichlorobenzene | ug/L | 20 | 19.5 | 97 | 75-125 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

LABORATORY CONTROL SAMPLE: 1721950

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| 1,2,4-Trimethylbenzene | ug/L | 20 | 22.3 | 111 | 75-125 | |
| 1,2-Dibromo-3-chloropropane | ug/L | 50 | 48.0 | 96 | 70-125 | |
| 1,2-Dibromoethane (EDB) | ug/L | 20 | 20.2 | 101 | 75-125 | |
| 1,2-Dichlorobenzene | ug/L | 20 | 21.4 | 107 | 75-125 | |
| 1,2-Dichloroethane | ug/L | 20 | 19.5 | 98 | 75-125 | |
| 1,2-Dichloropropane | ug/L | 20 | 20.6 | 103 | 75-125 | |
| 1,3,5-Trimethylbenzene | ug/L | 20 | 23.2 | 116 | 75-125 | |
| 1,3-Dichlorobenzene | ug/L | 20 | 21.5 | 108 | 75-125 | |
| 1,3-Dichloropropane | ug/L | 20 | 21.6 | 108 | 75-125 | |
| 1,4-Dichlorobenzene | ug/L | 20 | 21.3 | 107 | 75-125 | |
| 2,2-Dichloropropane | ug/L | 20 | 22.8 | 114 | 66-130 | |
| 2-Butanone (MEK) | ug/L | 100 | 81.6 | 82 | 64-126 | |
| 2-Chlorotoluene | ug/L | 20 | 21.8 | 109 | 73-125 | |
| 4-Chlorotoluene | ug/L | 20 | 21.6 | 108 | 75-125 | |
| 4-Methyl-2-pentanone (MIBK) | ug/L | 100 | 101 | 101 | 71-125 | |
| Acetone | ug/L | 100 | 114 | 114 | 66-131 | |
| Allyl chloride | ug/L | 20 | 19.3 | 97 | 70-129 | |
| Benzene | ug/L | 20 | 21.0 | 105 | 75-125 | |
| Bromobenzene | ug/L | 20 | 22.0 | 110 | 75-125 | |
| Bromochloromethane | ug/L | 20 | 19.5 | 98 | 75-125 | |
| Bromodichloromethane | ug/L | 20 | 20.2 | 101 | 75-125 | |
| Bromoform | ug/L | 20 | 18.4 | 92 | 70-125 | |
| Bromomethane | ug/L | 20 | 10.6 | 53 | 30-150 | CL |
| Carbon tetrachloride | ug/L | 20 | 21.6 | 108 | 68-129 | |
| Chlorobenzene | ug/L | 20 | 22.2 | 111 | 75-125 | |
| Chloroethane | ug/L | 20 | 19.6 | 98 | 68-133 | |
| Chloroform | ug/L | 20 | 20.8 | 104 | 75-125 | |
| Chloromethane | ug/L | 20 | 16.7 | 84 | 57-140 | |
| cis-1,2-Dichloroethene | ug/L | 20 | 20.7 | 104 | 75-125 | |
| cis-1,3-Dichloropropene | ug/L | 20 | 19.9 | 100 | 75-125 | |
| Dibromochloromethane | ug/L | 20 | 19.9 | 100 | 75-125 | |
| Dibromomethane | ug/L | 20 | 20.0 | 100 | 75-125 | |
| Dichlorodifluoromethane | ug/L | 20 | 18.8 | 94 | 50-134 | |
| Dichlorofluoromethane | ug/L | 20 | 19.6 | 98 | 74-125 | |
| Diethyl ether (Ethyl ether) | ug/L | 20 | 21.9 | 110 | 75-125 | |
| Ethylbenzene | ug/L | 20 | 20.9 | 105 | 75-125 | |
| Hexachloro-1,3-butadiene | ug/L | 20 | 20.7 | 104 | 74-128 | |
| Isopropylbenzene (Cumene) | ug/L | 20 | 22.1 | 111 | 73-125 | |
| Methyl-tert-butyl ether | ug/L | 20 | 20.5 | 102 | 75-125 | |
| Methylene Chloride | ug/L | 20 | 19.9 | 100 | 75-125 | |
| n-Butylbenzene | ug/L | 20 | 19.6 | 98 | 73-125 | |
| n-Propylbenzene | ug/L | 20 | 23.2 | 116 | 72-125 | |
| Naphthalene | ug/L | 20 | 16.1 | 80 | 74-125 | |
| p-Isopropyltoluene | ug/L | 20 | 21.7 | 108 | 74-125 | |
| sec-Butylbenzene | ug/L | 20 | 21.4 | 107 | 74-125 | |
| Styrene | ug/L | 20 | 23.3 | 116 | 75-125 | |
| tert-Butylbenzene | ug/L | 20 | 22.6 | 113 | 74-125 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

LABORATORY CONTROL SAMPLE: 1721950

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Tetrachloroethene | ug/L | 20 | 22.1 | 111 | 71-125 | |
| Tetrahydrofuran | ug/L | 200 | 246 | 123 | 70-125 | |
| Toluene | ug/L | 20 | 23.0 | 115 | 75-125 | |
| trans-1,2-Dichloroethene | ug/L | 20 | 20.1 | 100 | 73-125 | |
| trans-1,3-Dichloropropene | ug/L | 20 | 19.9 | 99 | 75-125 | |
| Trichloroethene | ug/L | 20 | 21.5 | 107 | 75-125 | |
| Trichlorofluoromethane | ug/L | 20 | 21.8 | 109 | 70-128 | |
| Vinyl chloride | ug/L | 20 | 18.2 | 91 | 70-130 | |
| Xylene (Total) | ug/L | 60 | 68.3 | 114 | 75-125 | |
| 1,2-Dichloroethane-d4 (S) | %. | | | 99 | 75-125 | |
| 4-Bromofluorobenzene (S) | %. | | | 99 | 75-125 | |
| Toluene-d8 (S) | %. | | | 103 | 75-125 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1725280 1725281

| Parameter | Units | 10267916002 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1,1,1,2-Tetrachloroethane | ug/L | ND | 20 | 20 | 19.4 | 19.6 | 97 | 98 | 74-131 | .6 | 30 | |
| 1,1,1-Trichloroethane | ug/L | ND | 20 | 20 | 21.5 | 20.8 | 107 | 104 | 73-139 | 3 | 30 | |
| 1,1,2,2-Tetrachloroethane | ug/L | ND | 20 | 20 | 16.6 | 17.0 | 83 | 85 | 72-125 | 3 | 30 | |
| 1,1,2-Trichloroethane | ug/L | ND | 20 | 20 | 18.4 | 18.0 | 92 | 90 | 75-125 | 2 | 30 | |
| 1,1,2-Trichlorotrifluoroethane | ug/L | ND | 20 | 20 | 25.4 | 25.2 | 127 | 126 | 68-150 | .6 | 30 | |
| 1,1-Dichloroethane | ug/L | ND | 20 | 20 | 19.9 | 19.6 | 99 | 98 | 73-132 | 2 | 30 | |
| 1,1-Dichloroethene | ug/L | ND | 20 | 20 | 19.9 | 19.5 | 99 | 98 | 71-142 | 2 | 30 | |
| 1,1-Dichloropropene | ug/L | ND | 20 | 20 | 19.5 | 18.4 | 97 | 92 | 73-139 | 6 | 30 | |
| 1,2,3-Trichlorobenzene | ug/L | ND | 20 | 20 | 17.6 | 17.2 | 88 | 86 | 70-129 | 2 | 30 | |
| 1,2,3-Trichloropropane | ug/L | ND | 20 | 20 | 15.6 | 15.9 | 78 | 79 | 74-125 | 2 | 30 | |
| 1,2,4-Trichlorobenzene | ug/L | ND | 20 | 20 | 18.5 | 17.4 | 92 | 87 | 70-129 | 6 | 30 | |
| 1,2,4-Trimethylbenzene | ug/L | ND | 20 | 20 | 19.9 | 20.3 | 100 | 101 | 72-136 | 2 | 30 | |
| 1,2-Dibromo-3-chloropropane | ug/L | ND | 50 | 50 | 39.8 | 41.1 | 80 | 82 | 66-127 | 3 | 30 | |
| 1,2-Dibromoethane (EDB) | ug/L | ND | 20 | 20 | 18.0 | 17.0 | 90 | 85 | 75-125 | 6 | 30 | |
| 1,2-Dichlorobenzene | ug/L | ND | 20 | 20 | 19.4 | 19.7 | 97 | 99 | 75-125 | 2 | 30 | |
| 1,2-Dichloroethane | ug/L | ND | 20 | 20 | 17.3 | 16.7 | 86 | 84 | 68-128 | 3 | 30 | |
| 1,2-Dichloropropane | ug/L | ND | 20 | 20 | 19.5 | 19.2 | 98 | 96 | 74-131 | 2 | 30 | |
| 1,3,5-Trimethylbenzene | ug/L | ND | 20 | 20 | 20.6 | 20.8 | 103 | 104 | 75-131 | 1 | 30 | |
| 1,3-Dichlorobenzene | ug/L | ND | 20 | 20 | 19.7 | 19.7 | 98 | 99 | 73-125 | .2 | 30 | |
| 1,3-Dichloropropane | ug/L | ND | 20 | 20 | 19.1 | 18.8 | 96 | 94 | 75-125 | 1 | 30 | |
| 1,4-Dichlorobenzene | ug/L | ND | 20 | 20 | 19.3 | 19.5 | 96 | 97 | 73-125 | 1 | 30 | |
| 2,2-Dichloropropane | ug/L | ND | 20 | 20 | 22.4 | 21.5 | 112 | 108 | 58-150 | 4 | 30 | |
| 2-Butanone (MEK) | ug/L | ND | 100 | 100 | 67.2 | 69.4 | 67 | 69 | 56-140 | 3 | 30 | |
| 2-Chlorotoluene | ug/L | ND | 20 | 20 | 20.2 | 19.9 | 101 | 100 | 70-130 | 2 | 30 | |
| 4-Chlorotoluene | ug/L | ND | 20 | 20 | 20.3 | 19.9 | 101 | 100 | 73-126 | 2 | 30 | |
| 4-Methyl-2-pentanone (MIBK) | ug/L | ND | 100 | 100 | 85.5 | 83.9 | 85 | 84 | 69-128 | 2 | 30 | |
| Acetone | ug/L | ND | 100 | 100 | 102 | 107 | 100 | 105 | 57-143 | 4 | 30 | |
| Allyl chloride | ug/L | ND | 20 | 20 | 17.7 | 18.7 | 89 | 94 | 65-146 | 5 | 30 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1725280 1725281

| Parameter | Units | 10267916002 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Benzene | ug/L | ND | 20 | 20 | 19.0 | 18.6 | 95 | 93 | 75-129 | 3 | 30 | |
| Bromobenzene | ug/L | ND | 20 | 20 | 19.6 | 19.5 | 98 | 97 | 74-125 | .5 | 30 | |
| Bromochloromethane | ug/L | ND | 20 | 20 | 17.6 | 17.4 | 88 | 87 | 75-126 | .9 | 30 | |
| Bromodichloromethane | ug/L | ND | 20 | 20 | 19.5 | 18.9 | 98 | 95 | 75-128 | 3 | 30 | |
| Bromoform | ug/L | ND | 20 | 20 | 16.3 | 16.2 | 81 | 81 | 66-130 | .5 | 30 | |
| Bromomethane | ug/L | ND | 20 | 20 | 12.6 | 15.6 | 63 | 78 | 30-150 | 21 | 30 | CL |
| Carbon tetrachloride | ug/L | ND | 20 | 20 | 20.3 | 19.7 | 102 | 98 | 69-148 | 3 | 30 | |
| Chlorobenzene | ug/L | ND | 20 | 20 | 20.1 | 19.5 | 101 | 97 | 75-125 | 3 | 30 | |
| Chloroethane | ug/L | ND | 20 | 20 | 21.3 | 21.9 | 107 | 110 | 71-143 | 3 | 30 | |
| Chloroform | ug/L | ND | 20 | 20 | 18.0 | 18.6 | 90 | 93 | 75-126 | 3 | 30 | |
| Chloromethane | ug/L | ND | 20 | 20 | 18.5 | 20.3 | 93 | 101 | 55-150 | 9 | 30 | |
| cis-1,2-Dichloroethene | ug/L | ND | 20 | 20 | 18.1 | 17.9 | 90 | 90 | 75-130 | .9 | 30 | |
| cis-1,3-Dichloropropene | ug/L | ND | 20 | 20 | 18.4 | 18.6 | 92 | 93 | 72-129 | .8 | 30 | |
| Dibromochloromethane | ug/L | ND | 20 | 20 | 18.1 | 17.6 | 90 | 88 | 73-129 | 3 | 30 | |
| Dibromomethane | ug/L | ND | 20 | 20 | 17.8 | 16.9 | 89 | 85 | 75-125 | 5 | 30 | |
| Dichlorodifluoromethane | ug/L | ND | 20 | 20 | 22.7 | 25.2 | 113 | 126 | 70-150 | 11 | 30 | |
| Dichlorofluoromethane | ug/L | ND | 20 | 20 | 20.3 | 21.8 | 102 | 109 | 75-135 | 7 | 30 | |
| Diethyl ether (Ethyl ether) | ug/L | ND | 20 | 20 | 18.7 | 19.2 | 93 | 96 | 72-126 | 3 | 30 | |
| Ethylbenzene | ug/L | ND | 20 | 20 | 19.5 | 19.2 | 97 | 96 | 75-128 | 1 | 30 | |
| Hexachloro-1,3-butadiene | ug/L | ND | 20 | 20 | 19.9 | 20.1 | 100 | 100 | 65-144 | .6 | 30 | |
| Isopropylbenzene (Cumene) | ug/L | ND | 20 | 20 | 20.2 | 20.2 | 101 | 101 | 75-131 | .009 | 30 | |
| Methyl-tert-butyl ether | ug/L | ND | 20 | 20 | 18.0 | 17.9 | 90 | 90 | 74-128 | .7 | 30 | |
| Methylene Chloride | ug/L | ND | 20 | 20 | 16.8 | 17.3 | 84 | 86 | 69-125 | 3 | 30 | |
| n-Butylbenzene | ug/L | ND | 20 | 20 | 18.5 | 18.1 | 92 | 90 | 70-137 | 2 | 30 | |
| n-Propylbenzene | ug/L | ND | 20 | 20 | 21.5 | 21.3 | 107 | 107 | 72-131 | .6 | 30 | |
| Naphthalene | ug/L | ND | 20 | 20 | 15.2 | 14.9 | 76 | 75 | 70-132 | 1 | 30 | |
| p-Isopropyltoluene | ug/L | ND | 20 | 20 | 19.7 | 19.6 | 98 | 98 | 73-133 | .7 | 30 | |
| sec-Butylbenzene | ug/L | ND | 20 | 20 | 19.6 | 19.9 | 98 | 99 | 74-133 | 2 | 30 | |
| Styrene | ug/L | ND | 20 | 20 | 20.4 | 20.0 | 102 | 100 | 75-128 | 2 | 30 | |
| tert-Butylbenzene | ug/L | ND | 20 | 20 | 20.5 | 20.9 | 103 | 104 | 74-130 | 2 | 30 | |
| Tetrachloroethene | ug/L | ND | 20 | 20 | 20.1 | 20.1 | 101 | 101 | 68-140 | .1 | 30 | |
| Tetrahydrofuran | ug/L | ND | 200 | 200 | 239 | 211 | 119 | 105 | 65-131 | 12 | 30 | |
| Toluene | ug/L | ND | 20 | 20 | 21.1 | 21.1 | 105 | 106 | 75-129 | .3 | 30 | |
| trans-1,2-Dichloroethene | ug/L | ND | 20 | 20 | 18.5 | 17.8 | 93 | 89 | 70-136 | 4 | 30 | |
| trans-1,3-Dichloropropene | ug/L | ND | 20 | 20 | 18.2 | 18.1 | 91 | 91 | 71-125 | .3 | 30 | |
| Trichloroethene | ug/L | ND | 20 | 20 | 19.1 | 19.6 | 96 | 98 | 72-135 | 2 | 30 | |
| Trichlorofluoromethane | ug/L | ND | 20 | 20 | 23.9 | 25.0 | 120 | 125 | 75-150 | 4 | 30 | |
| Vinyl chloride | ug/L | ND | 20 | 20 | 20.1 | 21.1 | 101 | 106 | 73-150 | 5 | 30 | |
| Xylene (Total) | ug/L | ND | 60 | 60 | 61.9 | 60.3 | 103 | 100 | 75-129 | 3 | 30 | |
| 1,2-Dichloroethane-d4 (S) | %. | | | | | | 96 | 97 | 75-125 | | | |
| 4-Bromofluorobenzene (S) | %. | | | | | | 97 | 100 | 75-125 | | | |
| Toluene-d8 (S) | %. | | | | | | 101 | 102 | 75-125 | | | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**



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150 N Ninth Street
Billings, MT 59101
(406)254-7226

# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

QC Batch: WETA/18973
QC Batch Method: SM 3500-Cr D Modified
Analysis Method: SM 3500-Cr D Modified
Analysis Description: Chromium, Hexavalent by 3500
Associated Lab Samples: 10272245001

METHOD BLANK: 1720287
Matrix: Water
Associated Lab Samples: 10272245001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Chromium, Hexavalent | mg/L | ND | 0.010 | 06/27/14 16:08 | |

LABORATORY CONTROL SAMPLE: 1720288

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Chromium, Hexavalent | mg/L | .2 | 0.19 | 97 | 90-110 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1720289 1720290

| Parameter | Units | 10272245001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chromium, Hexavalent | mg/L | ND | .2 | .2 | 0.20 | 0.19 | 99 | 95 | 85-115 | 4 | 20 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

QC Batch: WETA/19010
QC Batch Method: SM 4500-P B
Analysis Method: SM 4500-P E
Analysis Description: SM4500P-E, Total Phosphorus
Associated Lab Samples: 10272245001

METHOD BLANK: 1722017
Matrix: Water
Associated Lab Samples: 10272245001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Phosphorus | mg/L | ND | 0.050 | 07/02/14 12:56 | |

LABORATORY CONTROL SAMPLE: 1722018

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 1 | 1.1 | 108 | 90-110 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1722019 1722020

| Parameter | Units | 10271954005 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 0.030J | 1 | 1 | 1.0 | 1.1 | 100 | 103 | 80-120 | 3 | 30 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1722021 1722022

| Parameter | Units | 10272122004 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | mg/L | <0.025 | 1 | 1 | 1.2 | 1.2 | 119 | 115 | 80-120 | 3 | 30 | |

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

QC Batch: WETA/18970
QC Batch Method: SM 4500-P E
Analysis Method: SM 4500-P E
Analysis Description: SM4500P-E, Phosphate, Ortho
Associated Lab Samples: 10272245001

METHOD BLANK: 1720186
Matrix: Water
Associated Lab Samples: 10272245001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Orthophosphate as P | mg/L | ND | 0.020 | 06/27/14 15:11 | |

LABORATORY CONTROL SAMPLE: 1720187

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Orthophosphate as P | mg/L | .5 | 0.51 | 102 | 90-110 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1720188 1720189

| Parameter | Units | 10272245001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Orthophosphate as P | mg/L | 3.0 | .5 | .5 | 3.5 | 3.5 | 99 | 105 | 80-120 | .8 | 30 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**



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# QUALIFIERS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

## DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

## LABORATORIES

| | |
|---|---|
| PASI-M | Pace Analytical Services - Minneapolis |

## ANALYTE QUALIFIERS

| | |
|---|---|
| B | Analyte was detected in the associated method blank. |
| CL | The continuing calibration for this compound is outside of Pace Analytical acceptance limits. The results may be biased low. |



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# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272245

| Lab ID | Sample ID | QC Batch Method | QC Batch | Analytical Method | Analytical Batch |
|---|---|---|---|---|---|
| **10272245001** | **FMC POCATELLO** | EPA 3020 | MPRP/47124 | EPA 6020 | ICPM/20726 |
| **10272245001** | **FMC POCATELLO** | EPA 245.1 | MERP/10952 | EPA 245.1 | MERC/12586 |
| **10272245001** | **FMC POCATELLO** | EPA 8260 | MSV/27635 | | |
| **10272245002** | **TRIP BLANK** | EPA 8260 | MSV/27635 | | |
| **10272245001** | **FMC POCATELLO** | SM 3500-Cr D Modified | WETA/18973 | | |
| **10272245001** | **FMC POCATELLO** | SM 4500-P B | WETA/19010 | SM 4500-P E | WETA/19035 |
| **10272245001** | **FMC POCATELLO** | SM 4500-P E | WETA/18970 | | |



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10272245

# CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

SHORT HOLD

1125

62714A

Page: 1 of 1

1822594

**Section A**
**Required** Client Information:

Company: PARSONS
Address: 301 PLAINFIELD RD, STE 350
SYRACUSE, NY 13212
Email To: mohan.nayak@parsons.com
Phone: 315-552-9741 Fax:
Requested Due Date/TAT: 1-week

**Section B**
**Required** Project Information:

Report To: TED SCHOENBERG
Copy To: MOHAN NAYAK
Purchase Order No.:
Project Name: FMC POCATELLO
Project Number: 448396

**Section C**
Invoice Information:

Attention: TED SCHOENBERG
Company Name: PARSONS
Address: 301 PLAINFIELD RD, STE 350 SYRACUSE, NY 13212
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

**REGULATORY AGENCY**

☐ NPDES ☒ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: ID

**Section D**
**Required** Client Information

**SAMPLE ID**
(A-Z, 0-9 / ,-)
Sample IDs MUST BE UNIQUE

**Matrix Codes**
MATRIX / CODE

| | |
|---|---|
| Drinking Water | DW |
| Water | WT |
| Waste Water | WW |
| Product | P |
| Soil/Solid | SL |
| Oil | OL |
| Wipe | WP |
| Air | AR |
| Tissue | TS |
| Other | OT |

Requested Analysis Filtered (Y/N) ↓

| ITEM # | SAMPLE ID | MATRIX CODE (see valid codes to left) | SAMPLE TYPE (G=GRAB C=COMP) | COLLECTED COMPOSITE START DATE | COLLECTED COMPOSITE START TIME | COLLECTED COMPOSITE END/GRAB DATE | COLLECTED COMPOSITE END/GRAB TIME | SAMPLE TEMP AT COLLECTION | # OF CONTAINERS | Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Methanol | Other | Analysis Test ↓ Y/N | Hex chrome | Total P | PP-13 Metals | VOCs | ortho P | | | | | | | Residual Chlorine (Y/N) | Pace Project No./ Lab I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Hexavalent chrome/~~Total P~~ | WT | G | 6/26/14 | 1745 | 6/26/14 | 1745 | | 1 | X | | | | | | | | | X | | | | | | | | | | | | Extra bottle provided |
| 2 | Total P | WT | G | -11- | 1720 | -11- | 1720 | | 1 | | X | | | | | | | | | X | | | | | | | | | | | 001 |
| 3 | PP-13 Metals | WT | G | -11- | 1715 | -11- | 1715 | | 1 | | | X | | | | | | | | | X | | | | | | | | | | 001 |
| 4 | VOCs | WT | G | -11- | 1735 | -11- | 1745 | | 3 | | | | X | | | | | | | | | X | | | | | | | | | 001 |
| 5 | Ortho P | WT | G | -11- | 1725 | -11- | 1725 | | 1 | X | | | | | | | | | | | | | X | | | | | | | | 001 |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 002 |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| ADDITIONAL COMMENTS | RELINQUISHED BY / AFFILIATION | DATE | TIME | ACCEPTED BY / AFFILIATION | DATE | TIME | SAMPLE CONDITIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | [signature] PACE | 6-27-14 | 1000 | 0.9 | Y | Y | Y |
| | | | | | 6 | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

ORIGINAL

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: Mohan Nayak
SIGNATURE of SAMPLER: Mohan V
DATE Signed (MM/DD/YY): 06/26/14

| Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N) |
|---|---|---|---|

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

| Pace Analytical® | Document Name: **Sample Condition Upon Receipt Form** | Document Revised: 28Feb2014 Page 1 of 1 |
|---|---|---|
| | Document No.: **F-MN-L-213-rev.09** | Issuing Authority: Pace Minnesota Quality Office |

**Sample Condition Upon Receipt**

**Client Name:** Parsons

**Project #:** WO# : 10272245

10272245

**Courier:** ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

**Tracking Number:** 8053 7223 4038

**Custody Seal on Cooler/Box Present?** ☑ Yes ☐ No **Seals Intact?** ☑ Yes ☐ No

**Optional:** Proj. Due Date: Proj. Name:

**Packing Material:** ☐ Bubble Wrap ☑ Bubble Bags ☐ None ☐ Other: **Temp Blank?** ☑ Yes ☐ No

**Thermom. Used:** ☐ B88A9130516413 ☐ B88A912167504 ☑ B88A9132521491 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

**Cooler Temp Read (°C):** 0.9 **Cooler Temp Corrected (°C):** 0.9 **Biological Tissue Frozen?** ☐ Yes ☐ No ☑ N/A

Temp should be above freezing to 6°C **Correction Factor:** none **Date and Initials of Person Examining Contents:** 6/27/14 [illegible]

| | | | | **Comments:** |
|---|---|---|---|---|
| Chain of Custody Present? | ☑ Yes | ☐ No | ☐ N/A | 1. |
| Chain of Custody Filled Out? | ☑ Yes | ☐ No | ☐ N/A | 2. |
| Chain of Custody Relinquished? | ☐ Yes | ☑ No | ☐ N/A | 3. |
| Sampler Name and/or Signature on COC? | ☑ Yes | ☐ No | ☐ N/A | 4. |
| Samples Arrived within Hold Time? | ☑ Yes | ☐ No | ☐ N/A | 5. |
| **Short Hold Time Analysis (<72 hr)?** | ☑ Yes | ☐ No | ☐ N/A | 6. Hex. Chrom |
| **Rush Turn Around Time Requested?** | ☐ Yes | ☑ No | ☐ N/A | 7. |
| Sufficient Volume? | ☑ Yes | ☐ No | ☐ N/A | 8. |
| Correct Containers Used? | ☑ Yes | ☐ No | ☐ N/A | 9. |
| -Pace Containers Used? | ☑ Yes | ☐ No | ☐ N/A | |
| Containers Intact? | ☑ Yes | ☐ No | ☐ N/A | 10. |
| Filtered Volume Received for Dissolved Tests? | ☐ Yes | ☐ No | ☑ N/A | 11. |
| Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT | ☑ Yes | ☐ No | ☐ N/A | 12. |
| All containers needing acid/base preservation have been checked? | ☑ Yes | ☐ No | ☐ N/A | 13. ☑ $HNO_3$ ☑ $H_2SO_4$ ☐ NaOH ☐ HCl Sample # 1 Y/ Y/ |
| All containers needing preservation are found to be in compliance with EPA recommendation? ($HNO_3$, $H_2SO_4$, HCl<2; NaOH >9 Sulfide, NaOH>12 Cyanide) | ☑ Yes | ☐ No | ☐ N/A | |
| Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC | ☑ Yes | ☐ No | | Initial when completed: Lot # of added preservative: |
| Headspace in VOA Vials ( >6mm)? | ☐ Yes | ☑ No | ☐ N/A | 14. |
| Trip Blank Present? | ☑ Yes | ☐ No | ☐ N/A | 15. |
| Trip Blank Custody Seals Present? | ☑ Yes | ☐ No | ☐ N/A | |
| Pace Trip Blank Lot # (if purchased): 061014-01 | | | | |

**CLIENT NOTIFICATION/RESOLUTION** **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

**Project Manager Review:** [signature] **Date:** 6/30/14

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e out of hold, incorrect preservative, out of temp, incorrect containers).

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150 N Ninth Street
Billings, MT 59101
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July 14, 2014

Mohan Nayak
Parsons
301 Plainfield Rd
STE 350
Syracuse, NY 13212

RE: Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

Dear Mohan Nayak:
Enclosed are the analytical results for sample(s) received by the laboratory on July 03, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kabor Xiong

Kabor Xiong
kabor.xiong@pacelabs.com
Project Manager

Enclosures

cc: Ted Schoenberg, Parsons



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## CERTIFICATIONS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Minnesota Certification IDs**
1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alabama Certification #40770
Alabama Certification #40770
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: 8TMS-L
Florida/NELAP Certification #: E87605
Guam Certification #: Pace
Georgia Certification #: 959
Idaho Certification #: MN00064
Hawaii Certification #MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Kentucky Dept of Envi. Protection - WW #:90062
Louisiana DEQ Certification #: 3086
Louisiana DHH #: LA140001
Maine Certification #: 2013011
Maryland Certification #: 322
Michigan DEPH Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT0092
Nebraska Certification #: Pace
New Jersey Certification #: MN-002
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Carolina State Public Health #: 27700
North Dakota Certification #: R-036
Ohio EPA #: 4150
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Saipan (CNMI) #:MP0003
South Carolina #:74003001
Texas Certification #: T104704192
Tennessee Certification #: 02818
Utah Certification #: MN000642013-4
Virginia DGS Certification #: 251
Virginia/VELAP Certification #: Pace
Washington Certification #: C486
Wisconsin Certification #: 999407970
West Virginia Certification #: 382
West Virginia TO-15 Approval
West Virginia DHHR #:9952C



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## SAMPLE SUMMARY

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

| Lab ID | Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| **10272939001** | **JT-1A-0** | Water | 07/02/14 10:30 | 07/03/14 10:10 |
| **10272939002** | **JT-1A-10** | Water | 07/02/14 10:40 | 07/03/14 10:10 |
| **10272939003** | **JT-1A-20** | Water | 07/02/14 10:50 | 07/03/14 10:10 |
| **10272939004** | **JT-1A-40** | Water | 07/02/14 11:00 | 07/03/14 10:10 |
| **10272939005** | **JT-1A-80** | Water | 07/02/14 11:10 | 07/03/14 10:10 |
| **10272939006** | **JT-1B-0** | Water | 07/02/14 16:10 | 07/03/14 10:10 |
| **10272939007** | **JT-1B-10** | Water | 07/02/14 16:20 | 07/03/14 10:10 |
| **10272939008** | **JT-1B-20** | Water | 07/02/14 16:30 | 07/03/14 10:10 |
| **10272939009** | **JT-1B-40** | Water | 07/02/14 16:40 | 07/03/14 10:10 |
| **10272939010** | **JT-1B-80** | Water | 07/02/14 16:50 | 07/03/14 10:10 |



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## SAMPLE ANALYTE COUNT

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

| Lab ID | Sample ID | Method | Analysts | Analytes Reported |
|---|---|---|---|---|
| **10272939001** | **JT-1A-0** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939002** | **JT-1A-10** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939003** | **JT-1A-20** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939004** | **JT-1A-40** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939005** | **JT-1A-80** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939006** | **JT-1B-0** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939007** | **JT-1B-10** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939008** | **JT-1B-20** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939009** | **JT-1B-40** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |
| **10272939010** | **JT-1B-80** | EPA 6020 | RJS | 1 |
| | | SM 4500-P E | PH1 | 1 |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1A-0** **Lab ID: 10272939001** Collected: 07/02/14 10:30 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **51.8** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 02:13 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **3.1** | mg/L | 0.10 | 2 | 07/11/14 10:37 | 07/13/14 11:24 | 7723-14-0 | |



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(406)254-7226

# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1A-10** **Lab ID: 10272939002** Collected: 07/02/14 10:40 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **16.8** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 02:18 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.75** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:50 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1A-20** **Lab ID: 10272939003** Collected: 07/02/14 10:50 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **2.5** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 02:23 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.17** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:50 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1A-40** **Lab ID: 10272939004** Collected: 07/02/14 11:00 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.1** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 03:03 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.10** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:51 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1A-80** **Lab ID: 10272939005** Collected: 07/02/14 11:10 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | ND | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 03:07 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.081** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:52 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1B-0** **Lab ID: 10272939006** Collected: 07/02/14 16:10 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **48.0** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 02:28 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.79** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:52 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1B-10** **Lab ID: 10272939007** Collected: 07/02/14 16:20 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **22.2** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 03:12 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.80** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:53 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1B-20** **Lab ID: 10272939008** Collected: 07/02/14 16:30 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **5.4** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 03:17 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.23** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:56 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1B-40** **Lab ID: 10272939009** Collected: 07/02/14 16:40 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **2.9** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 03:22 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.18** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:56 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**Sample: JT-1B-80** **Lab ID: 10272939010** Collected: 07/02/14 16:50 Received: 07/03/14 10:10 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.2** | ug/L | 0.50 | 1 | 07/08/14 09:39 | 07/10/14 03:27 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.14** | mg/L | 0.050 | 1 | 07/11/14 10:37 | 07/13/14 10:57 | 7723-14-0 | |



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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

QC Batch: MPRP/47216 | Analysis Method: EPA 6020
QC Batch Method: EPA 3020 | Analysis Description: 6020 MET
Associated Lab Samples: 10272939001, 10272939002, 10272939003, 10272939004, 10272939005, 10272939006, 10272939007, 10272939008, 10272939009, 10272939010

METHOD BLANK: 1726656 | Matrix: Water
Associated Lab Samples: 10272939001, 10272939002, 10272939003, 10272939004, 10272939005, 10272939006, 10272939007, 10272939008, 10272939009, 10272939010

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Arsenic | ug/L | ND | 0.50 | 07/10/14 02:03 | |

LABORATORY CONTROL SAMPLE: 1726658

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Arsenic | ug/L | 80 | 81.1 | 101 | 80-120 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1727041 1727042

| Parameter | Units | 10272939006 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | ug/L | 48.0 | 80 | 80 | 132 | 130 | 105 | 103 | 75-125 | 1 | 20 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**

## REPORT OF LABORATORY ANALYSIS

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# QUALITY CONTROL DATA

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

QC Batch: WETA/19159 | Analysis Method: SM 4500-P E
QC Batch Method: SM 4500-P B | Analysis Description: SM4500P-E, Total Phosphorus
Associated Lab Samples: 10272939001, 10272939002, 10272939003, 10272939004, 10272939005, 10272939006, 10272939007, 10272939008, 10272939009, 10272939010

METHOD BLANK: 1729136 | Matrix: Water
Associated Lab Samples: 10272939001, 10272939002, 10272939003, 10272939004, 10272939005, 10272939006, 10272939007, 10272939008, 10272939009, 10272939010

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Phosphorus | mg/L | ND | 0.050 | 07/13/14 10:40 | |

LABORATORY CONTROL SAMPLE: 1729137

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 1 | 1.0 | 101 | 90-110 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1729138 1729139

| Parameter | Units | 10272553028 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | mg/L | ND | 1 | 1 | 0.92 | 0.90 | 92 | 90 | 80-120 | 2 | 30 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1729140 1729141

| Parameter | Units | 10272939007 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 0.80 | 1 | 1 | 1.8 | 1.8 | 104 | 99 | 80-120 | 2 | 30 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**



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# QUALIFIERS

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

**DEFINITIONS**

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.



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# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 448896 FMC POCATELLO
Pace Project No.: 10272939

| Lab ID | Sample ID | QC Batch Method | QC Batch | Analytical Method | Analytical Batch |
|---|---|---|---|---|---|
| **10272939001** | **JT-1A-0** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939002** | **JT-1A-10** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939003** | **JT-1A-20** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939004** | **JT-1A-40** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939005** | **JT-1A-80** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939006** | **JT-1B-0** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939007** | **JT-1B-10** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939008** | **JT-1B-20** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939009** | **JT-1B-40** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939010** | **JT-1B-80** | EPA 3020 | MPRP/47216 | EPA 6020 | ICPM/20790 |
| **10272939001** | **JT-1A-0** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939002** | **JT-1A-10** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939003** | **JT-1A-20** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939004** | **JT-1A-40** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939005** | **JT-1A-80** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939006** | **JT-1B-0** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939007** | **JT-1B-10** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939008** | **JT-1B-20** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939009** | **JT-1B-40** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |
| **10272939010** | **JT-1B-80** | SM 4500-P B | WETA/19159 | SM 4500-P E | WETA/19195 |



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# CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

1027243a

**RUSH** 7/3/14 PK

Page: 1 of 1

1822595

**Section A** Required Client Information:

Company: PARSONS
Address: 301 PLAINFIELD RD., STE 350
SYRACUSE, NY 13212
Email To: mohan.nayak@parsons.com
Phone: 315-552-9941 Fax:
Requested Due Date/TAT: 1-week

**Section B** Required Project Information:

Report To: TED SCHOENBERG
Copy To: MOHAN NAYAK
Purchase Order No.:
Project Name: FMC POCATELLO
Project Number: 448896

**Section C** Invoice Information:

Attention: TED SCHOENBERG
Company Name: PARSONS
Address: 301 PLAINFIELD RD., STE 350 SYRACUSE, NY 13212
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

**REGULATORY AGENCY**

☐ NPDES ☒ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER

Site Location STATE: ID

Requested Analysis Filtered (Y/N) N

**Section D** Required Client Information

**SAMPLE ID** (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Matrix Codes (MATRIX / CODE): Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

| ITEM # | SAMPLE ID | MATRIX CODE (see valid codes to left) | SAMPLE TYPE (G=GRAB C=COMP) | COLLECTED Composite Start DATE | COLLECTED Composite Start TIME | COLLECTED Composite End/Grab DATE | COLLECTED Composite End/Grab TIME | SAMPLE TEMP AT COLLECTION | # OF CONTAINERS | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Methanol | Other | Analysis Test (Y/N): TOTAL ARSENIC | TOTAL PHOSPHORUS | Residual Chlorine (Y/N) | Pace Project No./ Lab I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | JT-1A-0 | WT | G | 07/02/14 | 1030 | 07/02/14 | 1030 | | 2 | | | 1 | 1 | | | | | X | X | | 001 |
| 2 | JT-1A-10 | WT | G | -"- | 1040 | -"- | 1040 | | 2 | | | 1 | 1 | | | | | X | X | | 002 |
| 3 | JT-1A-20 | WT | G | -"- | 1050 | -"- | 1050 | | 2 | | | 1 | 1 | | | | | X | X | | 003 |
| 4 | JT-1A-40 | WT | G | -"- | 1100 | -"- | 1100 | | 2 | | | 1 | 1 | | | | | X | X | | 004 |
| 5 | JT-1A-80 | WT | G | -"- | 1110 | -"- | 1110 | | 2 | | | 1 | 1 | | | | | X | X | | 005 |
| 6 | JT-1B-0 | WT | G | -"- | 1610 | -"- | 1610 | | 2 | | | 1 | 1 | | | | | X | X | | 006 |
| 7 | JT-1B-10 | WT | G | -"- | 1620 | -"- | 1620 | | 2 | | | 1 | 1 | | | | | X | X | | 007 |
| 8 | JT-1B-20 | WT | G | -"- | 1630 | -"- | 1630 | | 2 | | | 1 | 1 | | | | | X | X | | 008 |
| 9 | JT-1B-40 | WT | G | -"- | 1640 | -"- | 1640 | | 2 | | | 1 | 1 | | | | | X | X | | 009 |
| 10 | JT-1B-80 | WT | G | -"- | 1650 | -"- | 1650 | | 2 | | | 1 | 1 | | | | | X | X | | 010 |
| 11 | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | |

| ADDITIONAL COMMENTS | RELINQUISHED BY / AFFILIATION | DATE | TIME | ACCEPTED BY / AFFILIATION | DATE | TIME | SAMPLE CONDITIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | [signature] PACE | 7/3/14 | 10:10 | 2.9 | Y | N | Y |

ORIGINAL

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: MOHAN NAYAK
SIGNATURE of SAMPLER: Mohan S Nayak DATE Signed (MM/DD/YY): 07/02/14

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

| Pace Analytical® | Document Name: **Sample Condition Upon Receipt Form** | Document Revised: 28Feb2014 Page 1 of 1 |
|---|---|---|
| | Document No.: **F-MN-L-213-rev.09** | Issuing Authority: Pace Minnesota Quality Office |

**Sample Condition Upon Receipt**

**Client Name:** Parsons

**Project #:** WO#: 10272939

10272939

**Courier:** ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

**Tracking Number:** 8053 1223 3182

**Custody Seal on Cooler/Box Present?** ☐ Yes ☑ No **Seals Intact?** ☐ Yes ☑ No

**Optional:** Proj. Due Date: Proj. Name:

**Packing Material:** ☐ Bubble Wrap ☐ Bubble Bags ☑ None ☐ Other: **Temp Blank?** ☐ Yes ☑ No

**Thermom. Used:** ☐ B88A9130516413 ☑ B88A912167504 ☐ B88A9132521491 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

**Cooler Temp Read (°C):** 3.0 **Cooler Temp Corrected (°C):** 2.9 **Biological Tissue Frozen?** ☐ Yes ☑ No ☐ N/A

Temp should be above freezing to 6°C **Correction Factor:** -0.1 **Date and Initials of Person Examining Contents:** 7/3/14 PMR

| | | | | **Comments:** |
|---|---|---|---|---|
| Chain of Custody Present? | ☑ Yes | ☐ No | ☐ N/A | 1. |
| Chain of Custody Filled Out? | ☑ Yes | ☐ No | ☐ N/A | 2. |
| Chain of Custody Relinquished? | ☐ Yes | ☑ No | ☐ N/A | 3. |
| Sampler Name and/or Signature on COC? | ☑ Yes | ☐ No | ☐ N/A | 4. |
| Samples Arrived within Hold Time? | ☑ Yes | ☐ No | ☐ N/A | 5. |
| **Short Hold Time Analysis (<72 hr)?** | ☐ Yes | ☑ No | ☐ N/A | 6. |
| **Rush Turn Around Time Requested?** | ☑ Yes | ☐ No | ☐ N/A | 7. |
| Sufficient Volume? | ☑ Yes | ☐ No | ☐ N/A | 8. |
| Correct Containers Used? | ☑ Yes | ☐ No | ☐ N/A | 9. |
| -Pace Containers Used? | ☑ Yes | ☐ No | ☐ N/A | |
| Containers Intact? | ☑ Yes | ☐ No | ☐ N/A | 10. |
| Filtered Volume Received for Dissolved Tests? | ☐ Yes | ☐ No | ☑ N/A | 11. |
| Sample Labels Match COC? | ☑ Yes | ☐ No | ☐ N/A | 12. |
| -Includes Date/Time/ID/Analysis Matrix: WT | | | | |
| All containers needing acid/base preservation have been checked? | ☑ Yes | ☐ No | ☐ N/A | 13. ☑ $HNO_3$ ☑ $H_2SO_4$ ☐ NaOH ☐ HCl |
| All containers needing preservation are found to be in compliance with EPA recommendation? ($HNO_3$, $H_2SO_4$, HCl<2; NaOH >9 Sulfide, NaOH>12 Cyanide) | ☑ Yes | ☐ No | ☐ N/A | Sample # 1-10 ½ ½ |
| Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC | ☐ Yes | ☑ No | | Initial when completed: Lot # of added preservative: |
| Headspace in VOA Vials ( >6mm)? | ☐ Yes | ☐ No | ☑ N/A | 14. |
| Trip Blank Present? | ☐ Yes | ☐ No | ☑ N/A | 15. |
| Trip Blank Custody Seals Present? | ☐ Yes | ☐ No | ☑ N/A | |
| Pace Trip Blank Lot # (if purchased): | | | | |

**CLIENT NOTIFICATION/RESOLUTION** **Field Data Required?** ☐ Yes ☐ No

Person Contacted: Date/Time:

Comments/Resolution:

**Project Manager Review:** Karen Xiong **Date:** July 3, 2014

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e out of hold, incorrect preservative, out of temp, incorrect containers)

**Pace Analytical Services, Inc.**
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July 21, 2014

Mohan Nayak
Parsons
301 Plainfield Rd
STE 350
Syracuse, NY 13212

RE: Project: 448896 FMC Pocatello
Pace Project No.: 10274277

Dear Mohan Nayak:
Enclosed are the analytical results for sample(s) received by the laboratory on July 17, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Dennsa Mohamed for
Kabor Xiong
kabor.xiong@pacelabs.com
Project Manager

Enclosures

cc: Ted Schoenberg, Parsons



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## CERTIFICATIONS

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

**Minnesota Certification IDs**
1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alabama Certification #40770
Alabama Certification #40770
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: 8TMS-L
Florida/NELAP Certification #: E87605
Guam Certification #: Pace
Georgia Certification #: 959
Idaho Certification #: MN00064
Hawaii Certification #MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Kentucky Dept of Envi. Protection - WW #:90062
Louisiana DEQ Certification #: 3086
Louisiana DHH #: LA140001
Maine Certification #: 2013011
Maryland Certification #: 322
Michigan DEPH Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT0092
Nebraska Certification #: Pace
New Jersey Certification #: MN-002
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Carolina State Public Health #: 27700
North Dakota Certification #: R-036
Ohio EPA #: 4150
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Saipan (CNMI) #:MP0003
South Carolina #:74003001
Texas Certification #: T104704192
Tennessee Certification #: 02818
Utah Certification #: MN000642013-4
Virginia DGS Certification #: 251
Virginia/VELAP Certification #: Pace
Washington Certification #: C486
Wisconsin Certification #: 999407970
West Virginia Certification #: 382
West Virginia TO-15 Approval
West Virginia DHHR #:9952C



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## SAMPLE SUMMARY

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

| Lab ID | Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| **10274277001** | **JT-02-01** | Water | 07/16/14 13:35 | 07/17/14 09:40 |
| **10274277002** | **JT-02-02** | Water | 07/16/14 13:40 | 07/17/14 09:40 |
| **10274277003** | **JT-02-03** | Water | 07/16/14 13:45 | 07/17/14 09:40 |
| **10274277004** | **JT-02-04** | Water | 07/16/14 13:50 | 07/17/14 09:40 |
| **10274277005** | **JT-02-05** | Water | 07/16/14 13:52 | 07/17/14 09:40 |
| **10274277006** | **JT-02-06** | Water | 07/16/14 13:53 | 07/17/14 09:40 |
| **10274277007** | **JT-02-07** | Water | 07/16/14 15:00 | 07/17/14 09:40 |
| **10274277008** | **JT-02-08** | Water | 07/16/14 15:05 | 07/17/14 09:40 |
| **10274277009** | **JT-02-09** | Water | 07/16/14 15:10 | 07/17/14 09:40 |
| **10274277010** | **JT-02-10** | Water | 07/16/14 10:55 | 07/17/14 09:40 |



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## SAMPLE ANALYTE COUNT

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

| Lab ID | Sample ID | Method | Analysts | Analytes Reported | Laboratory |
|---|---|---|---|---|---|
| **10274277001** | **JT-02-01** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277002** | **JT-02-02** | EPA 6020 | TT3 | 1 | PASI-M |
| | | EPA 300.0 | MWD | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277003** | **JT-02-03** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277004** | **JT-02-04** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277005** | **JT-02-05** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277006** | **JT-02-06** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277007** | **JT-02-07** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277008** | **JT-02-08** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277009** | **JT-02-09** | EPA 6020 | TT3 | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |
| **10274277010** | **JT-02-10** | EPA 6020 | TT3 | 1 | PASI-M |
| | | EPA 300.0 | MWD | 1 | PASI-M |
| | | SM 4500-P E | PH1 | 1 | PASI-M |



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# ANALYTICAL RESULTS

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

**Sample: JT-02-01** **Lab ID: 10274277001** Collected: 07/16/14 13:35 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.4** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 10:53 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.18** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:02 | 7723-14-0 | |

**Sample: JT-02-02** **Lab ID: 10274277002** Collected: 07/16/14 13:40 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **0.51** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:07 | 7440-38-2 | |
| **300.0 IC Anions** | Analytical Method: EPA 300.0 | | | | | | | |
| Fluoride | **0.19** | mg/L | 0.050 | 1 | | 07/18/14 15:25 | 16984-48-8 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.11** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:04 | 7723-14-0 | |

**Sample: JT-02-03** **Lab ID: 10274277003** Collected: 07/16/14 13:45 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | ND | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:09 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.10** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:04 | 7723-14-0 | |

**Sample: JT-02-04** **Lab ID: 10274277004** Collected: 07/16/14 13:50 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **3.7** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:12 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.24** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:05 | 7723-14-0 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

**Sample: JT-02-05** **Lab ID: 10274277005** Collected: 07/16/14 13:52 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.3** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:15 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.17** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:06 | 7723-14-0 | |

**Sample: JT-02-06** **Lab ID: 10274277006** Collected: 07/16/14 13:53 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.2** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:18 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.37** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:07 | 7723-14-0 | |

**Sample: JT-02-07** **Lab ID: 10274277007** Collected: 07/16/14 15:00 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **2.7** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:20 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.17** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:08 | 7723-14-0 | |

**Sample: JT-02-08** **Lab ID: 10274277008** Collected: 07/16/14 15:05 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.9** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:23 | 7440-38-2 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.12** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:09 | 7723-14-0 | |

**Sample: JT-02-09** **Lab ID: 10274277009** Collected: 07/16/14 15:10 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **1.6** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 11:26 | 7440-38-2 | |



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# ANALYTICAL RESULTS

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

**Sample: JT-02-09** **Lab ID: 10274277009** Collected: 07/16/14 15:10 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **0.098** | mg/L | 0.050 | 1 | 07/21/14 10:44 | 07/21/14 14:09 | 7723-14-0 | |

**Sample: JT-02-10** **Lab ID: 10274277010** Collected: 07/16/14 10:55 Received: 07/17/14 09:40 Matrix: Water

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6020 MET ICPMS** | Analytical Method: EPA 6020 Preparation Method: EPA 3020 | | | | | | | |
| Arsenic | **55.7** | ug/L | 0.50 | 1 | 07/18/14 08:58 | 07/21/14 10:50 | 7440-38-2 | |
| **300.0 IC Anions** | Analytical Method: EPA 300.0 | | | | | | | |
| Fluoride | **0.19** | mg/L | 0.050 | 1 | | 07/18/14 15:41 | 16984-48-8 | |
| **SM4500P-E, Total Phosphorus** | Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B | | | | | | | |
| Phosphorus | **3.8** | mg/L | 0.25 | 5 | 07/21/14 10:44 | 07/21/14 14:40 | 7723-14-0 | |



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# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

QC Batch: MPRP/47481 Analysis Method: EPA 6020
QC Batch Method: EPA 3020 Analysis Description: 6020 MET
Associated Lab Samples: 10274277001, 10274277002, 10274277003, 10274277004, 10274277005, 10274277006, 10274277007, 10274277008, 10274277009, 10274277010

METHOD BLANK: 1735773 Matrix: Water
Associated Lab Samples: 10274277001, 10274277002, 10274277003, 10274277004, 10274277005, 10274277006, 10274277007, 10274277008, 10274277009, 10274277010

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Arsenic | ug/L | ND | 0.50 | 07/21/14 10:45 | |

LABORATORY CONTROL SAMPLE: 1735774

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Arsenic | ug/L | 80 | 83.9 | 105 | 80-120 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1735775 1735776

| Parameter | Units | 10274277001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | ug/L | 1.4 | 80 | 80 | 87.6 | 88.3 | 108 | 109 | 75-125 | 1 | 20 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**

## REPORT OF LABORATORY ANALYSIS

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# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

QC Batch: WETA/19276 | Analysis Method: EPA 300.0
QC Batch Method: EPA 300.0 | Analysis Description: 300.0 IC Anions
Associated Lab Samples: 10274277002, 10274277010

METHOD BLANK: 1735635 | Matrix: Water
Associated Lab Samples: 10274277002, 10274277010

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Fluoride | mg/L | ND | 0.050 | 07/18/14 08:07 | |

LABORATORY CONTROL SAMPLE: 1735636

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Fluoride | mg/L | 1 | 1.0 | 102 | 90-110 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1735637 1735638

| Parameter | Units | 10268874001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fluoride | mg/L | 0.26 | 1 | 1 | 1.1 | 1.1 | 86 | 84 | 90-110 | 2 | 20 | H1,M1 |

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# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

QC Batch: WETA/19299 | Analysis Method: SM 4500-P E
QC Batch Method: SM 4500-P B | Analysis Description: SM4500P-E, Total Phosphorus
Associated Lab Samples: 10274277001, 10274277002, 10274277003, 10274277004, 10274277005, 10274277006, 10274277007, 10274277008, 10274277009, 10274277010

METHOD BLANK: 1737732 | Matrix: Water
Associated Lab Samples: 10274277001, 10274277002, 10274277003, 10274277004, 10274277005, 10274277006, 10274277007, 10274277008, 10274277009, 10274277010

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Phosphorus | mg/L | ND | 0.050 | 07/21/14 14:20 | |

LABORATORY CONTROL SAMPLE: 1737733

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 1 | 1.1 | 108 | 90-110 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1737734 1737735

| Parameter | Units | 10274277001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 0.18 | 1 | 1 | 1.3 | 1.2 | 108 | 104 | 80-120 | 3 | 30 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1737736 1737737

| Parameter | Units | 10274020003 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phosphorus | mg/L | 0.21 | 1 | 1 | 1.2 | 1.2 | 103 | 102 | 80-120 | 0 | 30 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**



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# QUALIFIERS

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

## DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

## LABORATORIES

| | |
|---|---|
| PASI-M | Pace Analytical Services - Minneapolis |

## ANALYTE QUALIFIERS

| | |
|---|---|
| H1 | Analysis conducted outside the recognized method holding time. |
| M1 | Matrix spike recovery exceeded QC limits. Batch accepted based on laboratory control sample (LCS) recovery. |



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# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 448896 FMC Pocatello
Pace Project No.: 10274277

| Lab ID | Sample ID | QC Batch Method | QC Batch | Analytical Method | Analytical Batch |
|---|---|---|---|---|---|
| **10274277001** | **JT-02-01** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277002** | **JT-02-02** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277003** | **JT-02-03** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277004** | **JT-02-04** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277005** | **JT-02-05** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277006** | **JT-02-06** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277007** | **JT-02-07** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277008** | **JT-02-08** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277009** | **JT-02-09** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277010** | **JT-02-10** | EPA 3020 | MPRP/47481 | EPA 6020 | ICPM/20927 |
| **10274277002** | **JT-02-02** | EPA 300.0 | WETA/19276 | | |
| **10274277010** | **JT-02-10** | EPA 300.0 | WETA/19276 | | |
| **10274277001** | **JT-02-01** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277002** | **JT-02-02** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277003** | **JT-02-03** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277004** | **JT-02-04** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277005** | **JT-02-05** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277006** | **JT-02-06** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277007** | **JT-02-07** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277008** | **JT-02-08** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277009** | **JT-02-09** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |
| **10274277010** | **JT-02-10** | SM 4500-P B | WETA/19299 | SM 4500-P E | WETA/19306 |



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# CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

RUSH

Page: 1 of 1

1735649

**Section A** Required Client Information:

Company: PARSONS
Address: 301 PLAINFIELD RD., STE 350
SYRACUSE, NY 13212
Email To: mohan.nayak@parsons.com
Phone: 315-552-9741 Fax:
Requested Due Date/TAT: 1-week 48 hrs

**Section B** Required Project Information:

Report To: TED SCHOENBERG
Copy To: MOHAN NAYAK
Purchase Order No.:
Project Name: FMC POCATELLO
Project Number: 448896

**Section C** Invoice Information:

Attention: TED SCHOENBERG
Company Name: PARSONS
Address: 301 PLAINFIELD RD., STE 350 SYRACUSE, NY 13212
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

**REGULATORY AGENCY**

☐ NPDES ☒ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: ID

Requested Analysis Filtered (Y/N): N

**Section D** Required Client Information

Matrix Codes MATRIX / CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

| ITEM # | SAMPLE ID | MATRIX CODE (see valid codes to left) | SAMPLE TYPE (G=GRAB C=COMP) | COLLECTED COMPOSITE START DATE | COLLECTED COMPOSITE START TIME | COLLECTED COMPOSITE END/GRAB DATE | COLLECTED COMPOSITE END/GRAB TIME | SAMPLE TEMP AT COLLECTION | # OF CONTAINERS | Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Methanol | Other | Analysis Test (Y/N) TOTAL ARSENIC | TOTAL PHOSPHORUS | TOTAL CHLORIDE | TOTAL FLUORIDE | Residual Chlorine (Y/N) | Pace Project No./ Lab I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | Y | Y | N | N | | |
| 1 | JT-02-01 | WW | G | 07/16/14 | 1:35PM | 07/16/14 | 1:35PM | | 2 | | 1 | 1 | | | | | | X | X | X | | | |
| 2 | JT-02-02 | WW | G | -"- | 1340 | -"- | 1340 | | 3 | | 1 | 1 | | | | | | X | X | X | X | | |
| 3 | JT-02-03 | WW | G | -"- | 1345 | -"- | 1345 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 4 | JT-02-04 | WW | G | -"- | 1350 | -"- | 1350 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 5 | JT-02-05 | WW | G | -"- | 1352 | -"- | 1352 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 6 | JT-02-06 | WW | G | -"- | 1353 | -"- | 1353 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 7 | JT-02-07 | WW | G | -"- | 1500 | -"- | 1500 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 8 | JT-02-08 | WW | G | -"- | 1505 | -"- | 1505 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 9 | JT-02-09 | WW | G | -"- | 1510 | -"- | 1510 | | 2 | | 1 | 1 | | | | | | X | X | | | | |
| 10 | JT-02-10 | WW | G | -"- | 1055 | -"- | 1055 | | 3 | 1 | 1 | 1 | | | | | | X | X | | X | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | |

| ADDITIONAL COMMENTS | RELINQUISHED BY / AFFILIATION | DATE | TIME | ACCEPTED BY / AFFILIATION | DATE | TIME | SAMPLE CONDITIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | CWS / pace | 7-17-14 | 940 | 0.7 | Y | Y | Y |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

ORIGINAL

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: MOHAN NAYAK

SIGNATURE of SAMPLER: Mohan L Nayak

DATE Signed (MM/DD/YY): 07/16/14

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

| Pace Analytical | Document Name: **Sample Condition Upon Receipt Form** | Document Revised: 28Feb2014 Page 1 of 1 |
|---|---|---|
| | Document No.: **F-MN-L-213-rev.09** | Issuing Authority: Pace Minnesota Quality Office |

**Sample Condition Upon Receipt**

**Client Name:** parsons

**Project #:** WO#: 10274277

10274277

**Courier:** ☑ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace ☐ SpeeDee ☐ Other:

**Tracking Number:** 6053 7223 4266

**Custody Seal on Cooler/Box Present?** ☑ Yes ☐ No **Seals Intact?** ☑ Yes ☐ No

**Optional:** Proj. Due Date: Proj. Name:

**Packing Material:** ☑ Bubble Wrap ☐ Bubble Bags ☐ None ☐ Other: **Temp Blank?** ☑ Yes ☐ No

**Thermom. Used:** ☐ B88A9130516413 ☑ B88A912167504 ☐ B88A9132521491 **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☐ Samples on ice, cooling process has begun

**Cooler Temp Read (°C):** 0.9 **Cooler Temp Corrected (°C):** 0.8 **Biological Tissue Frozen?** ☐ Yes ☐ No ☐ N/A

Temp should be above freezing to 6°C **Correction Factor:** 0.1 **Date and Initials of Person Examining Contents:** oms 7-17-14

| | | | | **Comments:** |
|---|---|---|---|---|
| Chain of Custody Present? | ☑ Yes | ☐ No | ☐ N/A | 1. |
| Chain of Custody Filled Out? | ☑ Yes | ☐ No | ☐ N/A | 2. |
| Chain of Custody Relinquished? | ☐ Yes | ☑ No | ☐ N/A | 3. |
| Sampler Name and/or Signature on COC? | ☑ Yes | ☐ No | ☐ N/A | 4. |
| Samples Arrived within Hold Time? | ☑ Yes | ☐ No | ☐ N/A | 5. |
| **Short Hold Time Analysis (<72 hr)?** | ☐ Yes | ☑ No | ☐ N/A | 6. |
| **Rush Turn Around Time Requested?** | ☑ Yes | ☐ No | ☐ N/A | 7. |
| Sufficient Volume? | ☑ Yes | ☐ No | ☐ N/A | 8. |
| Correct Containers Used? | ☑ Yes | ☐ No | ☐ N/A | 9. |
| -Pace Containers Used? | ☑ Yes | ☐ No | ☐ N/A | |
| Containers Intact? | ☑ Yes | ☐ No | ☐ N/A | 10. |
| Filtered Volume Received for Dissolved Tests? | ☐ Yes | ☑ No | ☐ N/A | 11. |
| Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT | ☑ Yes | ☐ No | ☐ N/A | 12. |
| All containers needing acid/base preservation have been checked? | ☑ Yes | ☐ No | ☐ N/A | 13. ☑ $HNO_3$ ☑ $H_2SO_4$ ☐ NaOH ☐ HCl |
| All containers needing preservation are found to be in compliance with EPA recommendation? ($HNO_3$, $H_2SO_4$, HCl<2; NaOH >9 Sulfide, NaOH>12 Cyanide) | ☑ Yes | ☐ No | ☐ N/A | Sample # 1-1 1-1 ~~3~~-01,2,3,4,5,6,7,8,9,10 |
| Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC | ☐ Yes | ☑ No | | Initial when completed:_____ Lot # of added preservative:_____ |
| Headspace in VOA Vials ( >6mm)? | ☐ Yes | ☐ No | ☑ N/A | 14. |
| Trip Blank Present? | ☐ Yes | ☐ No | ☑ N/A | 15. |
| Trip Blank Custody Seals Present? | ☐ Yes | ☐ No | ☑ N/A | |
| Pace Trip Blank Lot # (if purchased):_____ | | | | |

**CLIENT NOTIFICATION/RESOLUTION** **Field Data Required?** ☐ Yes ☐ No

Person Contacted: _____ Date/Time: _____

Comments/Resolution: _____

**Project Manager Review:** Karla Xiong **Date:** July 17, 2014

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office ( i.e out of hold, incorrect preservative, out of temp, incorrect containers)

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July 29, 2014

Mohan Nayak
Parsons
301 Plainfield Rd
STE 350
Syracuse, NY 13212

RE: Project: 448896 FMC Pocatello
Pace Project No.: 10275015

Dear Mohan Nayak:
Enclosed are the analytical results for sample(s) received by the laboratory on July 24, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Kabor Xiong

Kabor Xiong
kabor.xiong@pacelabs.com
Project Manager

Enclosures

cc: Ted Schoenberg, Parsons



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## CERTIFICATIONS

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

**Minnesota Certification IDs**
1700 Elm Street SE Suite 200, Minneapolis, MN 55414
A2LA Certification #: 2926.01
Alabama Certification #40770
Alabama Certification #40770
Alaska Certification #: UST-078
Alaska Certification #MN00064
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: 8TMS-L
Florida/NELAP Certification #: E87605
Guam Certification #: Pace
Georgia Certification #: 959
Idaho Certification #: MN00064
Hawaii Certification #MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Kentucky Dept of Envi. Protection - WW #:90062
Louisiana DEQ Certification #: 3086
Louisiana DHH #: LA140001
Maine Certification #: 2013011
Maryland Certification #: 322
Michigan DEPH Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT0092
Nebraska Certification #: Pace
New Jersey Certification #: MN-002
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Carolina State Public Health #: 27700
North Dakota Certification #: R-036
Ohio EPA #: 4150
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Saipan (CNMI) #:MP0003
South Carolina #:74003001
Texas Certification #: T104704192
Tennessee Certification #: 02818
Utah Certification #: MN000642013-4
Virginia DGS Certification #: 251
Virginia/VELAP Certification #: Pace
Washington Certification #: C486
Wisconsin Certification #: 999407970
West Virginia Certification #: 382
West Virginia TO-15 Approval
West Virginia DHHR #:9952C



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## SAMPLE SUMMARY

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

| Lab ID | Sample ID | Matrix | Date Collected | Date Received |
|---|---|---|---|---|
| **10275015001** | **TCLP-01** | Solid | 07/23/14 17:00 | 07/24/14 10:00 |



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## SAMPLE ANALYTE COUNT

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

| Lab ID | Sample ID | Method | Analysts | Analytes Reported | Laboratory |
|---|---|---|---|---|---|
| **10275015001** | **TCLP-01** | EPA 6010 | WBS | 7 | PASI-M |
| | | EPA 7470A | WBS | 1 | PASI-M |
| | | ASTM D2974 | CMS | 1 | PASI-M |



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# ANALYTICAL RESULTS

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

**Sample: TCLP-01** **Lab ID: 10275015001** Collected: 07/23/14 17:00 Received: 07/24/14 10:00 Matrix: Solid

***Results reported on a "dry-weight" basis***

| Parameters | Results | Units | Report Limit | DF | Prepared | Analyzed | CAS No. | Qual |
|---|---|---|---|---|---|---|---|---|
| **6010 MET ICP, TCLP** | Analytical Method: EPA 6010 Preparation Method: EPA 3010 | | | | | | | |
| | Leachate Method/Date: EPA 1311; 07/25/14 10:18 Initial pH: 7.4; Final pH: 1.41 | | | | | | | |
| Arsenic | ND | mg/L | 0.10 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7440-38-2 | |
| Barium | **0.58** | mg/L | 0.050 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7440-39-3 | |
| Cadmium | ND | mg/L | 0.015 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7440-43-9 | |
| Chromium | ND | mg/L | 0.050 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7440-47-3 | |
| Lead | ND | mg/L | 0.050 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7439-92-1 | |
| Selenium | ND | mg/L | 0.10 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7782-49-2 | |
| Silver | ND | mg/L | 0.050 | 1 | 07/25/14 12:08 | 07/28/14 15:17 | 7440-22-4 | |
| **7470 Mercury, TCLP** | Analytical Method: EPA 7470A Preparation Method: EPA 7470A | | | | | | | |
| | Leachate Method/Date: EPA 1311; 07/25/14 10:18 Initial pH: 7.4; Final pH: 1.41 | | | | | | | |
| Mercury | ND | ug/L | 0.60 | 1 | 07/25/14 12:50 | 07/29/14 10:16 | 7439-97-6 | |
| **Dry Weight** | Analytical Method: ASTM D2974 | | | | | | | |
| Percent Moisture | **99.4** | % | 0.10 | 1 | | 07/24/14 00:00 | | |



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# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

QC Batch: MERP/11138
QC Batch Method: EPA 7470A
Analysis Method: EPA 7470A
Analysis Description: 7470 Mercury TCLP
Associated Lab Samples: 10275015001

METHOD BLANK: 1742443
Matrix: Water
Associated Lab Samples: 10275015001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Mercury | ug/L | ND | 0.60 | 07/29/14 10:08 | |

METHOD BLANK: 1740924
Matrix: Water
Associated Lab Samples: 10275015001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Mercury | ug/L | ND | 0.60 | 07/29/14 10:12 | |

METHOD BLANK: 1740927
Matrix: Water
Associated Lab Samples: 10275015001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Mercury | ug/L | ND | 0.60 | 07/29/14 10:14 | |

LABORATORY CONTROL SAMPLE: 1742444

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Mercury | ug/L | 15 | 15.2 | 101 | 80-120 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1742445 1742446

| Parameter | Units | 10275015001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | ug/L | ND | 15 | 15 | 16.5 | 16.3 | 109 | 108 | 75-125 | 1 | 20 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**

## REPORT OF LABORATORY ANALYSIS

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# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

QC Batch: MPRP/47709
QC Batch Method: EPA 3010
Analysis Method: EPA 6010
Analysis Description: 6010 MET TCLP
Associated Lab Samples: 10275015001

METHOD BLANK: 1742462
Matrix: Water
Associated Lab Samples: 10275015001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Arsenic | mg/L | ND | 0.10 | 07/28/14 14:47 | |
| Barium | mg/L | ND | 0.050 | 07/28/14 14:47 | |
| Cadmium | mg/L | ND | 0.015 | 07/28/14 14:47 | |
| Chromium | mg/L | ND | 0.050 | 07/28/14 14:47 | |
| Lead | mg/L | ND | 0.050 | 07/28/14 14:47 | |
| Selenium | mg/L | ND | 0.10 | 07/28/14 14:47 | |
| Silver | mg/L | ND | 0.050 | 07/28/14 14:47 | |

METHOD BLANK: 1740924
Matrix: Water
Associated Lab Samples: 10275015001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Arsenic | mg/L | ND | 0.10 | 07/28/14 15:05 | |
| Barium | mg/L | ND | 0.050 | 07/28/14 15:05 | |
| Cadmium | mg/L | ND | 0.015 | 07/28/14 15:05 | |
| Chromium | mg/L | ND | 0.050 | 07/28/14 15:05 | |
| Lead | mg/L | ND | 0.050 | 07/28/14 15:05 | |
| Selenium | mg/L | ND | 0.10 | 07/28/14 15:05 | |
| Silver | mg/L | ND | 0.050 | 07/28/14 15:05 | |

METHOD BLANK: 1740927
Matrix: Water
Associated Lab Samples: 10275015001

| Parameter | Units | Blank Result | Reporting Limit | Analyzed | Qualifiers |
|---|---|---|---|---|---|
| Arsenic | mg/L | ND | 0.10 | 07/28/14 15:12 | |
| Barium | mg/L | ND | 0.050 | 07/28/14 15:12 | |
| Cadmium | mg/L | ND | 0.015 | 07/28/14 15:12 | |
| Chromium | mg/L | ND | 0.050 | 07/28/14 15:12 | |
| Lead | mg/L | ND | 0.050 | 07/28/14 15:12 | |
| Selenium | mg/L | ND | 0.10 | 07/28/14 15:12 | |
| Silver | mg/L | ND | 0.050 | 07/28/14 15:12 | |

LABORATORY CONTROL SAMPLE: 1742463

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Arsenic | mg/L | 5 | 5.0 | 100 | 80-120 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**

## REPORT OF LABORATORY ANALYSIS

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# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

LABORATORY CONTROL SAMPLE: 1742463

| Parameter | Units | Spike Conc. | LCS Result | LCS % Rec | % Rec Limits | Qualifiers |
|---|---|---|---|---|---|---|
| Barium | mg/L | 5 | 4.9 | 98 | 80-120 | |
| Cadmium | mg/L | 5 | 5.0 | 100 | 80-120 | |
| Chromium | mg/L | 5 | 4.9 | 97 | 80-120 | |
| Lead | mg/L | 5 | 4.7 | 95 | 80-120 | |
| Selenium | mg/L | 5 | 5.2 | 103 | 80-120 | |
| Silver | mg/L | 2.5 | 2.5 | 99 | 80-120 | |

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 1742464 1742465

| Parameter | Units | 10275015001 Result | MS Spike Conc. | MSD Spike Conc. | MS Result | MSD Result | MS % Rec | MSD % Rec | % Rec Limits | RPD | Max RPD | Qual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | mg/L | ND | 5 | 5 | 4.9 | 5.0 | 98 | 99 | 75-125 | 1 | 30 | |
| Barium | mg/L | 0.58 | 5 | 5 | 5.4 | 5.5 | 97 | 98 | 75-125 | 1 | 30 | |
| Cadmium | mg/L | ND | 5 | 5 | 4.9 | 4.9 | 98 | 98 | 75-125 | 0 | 30 | |
| Chromium | mg/L | ND | 5 | 5 | 4.8 | 4.8 | 96 | 96 | 75-125 | 0 | 30 | |
| Lead | mg/L | ND | 5 | 5 | 4.7 | 4.7 | 93 | 94 | 75-125 | 1 | 30 | |
| Selenium | mg/L | ND | 5 | 5 | 5.0 | 5.0 | 100 | 101 | 75-125 | 1 | 30 | |
| Silver | mg/L | ND | 2.5 | 2.5 | 2.4 | 2.4 | 97 | 98 | 75-125 | 1 | 30 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**



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Billings, MT 59101
(406)254-7226

# QUALITY CONTROL DATA

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

QC Batch: MPRP/47714
QC Batch Method: ASTM D2974
Analysis Method: ASTM D2974
Analysis Description: Dry Weight/Percent Moisture
Associated Lab Samples: 10275015001

SAMPLE DUPLICATE: 1741523

| Parameter | Units | 10274974001 Result | Dup Result | RPD | Max RPD | Qualifiers |
|---|---|---|---|---|---|---|
| Percent Moisture | % | 10.0 | 10.1 | 1 | 30 | |

SAMPLE DUPLICATE: 1741524

| Parameter | Units | 10274534005 Result | Dup Result | RPD | Max RPD | Qualifiers |
|---|---|---|---|---|---|---|
| Percent Moisture | % | 15.1 | 17.0 | 12 | 30 | |

**Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.**



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# QUALIFIERS

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

## DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

## LABORATORIES

PASI-M Pace Analytical Services - Minneapolis



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# QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 448896 FMC Pocatello
Pace Project No.: 10275015

| Lab ID | Sample ID | QC Batch Method | QC Batch | Analytical Method | Analytical Batch |
|---|---|---|---|---|---|
| **10275015001** | **TCLP-01** | EPA 3010 | MPRP/47709 | EPA 6010 | ICP/20311 |
| **10275015001** | **TCLP-01** | EPA 7470A | MERP/11138 | EPA 7470A | MERC/12809 |
| **10275015001** | **TCLP-01** | ASTM D2974 | MPRP/47714 | | |



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CMB 7.24.14

# CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

1027 ~~1192~~ BN 7/24/14

Page: of

1842467

**Section A** Required Client Information:

Company: Parsons
Address: 301 Plainfield Rd, Suite 350, Syracuse, NY 13212
Email To: mohan.nayak@parsons.com
Phone: (315) 552-9741 Fax:
Requested Due Date/TAT: 48hrs

**Section B** Required Project Information:

Report To: Ted Schoenberg
Copy To: Mohan Nayak, Kyle King
Purchase Order No.:
Project Name: FMC Pocatello
Project Number: 448896

**Section C** Invoice Information:

Attention: Ted Schoenberg
Company Name: Parsons
Address: 301 Plainfield Rd, Suite 350, Syr, NY
Pace Quote Reference:
Pace Project Manager:
Pace Profile #:

**REGULATORY AGENCY**

☐ NPDES ☒ GROUND WATER ☐ DRINKING WATER
☐ UST ☐ RCRA ☐ OTHER _____

Site Location STATE: ID

**Section D** Required Client Information

**SAMPLE ID** (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Matrix Codes MATRIX / CODE: Drinking Water DW; Water WT; Waste Water WW; Product P; Soil/Solid SL; Oil OL; Wipe WP; Air AR; Tissue TS; Other OT

Requested Analysis Filtered (Y/N): Y/N

| ITEM # | SAMPLE ID | MATRIX CODE (see valid codes to left) | SAMPLE TYPE (G=GRAB C=COMP) | COLLECTED Composite Start DATE | COLLECTED Composite Start TIME | COLLECTED Composite End/Grab DATE | COLLECTED Composite End/Grab TIME | SAMPLE TEMP AT COLLECTION | # OF CONTAINERS | Preservatives: Unpreserved | $H_2SO_4$ | $HNO_3$ | HCl | NaOH | $Na_2S_2O_3$ | Methanol | Other | Analysis Test: TCLP | Residual Chlorine (Y/N) | Pace Project No./ Lab I.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TCLP-01 | SL | G | 7/23/14 | 17:00 | 7/23/14 | 1700 | | | X | | | | | | | | | | 001 |
| 2 | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | |

| ADDITIONAL COMMENTS | RELINQUISHED BY / AFFILIATION | DATE | TIME | ACCEPTED BY / AFFILIATION | DATE | TIME | SAMPLE CONDITIONS | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Pace | 7/24/14 | 1000 | 2.0 | Y | n | Y |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

ORIGINAL

**SAMPLER NAME AND SIGNATURE**

PRINT Name of SAMPLER: Kyle King

SIGNATURE of SAMPLER: [signature] DATE Signed (MM/DD/YY): 7/23/14

Temp in °C | Received on Ice (Y/N) | Custody Sealed Cooler (Y/N) | Samples Intact (Y/N)

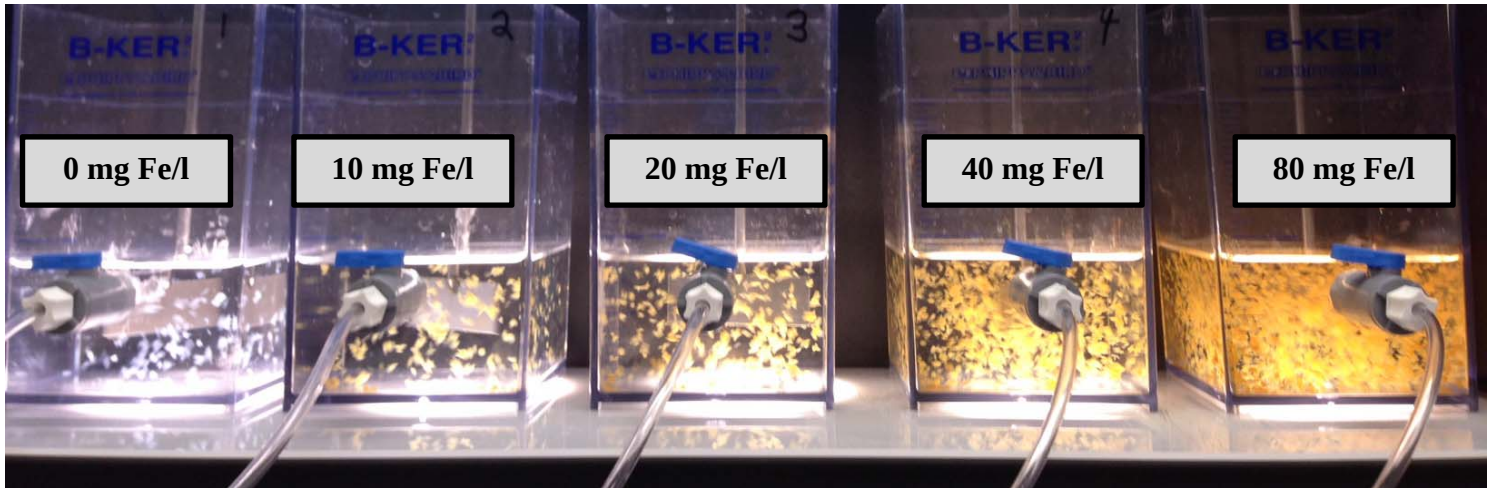
*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

F-ALL-Q-020rev.07, 15-May-2007

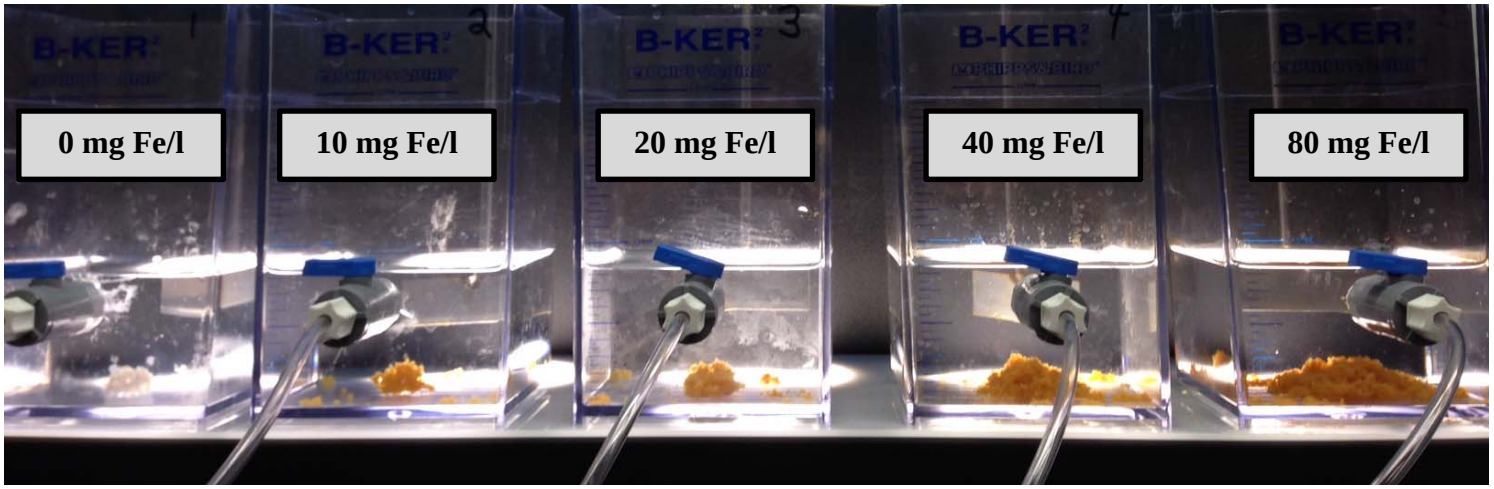
# Attachment F

# Bench-Scale Testing Photographs

**Floc Formation during Slow Mixing**
(1 mg/L anionic polymer added to all jars)




**Settled Sludge after 30 Minute Settling Period**



# APPENDIX C

## Calculations and General Design Criteria

# APPENDIX C-1

## Groundwater Treatment Process Calculations

| | | | |
|---|---|---|---|
| Client: | FMC | Job No.: | 10505612 |
| Project: | EMF 30% GW RD | Date: | 9/29/2014 |
| Description: | Preliminary Treatment Process Design | Calculated By: | B.Sick |
| Detail: | Chemical Dosing and Mass Balance Calculations | Updated Date: | 1/26/2015 |
| | | Updated By: | A. Boguslavsky |
| | | Checked By: | C. Tomlinson |

**Purpose:**

Calculate the required chemical feed and consumption rates, alkalinity consumption, sludge generation, and mass balance of solids through the coagulation/flocculation treatment process and the solids dewatering process.

**Treatment Parameters:**

Treatment Flow: 600 gpm = 0.86 MGD
Flow will be processed through a single DensaDeg train (coag/floc/sedimentation, with a design flow of 600 gpm

Coagulant Type: Ferric Chloride ($FeCl_3$)
Coagulant Dose: 80 mg/L as $FeCl_3$ = 27.5 mg/L as Fe

Flocculant Polymer Type: Anionic
Flocculant Polymer Dose: 1 mg/L Flocculation polymer and dose to be optimized at plant startup

**Calculate ferric chloride feed dose rate and consumption**

**Assumptions:**

Bulk Coag.: 40% Ferric Chloride Solution (% weight)
Spec. Gravity of Bulk Coag.: 1.45

**Chemical Feed Rate:**

Conc. of Bulk Coag: 580 g FeCl3/L
Mass input of Coagulant: 182 g FeCl3/min = 261.6 kg/day

Overall Feed Rate: 313 mL/min = 451 L/day
Daily Rate of Consumption: 119 gal 40% ferric solution/day 34 days per 4,000 gallon load

Feed Rate: 313 mL/min

**Calculate alkalinity consumption due to addition of ferric chloride**

**Assumptions:**

Alkalinity of Raw Water: 300 mg/L as CaCO3

Overall reaction for addition of ferric chloride is: $FeCl_3 + 3H_2O \rightarrow Fe(OH)_{3\downarrow} + 3H^+ + 3Cl^-$

1 mol of alkalinity is consumed per 1 mol of HCl added

**Alkalinity Consumption:**

Alk Consumption: 74 mg/L as CaCO3
Alk Remaining: 226 mg/L as CaCO3 (Sufficient alkalinity remaining)

**Calculate flocculation polymer feed rate**

**Assumptions:**

Liquid solution floc polymer: 5% Concentration
Dilution: 4% (4 parts liquid solution polymer to 96 parts dilution water)
Volume of tote: 275 gallons

**Poly flow and consumption:**

Dry polymer required: 7.2 lbs/day (dry) (1 mg/L at 600 gpm, assuming SG = 1)
Poly conc after dilution: 0.2%
Dilute poly flow @ 600 gpm: 432 gpd = 18.0 gph = 1134.7 mL/min
Liquid solution flow @ 600 gpm: 17.3 gpd = 0.7 gph = 45.4 mL/min
Dilution water flow @ 600 gpm: 414 gpd = 17.3 gph = 1089 mL/min

Rate of conc poly consumption: 17 gpd = 16 days/tote (@ 600 gpm)

**Calculate solids generation**

**Assumptions:**

1 mol of ferric hydroxide generated per 1 mol of FeCl3 added, per the chemical reaction above
TS of Raw Water: 20 mg/L 144 lbs/day
TS of Clarified Water: 5 mg/L 36 lbs/day

**Amount of dry sludge produced:**

| | | | | |
|---|---|---|---|---|
| Fe Precipitate Generation: | 52.7 mg/L | $Fe(OH)_3$ | 380 lbs/day | |
| + TS removal | 15.0 mg/L | TSS | 108 lbs/day | |
| + Floc Polymer Addition | 1.0 mg/L | Polymer | 7 lbs/day | |
| **Total Solids Generated (Dry):** | 68.7 mg/L | | 495 lbs/day | (Dry) |

(Note: 68.5 mg/L dry sludge generated during bench-top treatability study)

## Calculate mass flow of solids

**Assumptions:**

| | | |
|---|---|---|
| Assumed SG of dry sludge: | 1.5 | (iron sludge typically has a dry density of 1200 to 1800 kg/m3; Crittenden et al, Table 21-5) |
| % Solids post-clarifiers: | 3% | |
| % Solids post-Belt Press | 20% | |
| Neglect added mass of sludge conditioning polymer | | |

**Mass flow of sludge through system:**

SG of Sludge Slurry = 1/(%water+(%solids/SG of dry solids))

$Q_A$ * %$Solids_A$ * $S.G._A$ = $Q_B$ * %$Solids_B$ * $S.G._B$

**Solids Mass Flow Calculations for Process Streams**

| Flow Stream | Percent Solids | S.G. of Sludge Slurry | Density of Slurry (lb /gal.) | Total Dry Solids (lb/min) | Solids Slurry Mass Flow (lb/min) | Flow (gpm) | Flow (gpd) |
|---|---|---|---|---|---|---|---|
| Post Coagulation, Pre Settle | 0.0069% | 1.000 | 8.34 | 0.34 | **-** | **600** | **-** |
| Post Clarifier | 3.0% | 1.010 | 8.42 | 0.34 | **11.46** | **1.36** | **1,959** |
| Post Belt Filter Press | 20.0% | 1.071 | 8.94 | 0.34 | **1.72** | **0.19** | **277** |

## Calculate sludge holding tank fill time

**Assumptions:**

Volume of sludge tank: 6,000 gal

**Time to fill sludge holding tank:**

| | | |
|---|---|---|
| Time to fill tank: | 3.1 | days |
| Dry Solids per tank: | 1516 | lbs |

One 6,000 gallon tank allows for adequate storage of sludge over 2-day period of no dewatering operations (e.g., weekend or holiday)

## Calculate belt press feed rate and run time to process one sludge holding tank

**Assumptions (based on Ashbrook Klampress KP05 spec):**

| | | | |
|---|---|---|---|
| Sludge throughput: | 250 | lbs dry solids/hr | (200 - 500 acceptable, per spec) |
| Hydraulic capacity: | 15 - 50 | gpm | |
| Polymer consumption: | 8 | lbs active polymer/ton of dry solid | (6 - 10 expected) |

**Time and flow rate to process a full tank of solids:**

| | | | |
|---|---|---|---|
| Time to process one tank: | 6.07 | hrs | |
| Flow rate to belt press: | 16.5 | gpm | |
| lbs Active polymer: | 1.98 | lbs active polymer/day | (sludge conditioning polymer; Polymer 'B') |

## Calculate volume of dewatered sludge and frequency of truck unloading

**Assumptions:**

Solids unloaded directly from belt press to truck until truck is 80% full, then truck is unloaded at landfill

| | | | | | |
|---|---|---|---|---|---|
| Volume of truck: | 8 | yd3 | = | 10.1 tons | (Single axle dump truck) |
| Wet cake density: | 90 | lbs/ft3 | | | |

**Timing for unloading truck to the landfill:**

| | | | | | |
|---|---|---|---|---|---|
| Weight of solids/day: | 2,476 | lb/day | @ | 20.0% | solids |
| Volume of solids/day: | 27.5 | ft3/day | = | 1.02 | yd3 |
| Days/truck (weight): | 8.2 | days | | | |
| Days/truck (volume): | 7.9 | days | | | |
| Truck reaches 80% capacity: | 6.3 | days | | | |

# APPENDIX C-2

## Architectural Design Criteria

## ARCHITECTURAL DESIGN CRITERIA

## GENERAL

The WTF will consist of a pre-engineered metal building divided into two areas. The Process Area will house the treatment equipment including the blending tank, coagulation/flocculation system, sludge dewatering system (tanks and filter press), effluent tank, ferric chloride tank, polymer totes and maintenance area. The Administration Area will house MCC for the treatment system as well as restroom and small janitor/storage room on the ground floor. The control room will be located on the mezzanine level.

Detailed Design Criteria and Building Layout related to the WTF building is provided on the Architectural Drawings presented in Appendix B.

### APPLICABLE CODES

2012 International Building Code (IBC) with ID amendments
2009 International Energy Code (IEC) with ID amendments
2012 International Fire Code (IFC) with ID amendments
2009 International Mechanical Code (IMC) with ID amendments
2009 Uniform Plumbing Code (UPC) with ID amendments
2014 National Electrical Code – NFPA 70 (NEC) with ID amendments

### BUILDING CODE EVALUATION

**BUILDING HEIGHTS (IBC Table 503)**
Allowable Height: 55 ft., 2 stories
Actual Height: 34 ft., 1 story + mezzanine

**BUILDING AREA (IBC Table 503)**

| | |
|---|---|
| Group F-1 Moderate Hazard Factory Industrial Occupancy | 4847 s.f. |
| Group B Business (Ground Floor) | 185 s.f. |
| (Group B on Mezzanine | 193 s.f.) |
| Gross Area (Ground Floor) | 5032 s.f. |

**Allowable Area (IBC Table 503):**

| | |
|---|---|
| F-1 | 15,500 s.f. |
| B | 23,000 s.f. |

**Sum of Ratios (IBC 508.3.3.2):**
4847/15,500+185/23,000 =.32 < 1.0 OK

**CONSTRUCTION (IBC Chapter 6)**

| | |
|---|---|
| Type II-B | Non-Rated |
| Structural Wall | Non-Rated |
| Walls and Partitions | Non-Rated |
| Floors | Non-Rated |
| Roof | Non-Rated |

## FIRE RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION (IBC Chapter 6 – Table 602)

| FIRE SEPARATION DISTANCE = X (feet) | TYPE OF CONSTRUCTION | OCCUPANCY GROUP H[f] | OCCUPANCY GROUP F-1, M, S-1[g] | OCCUPANCY GROUP A, B, E, F-2, I, R, S-2[g], U[b] |
|---|---|---|---|---|
| X<5 | IIB | 3 | 2 | 1 |
| 5<X<10 | IIB | 2 | 1 | 1 |
| 10 < X <30 | IIB | 2 | 1 | 1[d] |
| X > 30 | IIB | 0 | 0 | 0 |

## FIRE PROTECTION SYSTEMS (IBC Chapter 9)

Automatic sprinkler not required.
Portable Fire Extinguishers provided within 75 feet of any point within the building. (NFPA 10)

## EXIT OCCUPANT LOAD (IBC Chapter 10)

Process Area: 4847/300 (space function – mechanical equipment) = 17 Occupants
Administration Area: 378/100 (space function – business/industrial) = 4 Occupants

## ACCESSIBILITY (IBC Chapter 11)

The Water Treatment Facility is exempt from Americans with Disabilities Act (ADA) based on ADA Accessibility Guidelines for Buildings and Facilities, 2004 and amended 2005, Part I, Chapter 2, Section 203 General Exceptions: “203.5 Machinery Spaces. Spaces frequented only by service personnel for maintenance, repair, or occasional monitoring of equipment shall not be required to comply with these requirements or to be on an accessible route. Machinery spaces include, but are not limited to, elevator pits or elevator penthouses; mechanical, electrical or communications equipment rooms; piping or equipment catwalks; water or sewage treatment pump rooms and stations; electric substations and transformer vaults; and highway and tunnel utility facilities.” and ICC/ANSI 117.1 – 2003: “Except for regular monitoring and maintenance of equipment, the above building is not intended for human occupancy for extended periods of time. The primary purpose of the above buildings is to house processing equipment for water conveyance.”

# APPENDIX C-3

## Structural Design Criteria

**Client:** FMC

**Project:** Groundwater Treatment System Design

**Date:** October 26, 2014 **Job Number:** 10505612

**PM, Office, Department:** Chad Tomlinson

## LOADING

**Live loads:**

| | | |
|---|---|---|
| Top Slabs: | 20 psf | |
| Roof: | 20 psf | |
| Platforms & Stairs: | 100 psf | 300 lbs concentrated on stair tread |

**Monorail loads:**

Live Load: 2 Kips

Monorail shall align with the centerline of each Densedeg Tank, spanning between Grid 2 and Grid 6 (approx. 80-ft each)

**Snow:**

| | | | | |
|---|---|---|---|---|
| Ground Snow Load ($P_g$): | 45 psf | | | |
| Exposure Factor ($C_e$): | 1.0 | | | |
| Thermal Factor ($C_t$): | 1.0 | | | |
| Rain-on-Snow Surcharge: | ☐ Yes | ☒ No | | |
| Ponding Instability: | ☐ Yes | ☒ No | | |
| Drifts: | ☒ Yes | ☐ No | | |
| Roof Projections: | ☒ Yes | ☐ No | | |
| Sliding Snow: | ☒ Yes | ☐ No | | |
| Importance Factor ($I_s$): | ☐ 1.0 | ☐ 1.1 | ☒ 1.2 | ☐ 0.8 |

**Seismic:**

| | | | |
|---|---|---|---|
| Site Class: | D | | |
| Mapped Spectral Response Acceleration at Short Periods (0.2 sec) - 5% Damping ($S_S$): | 0.432g | | |
| Mapped Spectral Response Acceleration at 1 second period - 5% damping ($S_1$): | 0.144g | | |
| Occupancy Category: | III | | |
| Seismic Design Category: | C | | |
| Importance Factor ($I_e$): | ☐ 1.50 | ☐ 1.25 | ☐ 1.00 |
| Seismic Q/A Plan Required? | ☐ Yes | ☒ No | |

**Client:** FMC

**Project:** Groundwater Treatment System Design

| | | | | |
|---|---|---|---|---|
| | Structural Observations Required? | [X] Yes | [ ] No | |
| **Rain Loads:** | | [ ] Yes | [X] No | |
| **Wind:** | Base Wind Speed - 3 Second Gust ($V_{3S}$): | 90 mph | | |
| | Fastest Mile Wind Velocity ($V_{fm}$) : | Xxxx mph | | |
| | Exposure Category: | C | | |
| | Importance Factor ($I_w$): | [X] 1.15 | [ ] 1.00 | [ ] 0.87 |
| | Hurricane Prone Region? | [ ] Yes | [X] No | |
| | Wind-Born Debris Region? | [ ] Yes | [X] No | |
| | Structural Observations Required? | [X] Yes | [ ] No | |
| | Wind Q/A Plan Required? | [ ] Yes | [X] No | |
| **Flood Loads:** | Base Flood Elevation: | TBD | | |
| | Design Flood Elevation: | TBD | | |
| | High Velocity Wave Action? | [ ] Yes | [X] No | |
| | Special Flood Hazard Area? | [ ] Yes | [X] No | |

## GEOTECHNICAL INFORMATION **All Information is Pending a Geotechnical Evaluation.**

| | | |
|---|---|---|
| **Allowable Bearing Pressure:** | All Loads (w/ wind & seismic): | xxxx psf |
| | Dead plus Live Loads: | xxxx psf |
| **Groundwater Elevation:** | 100 Year Flood Elevation: | xxxx.xx |
| **Friction Factor:** | | xxxx |
| **Soil Weight:** | Moist Weight | xxxx pcf |
| | Buoyant Weight | xxxx pcf |
| **Frost Depth:** | | 30 inches |
| **Minimum Footing Width:** | | xxxx inches |

**Client:** FMC

**Project:** Groundwater Treatment System Design

**Lateral Soil Pressure**

| | Above GW | Below GW |
|---|---|---|
| Restrained (At Rest): | xxxx pcf | xxxx pcf |
| Unrestrained (Active): | xxxx pcf | xxxx pcf |
| Passive: | xxxx pcf | xxxx pcf |
| Seismic: | xxxx pcf | xxxx pcf |
| Traffic Surcharge: | xxxx pcf | xxxx pcf |

**Other Soil Info:**

## STRUCTURAL MATERIALS:

**Concrete:**
4000 psi - STRUCTURAL (all structural applications)
3000 psi - SITEWORK (curb, gutter, and civil applications)

**Concrete Coatings:**
Ferric Chloride Containment Sump shall receive polyurethane sealant or equivalent sealing compound for protection from ferric chloride

3000 psi -

**Reinforcing:**
Grade 60 - all applications.

**Steel:**
Structural Tubing - ASTM A500, Grade B
Structural Pipe - ASTM A53, Grade B
Wide Flange Shapes - ASTM A992
Other Standard Shapes and Plates - ASTM A36.

**Stainless Steel:**
Type 304 - Architectural and common uses, and anaerobic conditions
Type 316 - Submerged or corrosive areas.

**Aluminum:**
6061-T6 - All applications.

**Wood:**
Stop Logs, Weirs, and baffles - Sawn Lumber - Redwood Construction Grade (Heart)
Building Materials - Sawn Lumber - Douglas Fir/Larch
Glulam - 24F - V3 - V8 (DF/DF)

**Masonry:**
ASTM C 90

- [ ] Light Weight (< 105 pcf)
- [X] Medium Weight (105 to < 125 pcf)
- [ ] Normal Weight ( 125 pcf or more)

Special Inspection: [X] Level 1 [ ] Level 2

Solid Grouted: [X] Yes [ ] No

Grout: 2000 psi

**Client:** FMC

**Project:** Groundwater Treatment System Design

| | |
|---|---|
| Mortar: | Type S - 1800 psi |
| Size: | 16" x 8" x 8" high CMU |
| f'm: | 1500 psi |

**Gaskets:** Neoprene

**Waterstops:** New Construction - PVC MWH standard shapes
Concrete joints at new structure/existing pipes - Preformed Plastic

**Other:**

## WEIGHTS OF MATERIALS:

| | |
|---|---|
| **Concrete:** | 150 pcf |
| **Steel:** | 490 pcf |
| **Aluminum:** | 170 pcf |
| **Fiberglass:** | 110 pcf |

## SAFETY FACTORS

| | |
|---|---|
| **TBD** | TBD |
| **Overturning:** | TBD |
| **Sliding:** | TBD |

## SPECIAL INSPECTIONS:

**Client:** FMC

**Project:** Groundwater Treatment System Design

| Inspections | Required | |
|---|---|---|
| | Yes | No |
| Structural Steel Construction | X | |
| Welding | X | |
| Bolting | X | |
| Cold Formed Steel Framing | | X |
| Concrete | X | |
| Reinforcing Steel | X | |
| Grout | | X |
| Adhesive Anchors/Drilled Anchors | X | |
| Masonry (Level X) | X | |
| Wood Construction | | X |
| Insulating Concrete Fill | | X |
| Sprayed-on Fireproofing | | X |
| Smoke Control | | X |
| Grading & Fill Material | | X |
| Pile / Pier Foundations | | X |
| Wall Panels and Veneers | | X |
| Exterior Insulation and Finish Systems (EIFS) | | X |
| Mechanical and Electrical Components | | X |
| Other | | X |

## OTHER:

**xxx** xxx
**xxx** xxx
**xxx** xxx
**xxx** xxx

## DESIGN CALCULATIONS, METHODS, AND ASSUMPTIONS:

Calculations will be done in accordance with MWH Project Procedure Directive No. 20. A table of contents shall be included for each set of calculations greater than five sheets long. Half size plots shall be included at the front of each set of calculations.

All structures will be designed in accordance with sound engineering principles based on the references listed below. Hydraulic concrete structures designed by ultimate strength will utilize additional sanitary durability coefficients as stated in ACI 350. A load factor of 1.7 will be used for all service live and dead loads, durability factor of 1.3 for flexure and 1.65 for direct tension reinforcing and reinforcing design will consider the effects of cracking by limiting z to <= 95 for service loads. Durability factor and cracking need not be considered for seismic loads.

### DESIGN REFERENCES:

**ACI-318/02** Building Code Requirements for Reinforced Concrete

**Client:** FMC

**Project:** Groundwater Treatment System Design

| | |
|---|---|
| **ACI-350R/02** | Environmental Engineering Concrete Structures |
| **ACI 530** | Building Code Requirements for Masonry Structures |
| **ACI 530.1** | Specifications for Masonry Structures |
| **ASCE 3** | Composite Slabs |
| **AISC** | Manual of Steel Construction |
| **AISI** | AISI Specification for the Design of Cold-formed Steel Structural Members |
| **AA** | Aluminum Association - aluminum design Manual |
| **NDS** | National Design Specification (NDS) for Wood Construction, Including Supplements |
| **PS-20** | American Softwood Lumber Standard |
| **PS-1** | Softwood Plywood - Construction and Industrial |
| **AITC A 190.1** | American National Standard for Wood Products - Structural Glued Laminated Timbers |
| **MWH** | Design Quality Procedures Database (DQP) |
| **Moody** | Moments and Reactions for Rectangular Plates - Engineering Monograph No. 27 |
| | USBR - W.T. Moody - Reprinted 1986 |
| **2000 IBC** | International Code Committee (ICC) - International Building Code |
| **ASCE-7/02** | Minimum Design Loads For Buildings and Other Structures |

**Local City/County Amendments to the Building Code**

# APPENDIX C-4

## Electrical Load List

**FMC Groundwater Treatment Plant**

**Electrical Load Estimate - 480VAC, 3 Phase**

By: John C. Deerkop

MWH

Revised: 1/06/2015

| ROW No. | EQUIPMENT DESCRIPTION | EQUIPMENT TYPE | TAG No. | LOOP No. | DWG No. | RATING | (HP) (kW) | LOOK-UP TABLE LOAD FACTOR | LOAD EFFIC-IENCY (%) | LOAD POWER FACTOR (%) | CONNECTED LOAD (kW) | **CONNECTED LOAD (kVA)** | **CONNECTED AMPS (A)** | **VFD(V), LINE(L) OR RVSS(S)** | STARTER EFFIC-IENCY (%) | STARTING INRUSH MULTIPLIER (%) | STARTING POWER FACTOR (%) ? | STARTING LOAD (kW) | STARTING LOAD (kVA) | STARTING AMPS (A) | COULD BE RUNNING AT ONE TIME (Y) | RUNNING LOAD (kW) | RUNNING LOAD (kVA) | RUNNING AMPS (A) | NEC DEMAND FACTOR (%) | DEMAND LOAD (kW) | DEMAND LOAD (kVA) | DEMAND AMPS (A) | RUNNING ON GENSET (Y) | DEMAND GENSET LOAD (kW) | DEMAND GENSET LOAD (kVA) | DEMAND GENSET AMPS (A) | LAST LOAD STARTED ON GENSET (Y) | STARTING GENSET LOAD (kW) | STARTING GENSET LOAD (kVA) | STARTING GENSET AMPS (A) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Pump, well - 1, feeder breaker | Pump, submersible, ___rpm | P-001 | 001 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 3 | Pump, well - 2, feeder breaker | Pump, submersible, ___rpm | P-002 | 002 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 4 | Pump, well - 3, feeder breaker | Pump, submersible, ___rpm | P-003 | 003 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 5 | Pump, well - 4, feeder breaker | Pump, submersible, ___rpm | P-004 | 004 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 6 | Pump, well - 5, feeder breaker | Pump, submersible, ___rpm | P-005 | 005 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 7 | Pump, well - 6, feeder breaker | Pump, submersible, ___rpm | P-006 | 006 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 8 | Pump, well - 7, feeder breaker | Pump, submersible, ___rpm | P-007 | 007 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 9 | Pump, well - 8, feeder breaker | Pump, submersible, ___rpm | P-008 | 008 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 10 | Pump, well - 9, feeder breaker | Pump, submersible, ___rpm | P-009 | 009 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 11 | Pump, well - 10, feeder breaker | Pump, submersible, ___rpm | P-010 | 010 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 12 | Pump, well - 11, feeder breaker | Pump, submersible, ___rpm | P-011 | 011 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **V** | 95 | 300 | 95 | 12.0 | 12.6 | 15.2 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | Mixer, DensaDeg | Mixer, vertical, ___rpm | MX-111 | 111 | | 1 | HP | 100 | 82.5 | 77.6 | 0.8 | 1.7 | 2.1 | **V** | 95 | 300 | 95 | 2.4 | 2.5 | 3.0 | Y | 0.8 | 1.7 | 2.1 | 125 | 0.9 | 2.1 | 2.6 | | | | | | | | |
| 15 | Flocculator, DensaDeg | Mixer, vertical, ___rpm | MX-112 | 112 | | 1.5 | HP | 100 | 84.0 | 77.6 | 1.2 | 2.4 | 3.0 | **V** | 95 | 300 | 95 | 3.8 | 4.0 | 4.8 | Y | 1.2 | 2.4 | 3.0 | 125 | 1.5 | 3.0 | 3.8 | | | | | | | | |
| 16 | Clarifier, DensaDeg | Clarifier, vertical, ___rpm | CL-113 | 113 | | 0.5 | HP | 100 | 72.0 | 58.4 | 0.4 | 0.9 | 1.1 | **V** | 95 | 300 | 95 | 1.2 | 1.2 | 1.5 | Y | 0.4 | 0.9 | 1.1 | 125 | 0.5 | 1.1 | 1.4 | | | | | | | | |
| 17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | Pump, sludge, blowdown | Pump, progressive cavity, ___rpm | P-131 | 131 | | 3 | HP | 100 | 82.5 | 77.1 | 2.3 | 3.9 | 4.8 | **S** | 97 | 300 | 46 | 7.1 | 15.4 | 18.5 | Y | 2.3 | 3.9 | 4.8 | 125 | 2.9 | 4.9 | 6.0 | | | | | | | | |
| 19 | Pump, sludge, recycle | Pump, progressive cavity, ___rpm | P-141 | 141 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **S** | 97 | 300 | 46 | 11.8 | 25.7 | 31.0 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 20 | Pump, sludge, spare | Pump, progressive cavity, ___rpm | P-143 | 151 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **S** | 97 | 300 | 46 | 11.8 | 25.7 | 31.0 | N | | | | 125 | | | | | | | | | | |
| 21 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | Mixer, sludge tank | Mixer, vertical, ___rpm | MX-301 | 301 | | 2 | HP | 100 | 82.5 | 76.4 | 1.5 | 2.8 | 3.4 | **V** | 95 | 300 | 95 | 4.7 | 5.0 | 6.0 | Y | 1.5 | 2.8 | 3.4 | 125 | 1.9 | 3.5 | 4.3 | | | | | | | | |
| 23 | Filter press, sludge, feeder breaker | Filter press, package, 30 amp | ME-320 | 320 | | 25 | kW | 100 | 80.0 | 80.0 | 25.0 | 31.3 | 24.1 | **V** | 95 | 125 | 80 | 32.9 | 41.1 | 49.5 | Y | 25.0 | 31.3 | 24.1 | 125 | 31.3 | 39.1 | 30.1 | | | | | | | | |
| 24 | Conveyor, sludge, feeder breaker | Sludge Conveyor, package, __ amp | ME-320 | 340 | | 9 | kW | 100 | 80.0 | 80.0 | 9.0 | 11.3 | 8.7 | **V** | 95 | 125 | 80 | 11.8 | 14.8 | 17.8 | Y | 9.0 | 11.3 | 8.7 | 125 | 11.3 | 14.1 | 10.8 | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | Pump, submersible, sump - 1 | Pump, submersible, ___rpm | P-331 | 331 | | 1 | HP | 100 | 82.5 | 77.6 | 0.8 | 1.7 | 2.1 | **V** | 95 | 300 | 95 | 2.4 | 2.5 | 3.0 | Y | 0.8 | 1.7 | 2.1 | 125 | 0.9 | 2.1 | 2.6 | | | | | | | | |
| 27 | Pump, submersible, sump - 2 | Pump, submersible, ___rpm | P-332 | 332 | | 1 | HP | 100 | 82.5 | 77.6 | 0.8 | 1.7 | 2.1 | **V** | 95 | 300 | 95 | 2.4 | 2.5 | 3.0 | N | | | | 125 | | | | | | | | | | |
| 28 | Pump, utility water | Pump, centrifugal, ___rpm | P-901 | 901 | | 5 | HP | 100 | 85.5 | 76.1 | 3.8 | 6.1 | 7.6 | **S** | 97 | 300 | 46 | 11.8 | 25.7 | 31.0 | Y | 3.8 | 6.1 | 7.6 | 125 | 4.8 | 7.6 | 9.5 | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | Heater, water, safety shower | Water heater, on demand | ME-911 | 911 | | 72 | kW | 100 | 100.0 | 100.0 | 72.0 | 72.0 | 86.6 | **S** | 97 | 125 | 100 | 92.8 | 92.8 | 111.6 | Y | 72.0 | 72.0 | 86.6 | 125 | 90.0 | 90.0 | 108.3 | Y | 90.0 | 90.0 | 108.3 | Y | 92.8 | 92.8 | 111.6 |
| 31 | Heater, water, safety shower | Water heater, on demand | ME-912 | 912 | | 72 | kW | 100 | 100.0 | 100.0 | 72.0 | 72.0 | 86.6 | **S** | 97 | 125 | 100 | 92.8 | 92.8 | 111.6 | Y | 72.0 | 72.0 | 86.6 | 125 | 90.0 | 90.0 | 108.3 | Y | 90.0 | 90.0 | 108.3 | | 90.0 | 90.0 | 108.3 |
| 32 | Heater, water, safety shower | Water heater, on demand | ME-913 | 913 | | 72 | kW | 100 | 100.0 | 100.0 | 72.0 | 72.0 | 86.6 | **S** | 97 | 125 | 100 | 92.8 | 92.8 | 111.6 | N | | | | 125 | | | | Y | | | | | | | |
| 33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 34 | Spare feeder breaker | | | | | 10 | kW | 100 | 80.0 | 80.0 | 10.0 | 12.5 | 9.6 | **V** | 95 | 125 | 80 | 13.2 | 16.4 | 19.8 | Y | 10.0 | 12.5 | 9.6 | 125 | 12.5 | 15.6 | 12.0 | | | | | | | | |
| 35 | Heater, unit, treatment plant - 1 | Includes thermostat | UH-901 | 901 | | 10 | kW | 100 | 100.0 | 100.0 | 10.0 | 10.0 | 12.0 | **V** | 95 | 125 | 100 | 13.2 | 13.2 | 15.8 | Y | 10.0 | 10.0 | 12.0 | 125 | 12.5 | 12.5 | 15.0 | Y | 12.5 | 12.5 | 15.0 | | 12.5 | 12.5 | 15.0 |
| 36 | Heater, unit, treatment plant - 2 | Includes thermostat | UH-902 | 902 | | 10 | kW | 100 | 100.0 | 100.0 | 10.0 | 10.0 | 12.0 | **V** | 95 | 125 | 100 | 13.2 | 13.2 | 15.8 | Y | 10.0 | 10.0 | 12.0 | 125 | 12.5 | 12.5 | 15.0 | Y | 12.5 | 12.5 | 15.0 | | 12.5 | 12.5 | 15.0 |
| 37 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 38 | 120/208v 3ph Transformer - 30kVA | For admin area loads | T-092 | 092 | | 30 | kVA | 100 | 100.0 | 100.0 | 30.0 | 30.0 | 36.1 | **L** | 99 | 125 | 100 | 37.9 | 37.9 | 45.6 | Y | 30.0 | 30.0 | 36.1 | 125 | 37.5 | 37.5 | 45.1 | Y | 37.5 | 37.5 | 45.1 | | 37.5 | 37.5 | 45.1 |
| 39 | Lighting Panelboard, 3ph, 42 ckt | For admin area loads | LP-092 | 092 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 120/208v 3ph Transformer - 15kVA | For Treatment Plant loads | T-093 | 093 | | 15 | kVA | 100 | 100.0 | 100.0 | 15.0 | 15.0 | 18.0 | **L** | 99 | 125 | 100 | 18.9 | 18.9 | 22.8 | Y | 15.0 | 15.0 | 18.0 | 125 | 18.8 | 18.8 | 22.6 | Y | 18.8 | 18.8 | 22.6 | | 18.8 | 18.8 | 22.6 |
| 41 | Lighting Panelboard, 3ph, 42 ckt | For Treatment Plant loads | LP-093 | 093 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 42 | Breaker,main | | CB-091 | 091 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 43 | Surge Protection Device, 208v 3ph | | SPD-091 | 091 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 44 | | | | | | **405** | | | | | 385.8 | **436.4** | **505.3** | 125% | **631.7** | | | 610.6 | **683.1** | **821.6** | | 309.3 | **356.6** | **409.0** | | 386.6 | **445.8** | **511.3** | | **261.3** | **261.3** | 314.2 | | **264.0** | **264.0** | 317.6 |
| 45 | | | | | | | | | | | | | 524.9 | | | | | | | 821.6 | | | | 428.9 | | | | 536.2 | | | | 314.2 | | | 330.0 | 317.6 |
| 46 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 47 | | | | | | **405** | **HP/kV** | **Total connected loads** | | | **TOTAL CONNECTED LOAD** | | | | | | | | | | | **PEAK LOAD FOR** | | | | **USED PER NEC** | | | | **PEAK LOAD FOR** | | | | **PEAK STARTING LOAD FOR** | | |
| 48 | | | | | | | | | | | 888 = Place holder information, MUST be replaced with real information | | | | | | | | | | | **TALKING WITH UTILITY** | | | | **FOR SIZING BUS AMPS** | | | | **SIZING GENSET** | | | | **SIZING GENSET** | | |

# APPENDIX C-5

## Infiltration Pond Sizing Calculations

MWH.

BUILDING A BETTER WORLD TECHNICAL MEMORANDUM

| | | | |
|---|---|---|---|
| TO: | Chad Tomlinson | DATE: | October 20, 2014 |
| FROM: | Alex Edstrom | CC: | Tomas Goode, Nathan Haws |
| SUBJECT: | Water Balance to Water Treatment Infiltration Pond at the FMC OU in Pocatello, Idaho | REF: | 10505612.010106 |

## 1. INTRODUCTION

This memorandum outlines the preliminary design analysis for the infiltration pond located at the FMC OU Plant in Pocatello, Idaho. The results of the analysis indicate that a trapezoidal pond 20 feet deep with 1 foot of freeboarrd, 5H:1V side slopes, and equal top lengths and widths of 790 feet will contain the 600 gpm from the proposed water treatment plant and direct rainfall equal to the observed precipitation events between 9/30/1981 and 9/30/2013. The ultimate storage capacity of this pond is 70 million gallons, which is 22% of the yearly 315 million gallons expected to be delivered by the water treatment plant.

## 2. BACKGROUND

The infiltration pond analyzed within this memo is part of the overall design analysis for the closure of the FMC OU Plant approximately 2.5 miles northwest of Pocatello, Idaho. The site is part of the Eastern Michaud Flats Superfund Site, where chemicals such as elemental-phosphorous are located in a number of highlighted remediation areas (RA; EPA, 2012). A water treatment plant is being developed to treat water captured through a proposed groundwater extraction network. The upper design discharge rate of this water treatment plant is expected to be 600 gpm, which will discharge into the infiltration pond presented here.

The infiltration pond will be excavated in the Cover/Cap soil Borrow Area. Developing the infiltration pond in this location will help to minimize the footprint of the remediation effort. The site would also be located approximately at the northwest end of the treatment area, reducing potential for contaminant dilution. Lastly, the borrow source region is generally characterized by differential layers of silty and gravely material. The persistence of gravels throughout the borrow area indicate the potential for a well draining pond.

## 3. ANALYSIS ASSUMPTIONS

The analysis of the infiltration pond was developed using the general water balance equation:

$$Change\ in\ water\ storage\ (\Delta S)\ =\ Sum\ of\ Inflows\ (\Sigma Qi) - Sum\ of\ Outflows\ (\Sigma Qo) \qquad [1]$$

A number of assumptions were made in the analysis of the infiltration pond, which are summarized in **Table 1**. These assumptions were generally conservative and were used to determine if the pond could be developed within the borrow area extents and at depths of approximately 20 feet.

***Table 1 – Assumptions Used to Analyze the Proposed Infiltration Pond***

| | |
|---|---|
| 1. | The pond would be constructed to prevent incoming stormwater flows. |
| 2. | Infiltration media beneath the pond is homogenous. |
| 3. | The aquifer phreatic surface is ~100 feet below the infiltration pond. |
| 4. | Steady-state, saturated conditions were assumed. |
| 5. | Darcy Flow was assumed was steady-state, saturate flow between the infiltration pond and the assumed aquifer level. |
| 6. | Losses only occured at the bottom of the pond. No losses were assumed along the pond slopes. |

| | |
|---|---|
| 7. | An Average yearly evaporation rate was assumed on a constsant daily time step. |
| 8. | The average yearly evaporation was based prior MWH analysis for developing non-capped covers at the FMC OU (citation necessary). No adjustments were made for open water evaporation. |
| 9. | Seasonal temperature impacts were ignored (no freezing and all precipitation falls as rain). |
| 10. | Historical precipitation was assumed to be stationary. That is, precipitation occurring between 1/03/1939 and 9/1/2014 is representative for future precipitation events. |
| 11. | If necessary, the entire borrow area can be used to create the infiltration pond (~ 2,000' x 2,000' surface area). |
| 12. | Reduced infiltration from soil compaction at the bottom of the pond was not considered. |

With these assumptions, it was possible to quickly develop an estimate for the required infiltration storage. The simulated inflows into the model included daily precipitation from 1/03/1939 to 9/30/2013 and the constant assumed discharge rate from the water treatment plant. Outflows from the pond were determined by the infiltration flow out the bottom of the pond and evaporative losses from the ponded water surface. These water balance elements are shown in **Table 2**. The following section discusses the pond dimensions and water balance flows in more detail.

***Table 2 – Water Balance Inflows and Outflows from the Infilitration Pond***

| **Inflows** | |
|---|---|
| 1. | A constant inflow of 600 gpm from the water treatment plant. |
| 2. | Daily precipitation from 1/03/1939 to 9/30/2013. |
| **Outflows** | |
| 1. | Saturated infiltration of water out the bottom of the pond using steady-state flux solved by Darcy's Equation. |
| 2. | Fixed evaporation adjusted by the area of the standing water surface in the infiltration pond. |

# 4. PRELIMINARY WATER BALANCE

## 4.1. Pond Dimensions

Three of the four flows in the water balance are modified by the water stored within the infiltration pond to convert a unit flow rate into a volumetric flow rate. These are the rainfall, evaporation, and the infiltration of water into the groundwater table. The pond dimensions are listed in **Table 3**. The pond shape was assumed to be trapezoidal for ease of calculating intermediate ponding depths, water surface areas, and water volume stored. These calculations were performed using linear interpolations based on change in storage, surface area, and relative elevation.

***Table 3 – Pond Dimensions***

| Dimension | Value | Unit |
|---|---|---|
| Pond Surface Length | 790 | feet |
| Pond Surface Width | 790 | feet |
| Pond Surface Area | 14.3 | acres |
| Total Pond Depth | 20 | feet |
| Pond Freeboard | 1 | foot |
| Pond Side Slopes | 5 | xH:1V |
| Pond Bottom Length | 590 | feet |
| Pond Bottom Width | 590 | feet |
| Pond Bottom Surface Area | 8.0 | acres |
| Maximum Storage Volume | 72.73 | million gallons |

## 4.2. Inflows

The inflows to the water balance were simplified to only include precipitation falling directly into the ponding area and the constant discharge rate of 600 gpm coming from the water treatment plant. The high flow rate from the treatment plant will impact the pond sizing most dramatically given the fixed assumptions from **Table 1**. Further discussion on the characterization of the water treatment plant flow is included in Groundwater Remedial Design Report.

Precipitation data was obtained through the National Ocenaic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC). The precipitation record was taken from the nearby Pocatello WSO Airport Weather Station (COOP Station 107211 and GHCND:USW00024156) located less than 10 miles away from the site. The daily precipitation value was multiplied by the surface pond area to obtain a volumetric loading rate. The daily rainfall rate was included to highlight potential seasonal effects in the pond sizing and to ensure a true maximum pond depth requirement was met for the observed record.

The annual cumulative precipitation at the weather station is shown in **Figure 1**. Data was examined over the course of a water year (which begins on October 1 and ends on Septermber 30 of the following year). In general, the last 35 years of record show both high and low variability while the prior dates are more focused about the annual average of 30 cm/year of rainfall. Water year 1993 received the most precipitation on record and is shown in **Figure 2**. The majority of the rainfall that occurred in this year was between March and May.

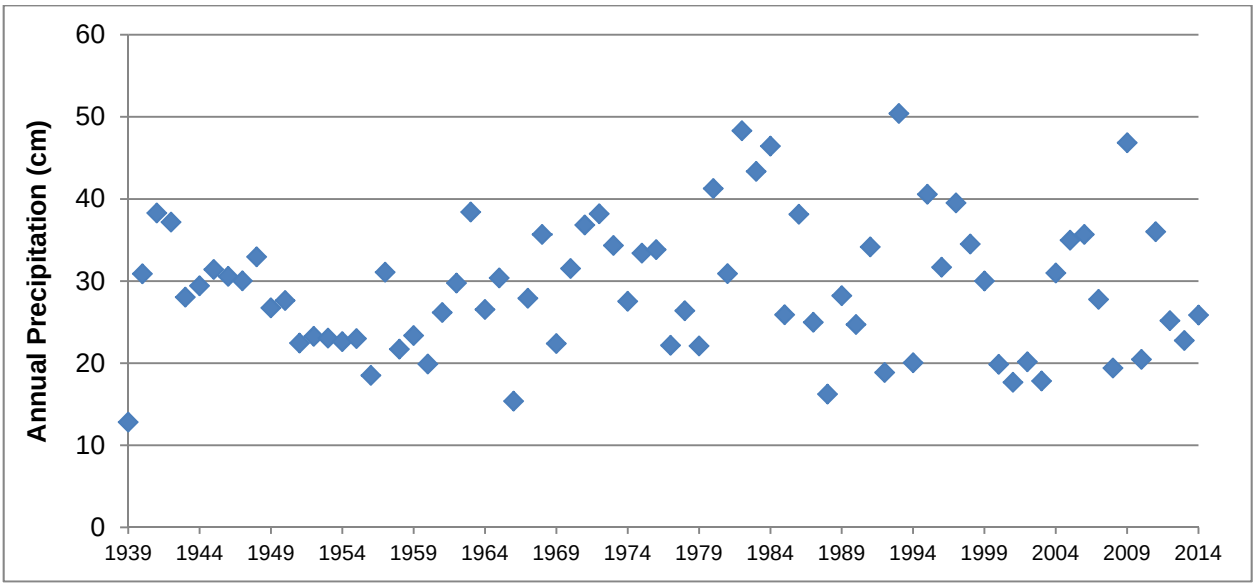



*Figure 1 – Annual Precipitation per Water Year at the Pocatello WSO Airport (GHCND:USW00024156)*

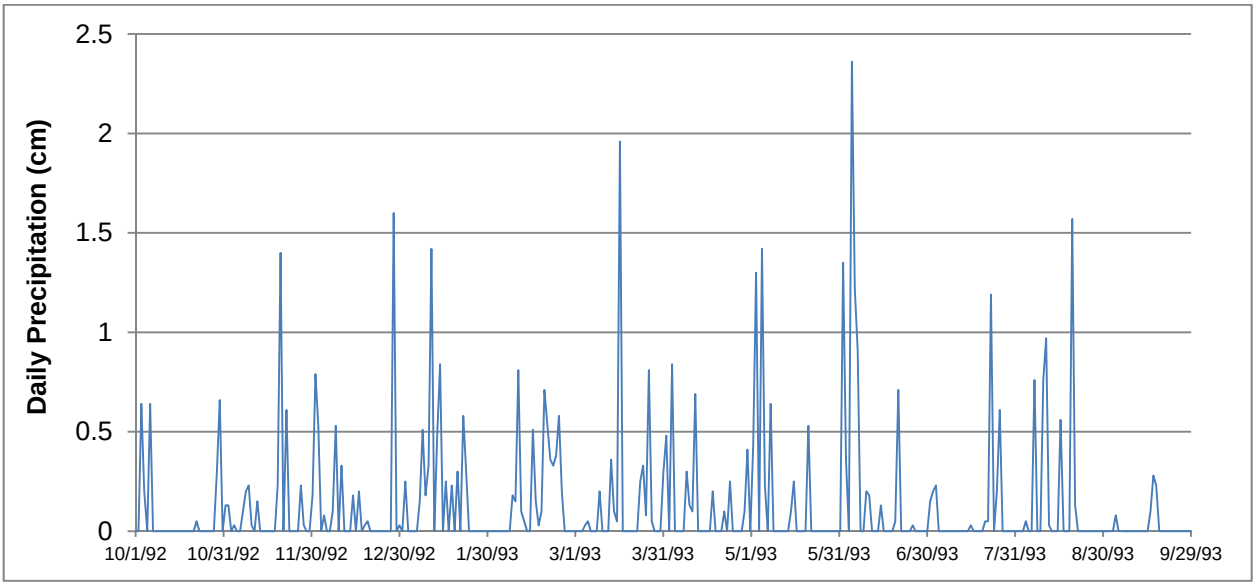



*Figure 2 – Daily Precipitation for Water Year 1993 at the Pocatello WSO Airport (GHCND:USW00024156)*

### 4.3. Outflows

Outflows from the infiltration pond were limited to infiltration from the bottom of the pond surface and from evaporation from the top of the standing water surface. Both of these elments vary with changes to water stored in the infiltration pond.

Evaporation from the pond water surface was assumed to be a constant daily value. Evaporation and transpiration were previously calculated by MWH for analysis of the cover system. The evaporation rate for water stored in the infiltration pond was assumed to be equivalent to average yearly evapotranspiration rate, 25.4 cm/year, from the previous MWH study. Converting to a daily equilvalent, losses from evaporation are approximately 0.07 cm/day (0.002 feet/day). Similarly to precipitation, the total evaporation rate is nearly negligible when compared to losses from the bottom of the infiltration pond.

Pond volume losses by infiltration were calculated using Darcy's Law assuming saturated conditions:

$$Q = K_s A \frac{dh}{dl} \qquad [2]$$

Where:

- Q = Volumetric flux rate ($L^3/T$)
- $K_s$ = Saturated Conductivty of the soil (L/T)
- A = Flow area that the water flows through ($L^2$)
- dh = Change in Total head gradient (L)
- dl = Flow distance traveled through the soil profile (L)

The flow area (A), change in total head (dh), and flow distance traveled (dl) are factors that vary with ponding depth. The ratio of dh/dl, for the given pond dimensions, varies between a minimum of 1 and a maximum of 1.19 (if the ponded water depth reaches 19 feet). The primary uncertainy in the equation comes from defining the saturated conductivity, $K_s$.

In this analysis, a constant $K_s$ of 1 x $10^{-4}$ cm/s was assumed. This was approximately equal to the average $K_s$ analyzed from various samples taken from the borrow area (MHW, 2013). This $K_s$ value is representative of silty materials and is considered a conservative approximation for this analysis. Additional soil sampling was conducted in the borrow area and showed cobbles and other larger particle distributions representative of GP type soils approximately 20 feet below the surface (MWH, 2013). These materials will likely transmit flows at greater rates than the maximum assumed rates.

### 4.4. Quick Sizing Analysis

A quick pond sizing check was calculated based only on the inflows from the water treatment plant, 600 gpm, and the outflow from infiltration at the bottom of the pond. The daily maximum water removed via infiltration – assuming a standing water depth of 19 feet and only flow from the bottom of the pond surface – is 610 gpm. This ensures that the pond will not overtop from the inflow rate of 600 gpm from the infiltration pond. However, a large rainstorm may allow for overtopping to occur, especially during a high wet season. To examine this outcome, a Goldsim model was developed to dyanimcally analyze the water balance.

## 5. GOLDSIM ANALYSIS

The pond sizing requirements were verified using GoldSim (version 11.1). GoldSim is used to create dynamic models for natural, engineered, and financial assessments. The conceptual model of the infiltration pond is shown in **Figure 3** and the sub-routine to analyze the standing water depth and area are shown in **Figure 4**.

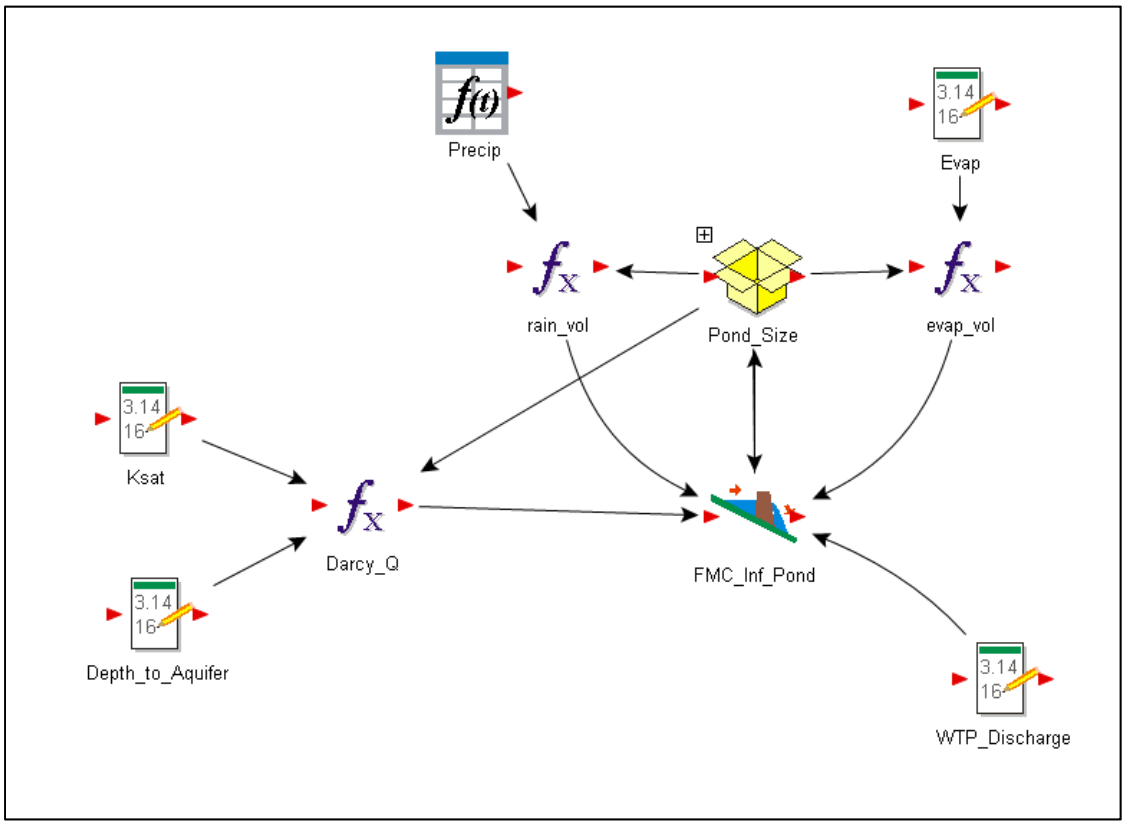



*Figure 3 – GoldSim Conceptual Model for the FMC Infiltration Pond*

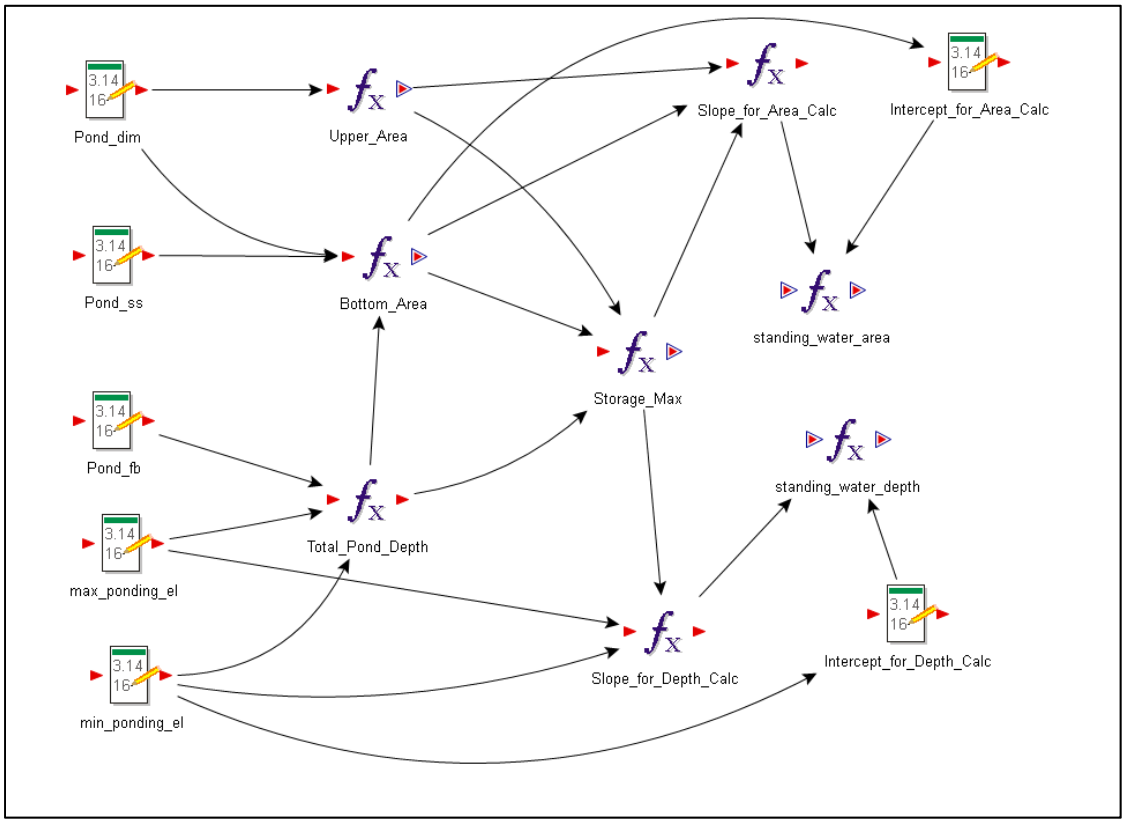



*Figure 4 – GoldSim Conceptual Model for the "Pond Sizing" element in Figure 3.*

## 6. WATER BALANCE RESULTS

Results from the GoldSim analysis were consistent with those presented in Section 4.4. The maximum ponding depth required is estimated to be 18.4 feet with a total storage of 70.3 million gallons. **Figure 5** shows the change in ponded water depth and total storage with time. Peak pond water was observed on December 31, 1983.

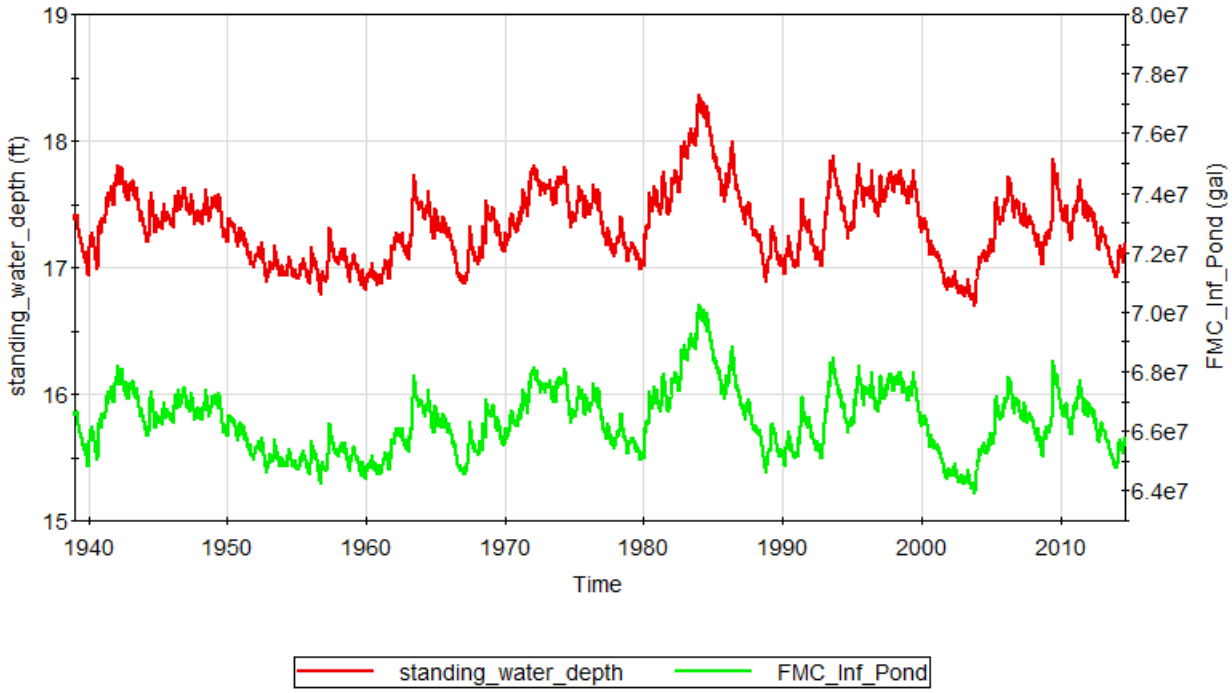



***Figure 5 – Changes in Standing Water Depth and the Total Storage (FMC_Inf_Pond) of the Proposed Infilitration Pond for Historic Precipitation from 1/3/1939 to 9/1/2014.***

## 7. REFERENCES

EPA. 2012. "Interim Amendment to the Record of Decision for the EMF Superfund Site; FMC Operable Unit; Pocatello, Idaho." Accessed online at http://www.epa.gov/region10/pdf/sites/emichaud/IRODA_sept2012.pdf on September 4 2014.

MWH, 2013. Remedial Design Data Gap Report for the FMC OU. Section 3.2 and Appendix D.

# APPENDIX C-6

## Hydraulic Calculations

# *APPENDIX C-6*

# *FMC POCATELLO REMEDIAL DESIGN*
# *Extraction Well Hydraulic Calculations*

| Revisioning | | | | | | |
|---|---|---|---|---|---|---|
| **Rev.** | **Date** | **Description** | **By** | **Checked** | **Date** | **Reviewed** |
| *0* | *30 Jan 15* | *Remedial Design* | *James Dixon* | *Dave Miklas* | *30 Jan 15* | *Chad Tomlinson* |

## Location and Format

*Electronic copies of these calculations are located in the project files system at:*

*\\Usslc1s01\ifo\Industrial Projects\FMC\10505612  30% GW RD\TECHNICAL\Calculations\Civil\Extraction Well Design*

*The calculations herein were generated using the following software:*

*AutoCAD Civil 3D 2011*
*SWMM 5.0*

## Attachments

*Attachment 1 – SWMM Model Status Report (Influent and Effluent)*
*Attachment 2 – SWMM Hydraulic Profiles*

# 1.0 INTRODUCTION

This appendix includes design details for the pipelines necessary to convey impacted waters to the water treatment plant (influent pipelines) and the pipeline necessary to convey treated water from the water treatment plant to the proposed infiltration pond (effluent pipeline).

# 2.0 BACKGROUND

The influent from the extraction wells and the Water Treatment Plant (WTP) effluent pipelines analyzed within this memo are part of the overall design analysis for the closure of the FMC OU Plant approximately 2.5 miles northwest of Pocatello, Idaho. The site is part of the Eastern Michaud Flats Superfund Site, where chemicals such as elemental-phosphorous are located in a number of highlighted remediation areas (RA; EPA, 2012). A water treatment plant is being developed to treat water captured through a proposed groundwater extraction network.

The upper design discharge rate of this groundwater extraction network is expected to be up to 600 gpm, which after treatment will flow out to the infiltration pond as presented here. The wells will be installed in one of the gamma capped areas and the infiltration pond will be excavated in the Cover/Cap soil Borrow Area. The infiltration site will also be located approximately at the northwest end of the treatment area, reducing potential for contaminant dilution of the treated water.

# 3.0 SYSTEM DESCRIPTION

Two major pipelines will be required at the project site consisting of the influent pipe (before treatment) and the effluent pipe (after treatment). In addition to the well design, this appendix discusses the influent and effluent pipe sections individually, as they are somewhat independent of each other.

## 3.1 WELLS

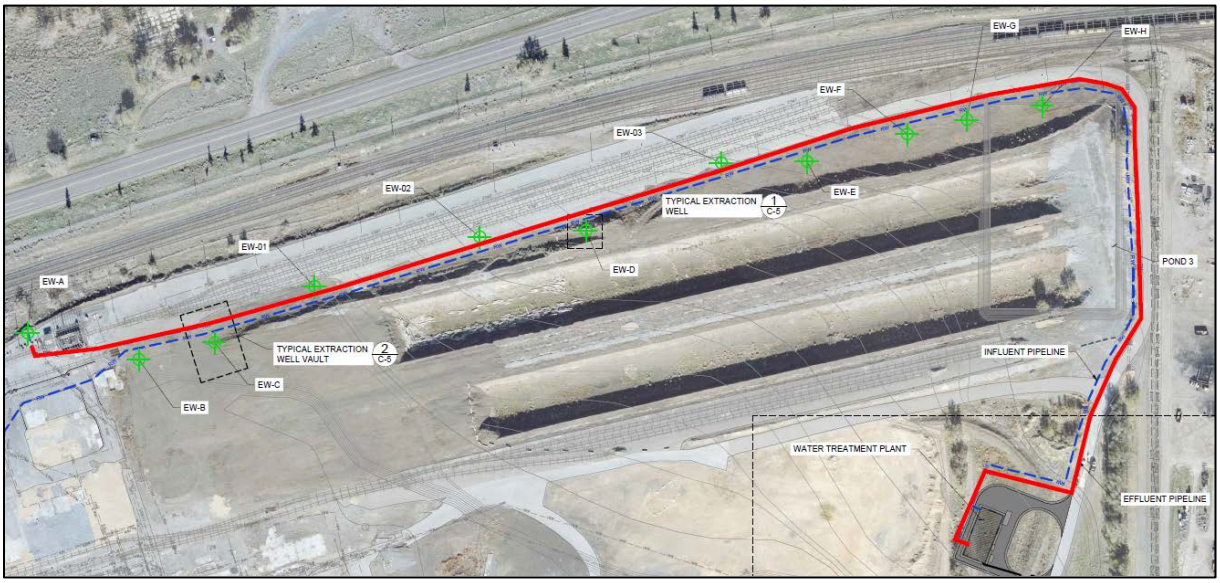
The well system is comprised of a series of 11 nearly identical wells. Each well will be installed to a depth of approximately 110-feet below existing ground level. The well designs will only differ in their flow rates, as discussed in Section 5.0 of this document. Figure 1 shows the approximate locations of the wells in green.

*Figure 1: Approximate extraction well locations*

## 3.2 INFLUENT PIPING

The influent flow runs in a lateral from each of the 11 well heads to a main trunk line and then up to the WTP. Each lateral will be composed of 2-inch HDPE pipe. The main trunk line will consist of 6-inch pipe that runs from the well tie-ins until discharging into the top of the WTP blending tank. Figure 2 shows the approximate location of the influent trunk line in red.

*Figure 2: Approximate location of influent pipeline*




## 3.3 EFFLUENT PIPING

The effluent pipeline will flow from the WTP treated water tank to an infiltration pond located roughly 2-miles to the southwest of the plant. The effluent will be able to flow via gravity through a 12-inch pipeline. No pumps are required for this pipeline. Figure 3 shows the approximate location of the effluent pipeline (shown in red) into the infiltration pond.

*Figure 3: Approximate location of effluent pipeline*

# 4.0 METHODOLOGY

In order to accurately determine water levels in the pipelines and to calculate the pipe sizing, a model was created using the SWMM 5.0 software program (EPA, 2011). This program uses a series of user-input nodes and links to simulate the pipeline and to route flows through the system. These nodes and links require inputs such as lengths, diameters, elevations, and coefficients in order to accurately model the system. While the nodes do not necessarily represent manholes or points of inflection, they can be adjusted to simulate these structures. The model provides calculations for heads and depths in the nodes, and flows, velocities, and slopes for the links.

The program utilizes a dynamic wave model to route flows through the pipeline to the outfall points. The dynamic wave method was necessary due to the adverse slopes that occur regularly throughout the various pipelines. In the pressurized sections of pipe, the Hazen-Williams equation is used to calculate head losses due to friction through the pipe; whereas the Manning equation is used in non-pressurized sections.

The Manning equation is:

$$Q = \frac{1.486}{n} * \frac{A_{pipe}^{5/3}}{P^{2/3}} * S_o^{1/2}$$

Where:

$Q$ is the quantity of flow travelling through the pipe (cubic feet per second [cfs])
$n$ is the Manning's coefficient
$A_{pipe}$ is the cross-sectional area of the pipe (square feet [sf])
$P$ is the wetted perimeter of the pipe (ft)
$S_o$ is the slope of the pipe (ft/ft)

The Hazen-Williams pressurized friction head loss equation is:

$$h_f = \frac{4.52LQ^{1.85}}{C^{1.85}d^{4.87}}$$

Where:

$h_f$ is the head loss in the pipe due to friction (psi)
$L$ is the length of the pipe (ft)
$Q$ is the quantity of flow (gpm)
$C$ is the Hazen-Williams coefficient
$d$ is the inside diameter of the pipe (in)

Other pressurized minor head losses were calculated as:

$$h_L = K\frac{Q^2}{2gA^2}$$

Where:

$h_L$ is the head loss (ft)
$K$ is the loss coefficient
$Q$ is the flow in the pipe (cfs)
$g$ is the acceleration of gravity (ft/s$^2$)
$A$ is the cross-sectional area of the pipe (sf)

# 5.0 ASSUMPTIONS

Pipe diameters of the pipelines were added to the SWMM model and vary for each pipeline.

Pipe diameters from each of the well head laterals were 2-inches until reaching the 6-inch diameter trunk line pipe in order to maintain higher velocities in the pipe and reduce the potential for the settling of solids.

The Manning friction coefficient used was 0.012 for all sections of pipe. This number is based on the coefficient for slightly rougher than new plastic pipe. (Sanks, 1998) An average head loss was assumed to be approximately one velocity head ($1 \times V^2/2g$) per thousand feet of pipe to calculate any small losses not accounted for otherwise, such as uneven pipe and wide bends. Entrance losses assumed 0.5 velocity heads and exit losses assumed 1.0 velocity head (Sanks, 1998).

A 3-foot minimum depth of cover will be required to avoid freezing. An assumed depth of 3.5-feet to pipe invert was used. Where adverse slopes occurred in the gravity flow sections of pipe, depths will be increased to avoid dips and humps as much as possible, but are not allowed to be more than 10-feet in depth.

Assumed flow rates for each well are shown in **Table 1**, below.

*Table 1: Summary of Well Flow Rates*

| Well Name | Flow Rate (gpm) |
|---|---|
| EW-01 | 26.0 |
| EW-02 | 45.8 |
| EW-03 | 76.4 |
| EW-A | 45.8 |
| EW-B | 45.8 |
| EW-C | 45.8 |
| EW-D | 45.8 |
| EW-E | 45.8 |
| EW-F | 45.8 |
| EW-G | 45.8 |
| EW-H | 45.8 |
| **Total** | **514.4** |

The trunk line carrying the plant influent discharges into the top of the blending tank at the head of the process in the WTP. A free discharge is assumed into the tank.

The effluent pipeline is designed to carry 600 gpm and it is assumed that it will also discharge freely at the top of the infiltration pond.

SWMM assumes that hydraulic jumps do not occur and that transitions are linear between nodes. Exact locations of jumps are not calculated within the pipe sections. This does not allow the model to determine exact distances of pressurized sections in the pipe, but can at least determine which segments of pipe will be pressurized over some length.

# 6.0 NODE AND LINK IDS

Node and link IDs for each of the pipeline models were used to relate the plan views to the profiles and outputs. Figure 4 and Figure 5 below show the nodes and links, respectively, used to model the various wells and pipelines.

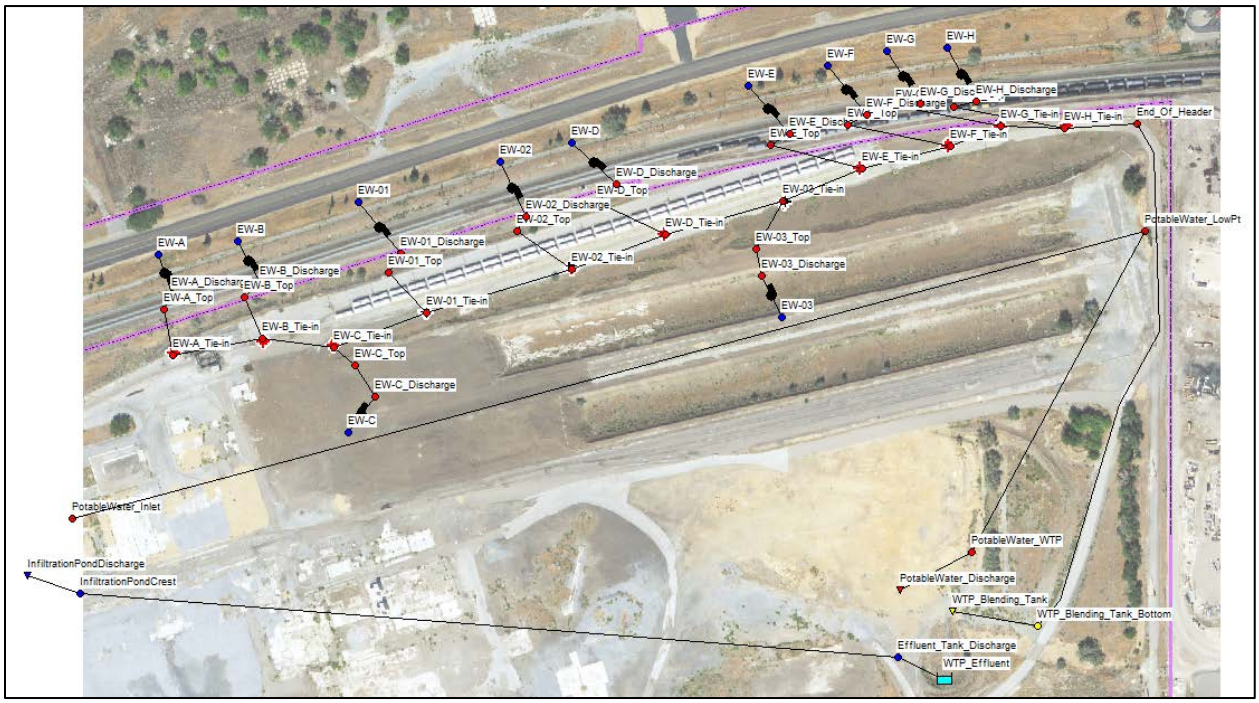



*Figure 4. SWMM Model Nodes*

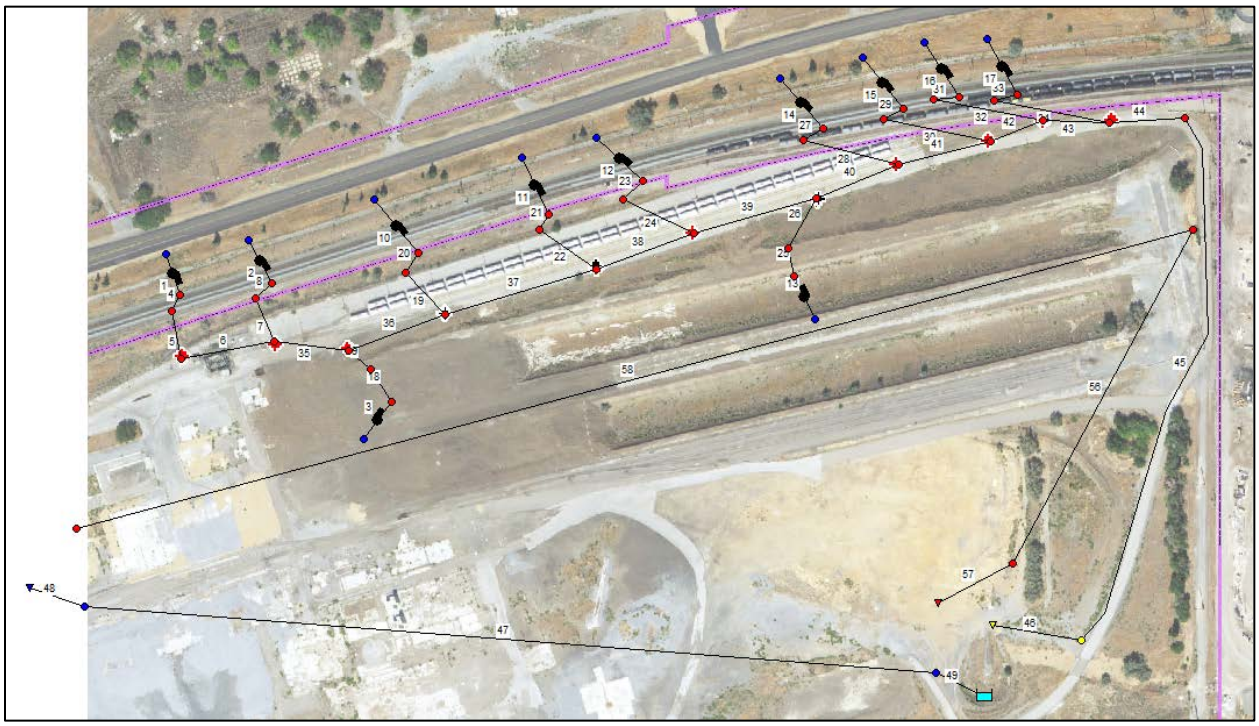


*Figure 5. SWMM Model Links*

# 7.0 MODEL RESULTS

The calculations for the influent and effluent pipelines are presented below.

## 7.1 INFLUENT PIPING

The extraction wells are located below the elevation of the WTP and, as a result, will require that the influent pipelines remain pressurized through all segments. Maximum pressures occur at the well pump discharges and vary between 46 PSI and 53 PSI. Pressures at each of the wells are shown in Table 2, below.

*Table 2: Calculated Well Pumping Pressures*

| Well | Pressure at Pump Feet (PSI) | Pressure at Top of Well Feet (PSI) |
|---|---|---|
| EW-A | 120.51 (52.2) | 76.70 (33.2) |
| EW-B | 107.44 (46.5) | 63.63 (27.5) |
| EW-C | 110.30 (47.7) | 66.50 (28.8) |
| EW-01 | 109.54 (47.4) | 67.23 (29.1) |
| EW-02 | 113.00 (48.9) | 69.20 (30.0) |
| EW-D | 114.08 (49.4) | 70.28 (30.4) |
| EW-03 | 119.04 (51.5) | 71.59 (31.0) |
| EW-E | 114.60 (49.6) | 70.79 (30.6) |
| EW-F | 115.16 (49.9) | 71.35 (30.9) |
| EW-G | 115.28 (49.9) | 71.47 (30.9) |
| EW-H | 112.63 (48.8) | 68.83 (29.8) |

The combined flow along the trunk line will vary from about 45 GPM up to around 515 GPM and requires a nominal pipe diameter of 6-inches. Velocities also vary and range from about 1 ft/s up to nearly 6 ft/s. These flow rates are acceptable per the Handbook of Polyethylene Pipe (PPI, 2012).

Velocities, pipe slopes, and other information through individual sections of pipe are contained in the attached Status Report document (see Attachment 1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results along the trunk line are shown in Figure 6 below. Views of individual well profile sections are included in Attachment 2.

These profiles begin at the well inlet and continue to the blending tank. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the head elevation or pressure in the pipe, and the dashed black line indicates the existing ground level.

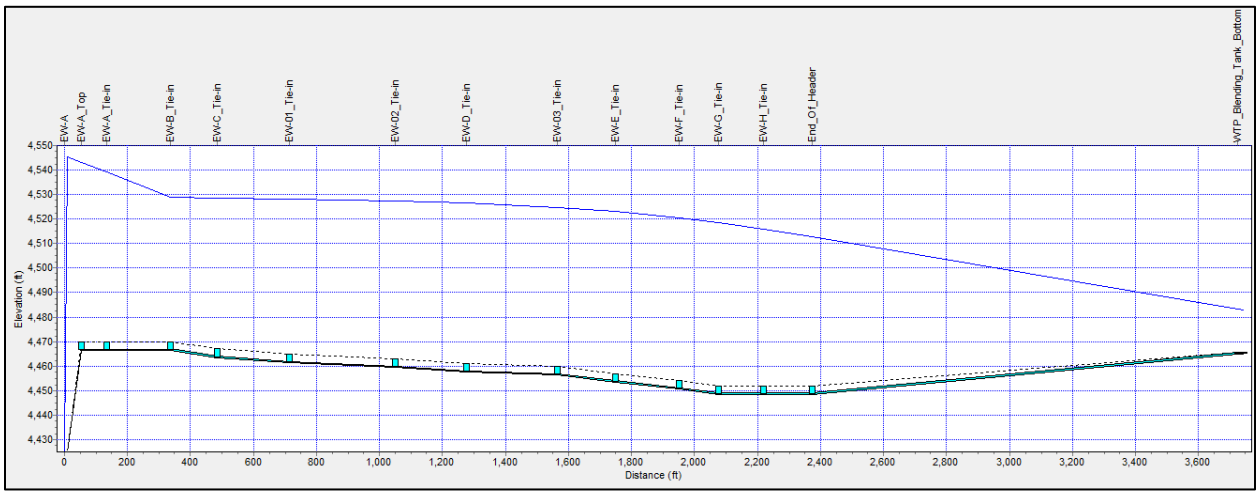



*Figure 6. Influent Pipeline Profile from EW-A to WTP*

## 7.2 EFFLUENT PIPING

The effluent pipeline is begins at the WTP and runs downhill to the infiltration pond. As a result, water is able to flow through the pipeline via gravity without additional pumping. A minimal amount of pressurization will occur in the pipeline near the Treated Water Tank with the maximum pressure at the treated water tank of approximately 1 PSI. In order to maintain the ability to convey 600 GPM through the pipeline without significant pressurization a nominal 12-inch pipeline diameter is required. Velocities remain just under 3 ft/s through the majority of the pipeline. These flow rates are acceptable per the Handbook of Polyethylene Pipe (PPI, 2012).

Velocities, pipe slopes, and other information through individual sections of pipe are contained in the attached Status Report document (see Attachment 1). Using the previously listed assumptions and running the alignment in the SWMM model, the calculated water depths and pressure results along the effluent pipe are shown in Figure 7 below.

These profiles begin at the well inlet and continue down to the infiltration pond. Boxes indicate the location of nodes, black lines indicate the pipe, blue lines indicate the water level or pressure in the pipe, and the dashed black line indicates the existing ground level.

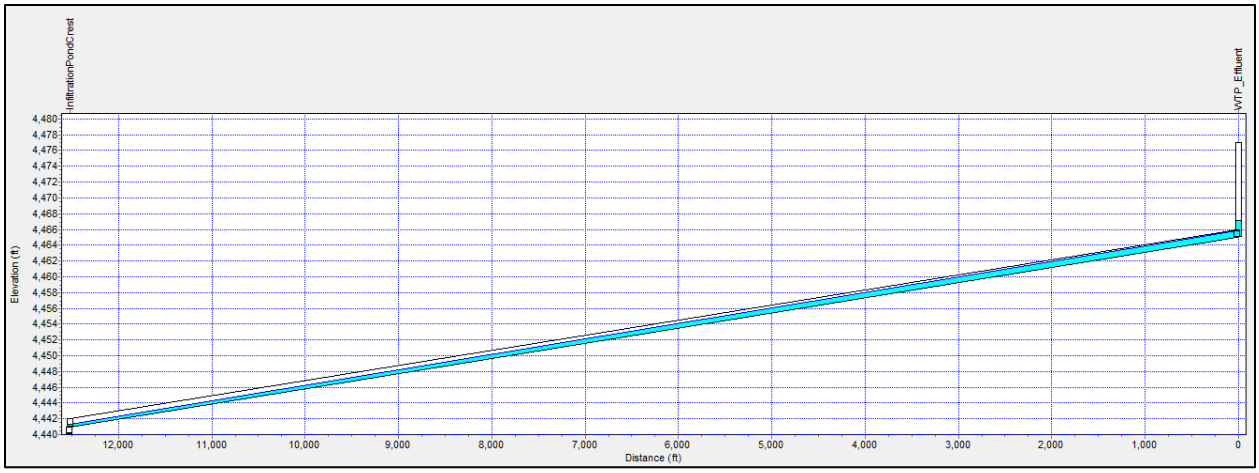



*Figure 7. Effluent Pipeline Profile from Infiltration Pond to the WTP*

## 8.0 CONCLUSIONS

The influent pipelines will require constant pressurization during operation due to the elevation of the WTP being higher than the wells. An added benefit of pressurization is that it allows the pipes to maintain invert depths at 3.5 feet along nearly the entire alignment which will reduce the costs of deep trenches that might otherwise be needed to maintain gravity flow.

For the majority of the pipelines, slopes maintain a consistent upward or downward grade. However, a significant low point occurs to the east of EW-H which will require consideration for cleaning and draining as part of final design.

The pipe sizing and outputs are summarized in Table 1, below.

*Table 1. Final Pipe Sizing and Outputs*

| Pipeline | Diameter (inches) | Design Flow Rate (gpm) | Max Velocity (fps) | Max Pressure at Grade (psi) |
|---|---|---|---|---|
| EW-A to Trunkline | 2 | 45.8 | 4.6 | 33.2 |
| EW-B to Trunkline | 2 | 45.8 | 4.6 | 27.5 |
| EW-C to Trunkline | 2 | 45.8 | 4.6 | 28.8 |
| EW-01 to Trunkline | 2 | 26.0 | 2.6 | 29.1 |
| EW-02 to Trunkline | 2 | 45.8 | 4.6 | 30.0 |
| EW-D to Trunkline | 2 | 45.8 | 4.6 | 30.4 |
| EW-03 to Trunkline | 2 | 76.4 | 7.8 | 31.0 |
| EW-E to Trunkline | 2 | 45.8 | 4.6 | 30.6 |
| EW-F to Trunkline | 2 | 45.8 | 4.6 | 30.9 |
| EW-G to Trunkline | 2 | 45.8 | 4.6 | 30.9 |
| EW-H to Trunkline | 2 | 45.8 | 4.6 | 29.8 |
| Trunkline to WTP | 6 | 514.6 | 5.8 | 30.3 |
| Effluent Pipe | 12 | 600 | 2.9 | ~1.0 |

# 9.0 REFERENCES

EPA. 2012. Interim Amendment to the Record of Decision for the EMF Superfund Site - FMC Operable Unit - Pocatello, Idaho, September 27, 2012.

MWH Americas, Inc. (MWH), 2013. Effluent Discharge Mixing Evaluation for the Midnite Mine Water Treatment Plant. November 2013.

Plastic Pipe Institute (PPI), 2012. Handbook of Polyethylene (PE) Pipe.

Sanks, R.L., 1998. “Pumping Station Design”.

U.S. Environmental Protection Agency (EPA), 2011. Program Storm Water Management Model (SWMM) version 5.0. 2011.

# Attachment 1
# SWMM Model Status Report

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.022)
--------------------------------------------------------------


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... GPM
Process Models:
  Rainfall/Runoff ........ NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Starting Date ............ SEP-16-2014 00:00:00
Ending Date .............. SEP-17-2014 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:15:00
Routing Time Step ........ 30.00 sec


WARNING 04: minimum elevation drop used for Conduit 5

WARNING 04: minimum elevation drop used for Conduit 6

WARNING 04: minimum elevation drop used for Conduit 7

WARNING 04: minimum elevation drop used for Conduit 9

WARNING 04: minimum elevation drop used for Conduit 19

WARNING 04: minimum elevation drop used for Conduit 22

WARNING 04: minimum elevation drop used for Conduit 24

WARNING 04: minimum elevation drop used for Conduit 26

WARNING 04: minimum elevation drop used for Conduit 28

WARNING 04: minimum elevation drop used for Conduit 30

WARNING 04: minimum elevation drop used for Conduit 32

WARNING 04: minimum elevation drop used for Conduit 34

WARNING 04: minimum elevation drop used for Conduit 43

WARNING 04: minimum elevation drop used for Conduit 44

WARNING 04: minimum elevation drop used for Conduit 46

WARNING 04: minimum elevation drop used for Conduit 49

WARNING 04: minimum elevation drop used for Conduit 57

**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
```

```
External Inflow ..........          5.409         1.762
External Outflow .........          5.289         1.724
Internal Outflow .........          0.001         0.000
Storage Losses ...........          0.000         0.000
Initial Stored Volume ....          0.115         0.038
Final Stored Volume ......          0.227         0.074
Continuity Error (%) .....          0.114


*************************
Highest Continuity Errors
*************************
Node PotableWater_LowPt (3.42%)
Node Effluent_Tank_Discharge (3.33%)
Node InfiltrationPondCrest (1.53%)


***************************
Time-Step Critical Elements
***************************
Link 48 (98.11%)
Link 49 (1.68%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.76 sec
Average Time Step           :     0.68 sec
Maximum Time Step           :     0.77 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     1.78


******************
Node Depth Summary
******************

----------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max
                                  Depth    Depth      HGL   Occurrence
Node                 Type          Feet     Feet     Feet  days hr:min
----------------------------------------------------------------------
EW-A_Discharge       JUNCTION    107.17   120.51  4545.51     0  05:05
EW-B_Discharge       JUNCTION     95.55   107.44  4532.44     0  03:29
EW-01_Discharge      JUNCTION     97.42   109.54  4529.54     0  10:07
EW-A_Top             JUNCTION     68.21    76.70  4543.20     0  13:06
EW-B_Top             JUNCTION     56.59    63.63  4530.13     0  21:29
EW-C_Top             JUNCTION     59.14    66.50  4530.00     0  16:47
EW-A_Tie-in          JUNCTION     64.57    72.60  4539.10     0  10:17
EW-B_Tie-in          JUNCTION     55.45    62.35  4528.85     0  21:56
EW-C_Tie-in          JUNCTION     58.00    65.22  4528.72     0  13:03
EW-01_Tie-in         JUNCTION     59.39    66.78  4528.28     0  21:56
EW-A                 JUNCTION      0.00     0.00  4425.00     0  00:00
EW-B                 JUNCTION      0.00     0.00  4425.00     0  00:00
EW-C                 JUNCTION      0.00     0.00  4422.00     0  00:00
EW-01_Top            JUNCTION     59.79    67.23  4528.73     0  08:33
EW-02_Top            JUNCTION     61.54    69.20  4528.70     0  14:39
EW-D_Top             JUNCTION     62.50    70.28  4527.78     0  19:16
EW-03_Top            JUNCTION     63.67    71.59  4528.09     0  16:39
EW-E_Top             JUNCTION     62.96    70.79  4524.29     0  07:48
EW-F_Top             JUNCTION     63.46    71.35  4521.85     0  21:21
EW-G_Top             JUNCTION     63.56    71.47  4519.97     0  03:13
EW-H_Top             JUNCTION     61.21    68.83  4517.33     0  05:17
EW-01                JUNCTION      0.00     0.00  4420.00     0  00:00
```

| | | | | | | |
|---|---|---|---|---|---|---|
| EW-02 | JUNCTION | 0.00 | 0.00 | 4418.00 | 0 | 00:00 |
| EW-D | JUNCTION | 0.00 | 0.00 | 4416.00 | 0 | 00:00 |
| EW-03 | JUNCTION | 0.00 | 0.00 | 4415.00 | 0 | 00:00 |
| EW-E | JUNCTION | 0.00 | 0.00 | 4412.00 | 0 | 00:00 |
| EW-F | JUNCTION | 0.00 | 0.00 | 4409.00 | 0 | 00:00 |
| EW-G | JUNCTION | 0.00 | 0.00 | 4407.00 | 0 | 00:00 |
| EW-H | JUNCTION | 0.00 | 0.00 | 4407.00 | 0 | 00:00 |
| EW-02_Tie-in | JUNCTION | 60.40 | 67.92 | 4527.42 | 0 | 06:42 |
| EW-D_Tie-in | JUNCTION | 61.36 | 69.00 | 4526.50 | 0 | 06:42 |
| EW-03_Tie-in | JUNCTION | 60.73 | 68.28 | 4524.78 | 0 | 11:15 |
| EW-E_Tie-in | JUNCTION | 61.82 | 69.51 | 4523.01 | 0 | 03:53 |
| EW-F_Tie-in | JUNCTION | 62.32 | 70.07 | 4520.57 | 0 | 11:38 |
| EW-G_Tie-in | JUNCTION | 62.42 | 70.19 | 4518.69 | 0 | 22:53 |
| EW-H_Tie-in | JUNCTION | 60.07 | 67.54 | 4516.04 | 0 | 23:53 |
| End_Of_Header | JUNCTION | 57.08 | 64.19 | 4512.69 | 0 | 10:26 |
| WTP_Blending_Tank_Bottom | JUNCTION | 16.39 | 18.43 | 4483.43 | 0 | 03:42 |
| EW-02_Discharge | JUNCTION | 100.50 | 113.00 | 4531.00 | 0 | 07:17 |
| EW-D_Discharge | JUNCTION | 101.46 | 114.08 | 4530.08 | 0 | 18:47 |
| EW-03_Discharge | JUNCTION | 105.87 | 119.04 | 4534.04 | 0 | 06:15 |
| EW-C_Discharge | JUNCTION | 98.10 | 110.30 | 4532.30 | 0 | 07:39 |
| EW-E_Discharge | JUNCTION | 101.92 | 114.60 | 4526.60 | 0 | 05:05 |
| EW-F_Discharge | JUNCTION | 102.42 | 115.16 | 4524.16 | 0 | 03:08 |
| EW-G_Discharge | JUNCTION | 102.52 | 115.28 | 4522.28 | 0 | 19:02 |
| EW-H_Discharge | JUNCTION | 100.17 | 112.63 | 4519.63 | 0 | 08:11 |
| Effluent_Tank_Discharge | JUNCTION | 0.70 | 0.86 | 4465.86 | 0 | 03:00 |
| InfiltrationPondCrest | JUNCTION | 0.31 | 0.37 | 4441.37 | 0 | 03:00 |
| PotableWater_LowPt | JUNCTION | 135.51 | 152.37 | 4604.37 | 0 | 21:50 |
| PotableWater_WTP | JUNCTION | 123.63 | 139.02 | 4604.02 | 0 | 15:29 |
| PotableWater_Inlet | JUNCTION | 120.08 | 135.03 | 4605.03 | 0 | 21:50 |
| WTP_Blending_Tank | OUTFALL | 16.01 | 18.00 | 4483.00 | 0 | 03:00 |
| InfiltrationPondDischarge | OUTFALL | 0.20 | 0.23 | 4440.23 | 0 | 03:00 |
| PotableWater_Discharge | OUTFALL | 123.62 | 139.00 | 4604.00 | 0 | 03:00 |
| WTP_Effluent | STORAGE | 1.94 | 2.33 | 4467.33 | 0 | 03:00 |

**********
Node Inflow Summary
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| Node | Type | Maximum Lateral Inflow GPM | Maximum Total Inflow GPM | Time of Max Occurrence days | hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal |
|---|---|---|---|---|---|---|---|
| EW-A_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-B_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-01_Discharge | JUNCTION | 0.00 | 26.00 | 0 | 03:00 | 0.000 | 0.037 |
| EW-A_Top | JUNCTION | 0.00 | 45.80 | 0 | 17:21 | 0.000 | 0.066 |
| EW-B_Top | JUNCTION | 0.00 | 45.80 | 0 | 03:11 | 0.000 | 0.066 |
| EW-C_Top | JUNCTION | 0.00 | 45.80 | 0 | 05:56 | 0.000 | 0.066 |
| EW-A_Tie-in | JUNCTION | 0.00 | 45.80 | 0 | 13:29 | 0.000 | 0.066 |
| EW-B_Tie-in | JUNCTION | 0.00 | 91.60 | 0 | 11:57 | 0.000 | 0.132 |
| EW-C_Tie-in | JUNCTION | 0.00 | 137.40 | 0 | 16:28 | 0.000 | 0.198 |
| EW-01_Tie-in | JUNCTION | 0.00 | 163.40 | 0 | 20:02 | 0.000 | 0.235 |
| EW-A | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-B | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-C | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-01_Top | JUNCTION | 0.00 | 26.00 | 0 | 11:31 | 0.000 | 0.037 |
| EW-02_Top | JUNCTION | 0.00 | 45.80 | 0 | 19:36 | 0.000 | 0.066 |
| EW-D_Top | JUNCTION | 0.00 | 45.80 | 0 | 16:17 | 0.000 | 0.066 |
| EW-03_Top | JUNCTION | 0.00 | 76.40 | 0 | 10:16 | 0.000 | 0.110 |
| EW-E_Top | JUNCTION | 0.00 | 45.80 | 0 | 05:22 | 0.000 | 0.066 |
| EW-F_Top | JUNCTION | 0.00 | 45.80 | 0 | 14:42 | 0.000 | 0.066 |
| EW-G_Top | JUNCTION | 0.00 | 45.80 | 0 | 12:31 | 0.000 | 0.066 |
| EW-H_Top | JUNCTION | 0.00 | 45.80 | 0 | 19:44 | 0.000 | 0.066 |
| EW-01 | JUNCTION | 26.00 | 26.00 | 0 | 03:00 | 0.033 | 0.037 |
| EW-02 | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-D | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-03 | JUNCTION | 76.40 | 76.40 | 0 | 03:00 | 0.096 | 0.110 |
| EW-E | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EW-F | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-G | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-H | JUNCTION | 45.80 | 45.80 | 0 | 03:00 | 0.058 | 0.066 |
| EW-02_Tie-in | JUNCTION | 0.00 | 209.20 | 0 | 20:54 | 0.000 | 0.301 |
| EW-D_Tie-in | JUNCTION | 0.00 | 255.00 | 0 | 22:27 | 0.000 | 0.367 |
| EW-03_Tie-in | JUNCTION | 0.00 | 331.40 | 0 | 06:28 | 0.000 | 0.476 |
| EW-E_Tie-in | JUNCTION | 0.00 | 377.20 | 0 | 12:36 | 0.000 | 0.542 |
| EW-F_Tie-in | JUNCTION | 0.00 | 423.00 | 0 | 14:32 | 0.000 | 0.608 |
| EW-G_Tie-in | JUNCTION | 0.00 | 468.80 | 0 | 14:29 | 0.000 | 0.673 |
| EW-H_Tie-in | JUNCTION | 0.00 | 514.60 | 0 | 12:26 | 0.000 | 0.739 |
| End_Of_Header | JUNCTION | 0.00 | 514.60 | 0 | 18:42 | 0.000 | 0.740 |
| WTP_Blending_Tank_Bottom | JUNCTION | 0.00 | 514.60 | 0 | 03:48 | 0.000 | 0.741 |
| EW-02_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-D_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-03_Discharge | JUNCTION | 0.00 | 76.40 | 0 | 03:00 | 0.000 | 0.110 |
| EW-C_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-E_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-F_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-G_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| EW-H_Discharge | JUNCTION | 0.00 | 45.80 | 0 | 03:00 | 0.000 | 0.066 |
| Effluent_Tank_Discharge | JUNCTION | 0.00 | 616.79 | 0 | 03:00 | 0.000 | 0.885 |
| InfiltrationPondCrest | JUNCTION | 0.00 | 650.66 | 0 | 03:00 | 0.000 | 0.856 |
| PotableWater_LowPt | JUNCTION | 0.00 | 100.00 | 0 | 03:47 | 0.000 | 0.152 |
| PotableWater_WTP | JUNCTION | 0.00 | 100.00 | 0 | 09:52 | 0.000 | 0.154 |
| PotableWater_Inlet | JUNCTION | 100.00 | 100.00 | 0 | 03:00 | 0.126 | 0.147 |
| WTP_Blending_Tank | OUTFALL | 0.00 | 514.60 | 0 | 05:34 | 0.000 | 0.741 |
| InfiltrationPondDischarge | OUTFALL | 0.00 | 658.73 | 0 | 03:00 | 0.000 | 0.843 |
| PotableWater_Discharge | OUTFALL | 0.00 | 100.00 | 0 | 16:12 | 0.000 | 0.154 |
| WTP_Effluent | STORAGE | 600.00 | 600.00 | 0 | 03:00 | 0.756 | 0.901 |

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

| Node | Type | Hours Surcharged | Max. Height Above Crown Feet | Min. Depth Below Rim Feet |
|---|---|---|---|---|
| EW-A_Discharge | JUNCTION | 21.00 | 120.342 | 0.000 |
| EW-B_Discharge | JUNCTION | 21.00 | 107.270 | 0.000 |
| EW-01_Discharge | JUNCTION | 21.00 | 109.374 | 0.000 |
| EW-A_Top | JUNCTION | 21.00 | 76.535 | 0.000 |
| EW-B_Top | JUNCTION | 21.00 | 63.463 | 0.000 |
| EW-C_Top | JUNCTION | 21.00 | 66.330 | 0.000 |
| EW-A_Tie-in | JUNCTION | 21.00 | 72.434 | 0.000 |
| EW-B_Tie-in | JUNCTION | 21.00 | 61.849 | 0.000 |
| EW-C_Tie-in | JUNCTION | 21.00 | 64.716 | 0.000 |
| EW-01_Tie-in | JUNCTION | 21.00 | 66.284 | 0.000 |
| EW-A | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-B | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-C | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-01_Top | JUNCTION | 21.00 | 67.066 | 0.000 |
| EW-02_Top | JUNCTION | 21.00 | 69.031 | 0.000 |
| EW-D_Top | JUNCTION | 21.00 | 70.110 | 0.000 |
| EW-03_Top | JUNCTION | 21.00 | 71.423 | 0.000 |
| EW-E_Top | JUNCTION | 21.00 | 70.624 | 0.000 |
| EW-F_Top | JUNCTION | 21.00 | 71.186 | 0.000 |
| EW-G_Top | JUNCTION | 21.00 | 71.302 | 0.000 |
| EW-H_Top | JUNCTION | 21.00 | 68.658 | 0.000 |
| EW-01 | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-02 | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-D | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-03 | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-E | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-F | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-G | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-H | JUNCTION | 21.00 | 0.000 | 0.000 |
| EW-02_Tie-in | JUNCTION | 21.00 | 67.416 | 0.000 |

| | | | | |
|---|---|---|---|---|
| EW-D_Tie-in | JUNCTION | 21.00 | 68.496 | 0.000 |
| EW-03_Tie-in | JUNCTION | 21.00 | 67.784 | 0.000 |
| EW-E_Tie-in | JUNCTION | 21.00 | 69.010 | 0.000 |
| EW-F_Tie-in | JUNCTION | 21.00 | 69.572 | 0.000 |
| EW-G_Tie-in | JUNCTION | 21.00 | 69.688 | 0.000 |
| EW-H_Tie-in | JUNCTION | 21.00 | 67.044 | 0.000 |
| End_Of_Header | JUNCTION | 21.00 | 63.685 | 0.000 |
| WTP_Blending_Tank_Bottom | JUNCTION | 21.00 | 17.933 | 0.000 |
| EW-02_Discharge | JUNCTION | 21.00 | 112.838 | 0.000 |
| EW-D_Discharge | JUNCTION | 21.00 | 113.917 | 0.000 |
| EW-03_Discharge | JUNCTION | 21.00 | 118.874 | 0.000 |
| EW-C_Discharge | JUNCTION | 21.00 | 110.137 | 0.000 |
| EW-E_Discharge | JUNCTION | 21.00 | 114.431 | 0.000 |
| EW-F_Discharge | JUNCTION | 21.00 | 114.993 | 0.000 |
| EW-G_Discharge | JUNCTION | 21.00 | 115.109 | 0.000 |
| EW-H_Discharge | JUNCTION | 21.00 | 112.465 | 0.000 |
| PotableWater_LowPt | JUNCTION | 21.00 | 151.703 | 0.000 |
| PotableWater_WTP | JUNCTION | 21.00 | 138.349 | 0.000 |
| PotableWater_Inlet | JUNCTION | 21.00 | 134.360 | 0.000 |
| WTP_Effluent | STORAGE | 21.00 | 1.664 | 9.669 |

**********
Node Flooding Summary
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No nodes were flooded.

**********
Storage Volume Summary
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| Storage Unit | Average Volume 1000 ft3 | Avg Pcnt Full | E&I Pcnt Loss | Maximum Volume 1000 ft3 | Max Pcnt Full | Time of Max Occurrence days hr:min | Maximum Outflow GPM |
|---|---|---|---|---|---|---|---|
| WTP_Effluent | 1.944 | 16 | 0 | 2.331 | 19 | 0 03:00 | 616.79 |

**********
Outfall Loading Summary
**********

| Outfall Node | Flow Freq. Pcnt. | Avg. Flow GPM | Max. Flow GPM | Total Volume 10^6 gal |
|---|---|---|---|---|
| WTP_Blending_Tank | 88.93 | 514.60 | 514.60 | 0.741 |
| InfiltrationPondDischarge | 88.93 | 604.23 | 658.73 | 0.843 |
| PotableWater_Discharge | 88.93 | 100.00 | 100.00 | 0.154 |
| System | 88.93 | 1218.83 | 1273.33 | 1.737 |

**********
Link Flow Summary
**********

| Link | Type | Maximum \|Flow\| GPM | Time of Max Occurrence days hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|
| 4 | CONDUIT | 45.80 | 0 17:21 | 4.66 | 0.11 | 1.00 |
| 5 | CONDUIT | 45.80 | 0 13:29 | 4.66 | 78.71 | 1.00 |
| 6 | CONDUIT | 45.80 | 0 13:23 | 4.66 | 129.10 | 1.00 |
| 7 | CONDUIT | 45.80 | 0 11:57 | 4.66 | 42.00 | 1.00 |
| 8 | CONDUIT | 45.80 | 0 03:11 | 4.66 | 0.11 | 1.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 9 | CONDUIT | 45.80 | 0 | 08:02 | 4.66 | 42.00 | 1.00 |
| 18 | CONDUIT | 45.80 | 0 | 05:56 | 4.66 | 0.11 | 1.00 |
| 19 | CONDUIT | 26.00 | 0 | 04:47 | 2.64 | 23.84 | 1.00 |
| 20 | CONDUIT | 26.00 | 0 | 11:31 | 2.64 | 0.06 | 1.00 |
| 21 | CONDUIT | 45.80 | 0 | 19:36 | 4.66 | 0.11 | 1.00 |
| 22 | CONDUIT | 45.80 | 0 | 06:28 | 4.66 | 42.00 | 1.00 |
| 23 | CONDUIT | 45.80 | 0 | 16:17 | 4.66 | 0.11 | 1.00 |
| 24 | CONDUIT | 45.80 | 0 | 22:27 | 4.66 | 42.00 | 1.00 |
| 25 | CONDUIT | 76.40 | 0 | 10:16 | 7.77 | 0.18 | 1.00 |
| 26 | CONDUIT | 76.40 | 0 | 19:11 | 7.77 | 70.06 | 1.00 |
| 27 | CONDUIT | 45.80 | 0 | 05:22 | 4.66 | 0.11 | 1.00 |
| 28 | CONDUIT | 45.80 | 0 | 10:07 | 4.66 | 42.00 | 1.00 |
| 29 | CONDUIT | 45.80 | 0 | 14:42 | 4.66 | 0.11 | 1.00 |
| 30 | CONDUIT | 45.80 | 0 | 11:12 | 4.66 | 42.00 | 1.00 |
| 31 | CONDUIT | 45.80 | 0 | 12:31 | 4.66 | 0.11 | 1.00 |
| 32 | CONDUIT | 45.80 | 0 | 15:10 | 4.66 | 42.00 | 1.00 |
| 33 | CONDUIT | 45.80 | 0 | 19:44 | 4.66 | 0.11 | 1.00 |
| 34 | CONDUIT | 45.80 | 0 | 23:36 | 4.66 | 42.00 | 1.00 |
| 35 | CONDUIT | 91.60 | 0 | 16:28 | 1.04 | 0.17 | 1.00 |
| 36 | CONDUIT | 137.40 | 0 | 11:20 | 1.56 | 0.40 | 1.00 |
| 37 | CONDUIT | 163.40 | 0 | 20:20 | 1.85 | 0.59 | 1.00 |
| 38 | CONDUIT | 209.20 | 0 | 16:01 | 2.37 | 0.61 | 1.00 |
| 39 | CONDUIT | 255.00 | 0 | 11:38 | 2.89 | 1.23 | 1.00 |
| 40 | CONDUIT | 331.40 | 0 | 22:37 | 3.76 | 0.69 | 1.00 |
| 41 | CONDUIT | 377.20 | 0 | 03:53 | 4.28 | 0.82 | 1.00 |
| 42 | CONDUIT | 423.00 | 0 | 17:50 | 4.80 | 0.89 | 1.00 |
| 43 | CONDUIT | 468.80 | 0 | 23:22 | 5.32 | 64.88 | 1.00 |
| 44 | CONDUIT | 514.60 | 0 | 18:42 | 5.84 | 73.83 | 1.00 |
| 45 | CONDUIT | 514.60 | 0 | 03:48 | 5.84 | 1.25 | 1.00 |
| 46 | CONDUIT | 514.60 | 0 | 05:34 | 5.84 | 24.44 | 1.00 |
| 47 | CONDUIT | 650.66 | 0 | 03:00 | 2.92 | 0.72 | 0.61 |
| 48 | CONDUIT | 658.73 | 0 | 03:00 | 7.35 | 0.12 | 0.30 |
| 49 | CONDUIT | 616.79 | 0 | 03:00 | 3.93 | 13.88 | 1.00 |
| 56 | CONDUIT | 100.00 | 0 | 09:52 | 0.64 | 0.13 | 1.00 |
| 57 | CONDUIT | 100.00 | 0 | 16:12 | 0.64 | 3.69 | 1.00 |
| 58 | CONDUIT | 100.00 | 0 | 03:47 | 0.64 | 0.15 | 1.00 |
| 1 | PUMP | 45.80 | 0 | 03:00 | | | |
| 2 | PUMP | 45.80 | 0 | 03:00 | | | |
| 3 | PUMP | 45.80 | 0 | 03:00 | | | |
| 10 | PUMP | 26.00 | 0 | 03:00 | | | |
| 11 | PUMP | 45.80 | 0 | 03:00 | | | |
| 12 | PUMP | 45.80 | 0 | 03:00 | | | |
| 13 | PUMP | 76.40 | 0 | 03:00 | | | |
| 14 | PUMP | 45.80 | 0 | 03:00 | | | |
| 15 | PUMP | 45.80 | 0 | 03:00 | | | |
| 16 | PUMP | 45.80 | 0 | 03:00 | | | |
| 17 | PUMP | 45.80 | 0 | 03:00 | | | |

**********
Flow Classification Summary
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| Conduit | Adjusted /Actual Length | --- Fraction of Time in Flow Class ---- Dry | Up Dry | Down Dry | Sub Crit | Sup Crit | Up Crit | Down Crit | Avg. Froude Number | Avg. Flow Change |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 5 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 6 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 7 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 8 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 9 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 18 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 19 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 20 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 21 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 22 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 23 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 24 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 26 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 27 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 28 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 29 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 30 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 31 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 32 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 33 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 34 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 35 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 36 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 37 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 38 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 39 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 40 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 41 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 42 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 43 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 44 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 45 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 46 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 47 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.67 | 0.0000 |
| 48 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 2.52 | 0.0000 |
| 49 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 56 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 57 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |
| 58 | 1.00 | 0.00 | 0.00 | 0.00 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0000 |

**********
Conduit Surcharge Summary
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| Conduit | Hours Full Both Ends | Hours Full Upstream | Hours Full Dnstream | Hours Above Full Normal Flow | Hours Capacity Limited |
|---|---|---|---|---|---|
| 4 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 5 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 6 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 7 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 8 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 9 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 18 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 19 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 20 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 21 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 22 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 23 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 24 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 25 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 26 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 27 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 28 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 29 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 30 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 31 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 32 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 33 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 34 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 35 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 36 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 37 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 38 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 39 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 40 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 41 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 42 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 43 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |

| | | | | | |
|---|---|---|---|---|---|
| 44 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 45 | 21.00 | 21.00 | 21.00 | 21.00 | 0.01 |
| 46 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 49 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 56 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |
| 57 | 21.00 | 21.00 | 21.00 | 21.00 | 21.00 |
| 58 | 21.00 | 21.00 | 21.00 | 0.01 | 0.01 |

**********
Pumping Summary
**********

| Pump | Percent Utilized | Number of Start-Ups | Min Flow GPM | Avg Flow GPM | Max Flow GPM | Total Volume 10^6 gal | Power Usage Kw-hr | % Time Off Pump Curve Low | High |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 21.85 | 0.0 | 0.0 |
| 2 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 19.48 | 0.0 | 0.0 |
| 3 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.00 | 0.0 | 0.0 |
| 10 | 87.50 | 0 | 0.00 | 26.00 | 26.00 | 0.033 | 11.27 | 0.0 | 0.0 |
| 11 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.49 | 0.0 | 0.0 |
| 12 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.68 | 0.0 | 0.0 |
| 13 | 87.50 | 0 | 0.00 | 76.40 | 76.40 | 0.096 | 36.00 | 0.0 | 0.0 |
| 14 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.78 | 0.0 | 0.0 |
| 15 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.88 | 0.0 | 0.0 |
| 16 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.90 | 0.0 | 0.0 |
| 17 | 87.50 | 0 | 0.00 | 45.80 | 45.80 | 0.058 | 20.42 | 0.0 | 0.0 |

Analysis begun on: Fri Nov 14 12:46:03 2014
Analysis ended on: Fri Nov 14 12:46:07 2014
Total elapsed time: 00:00:04

# Attachment 2
# Hydraulic Profiles

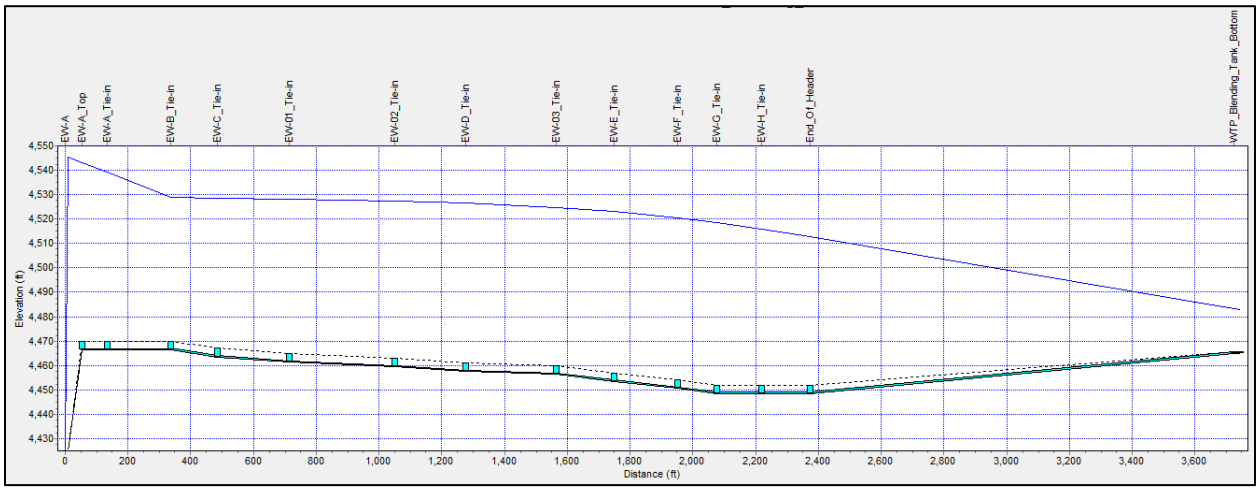


*Figure 8. Influent Pipeline Profile from EW-A to WTP*

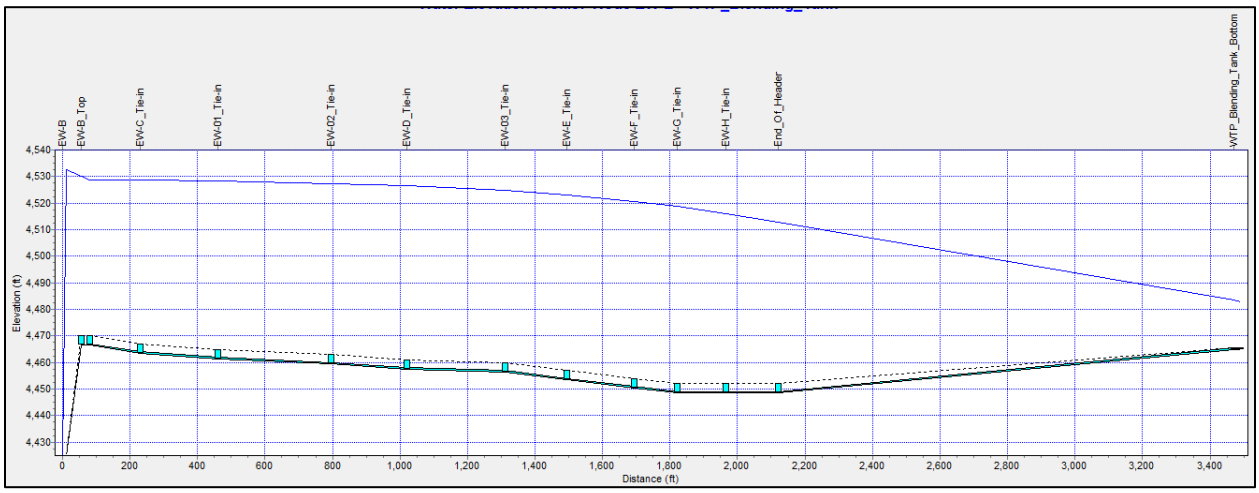


*Figure 9. Influent Pipeline Profile from EW-B to WTP*

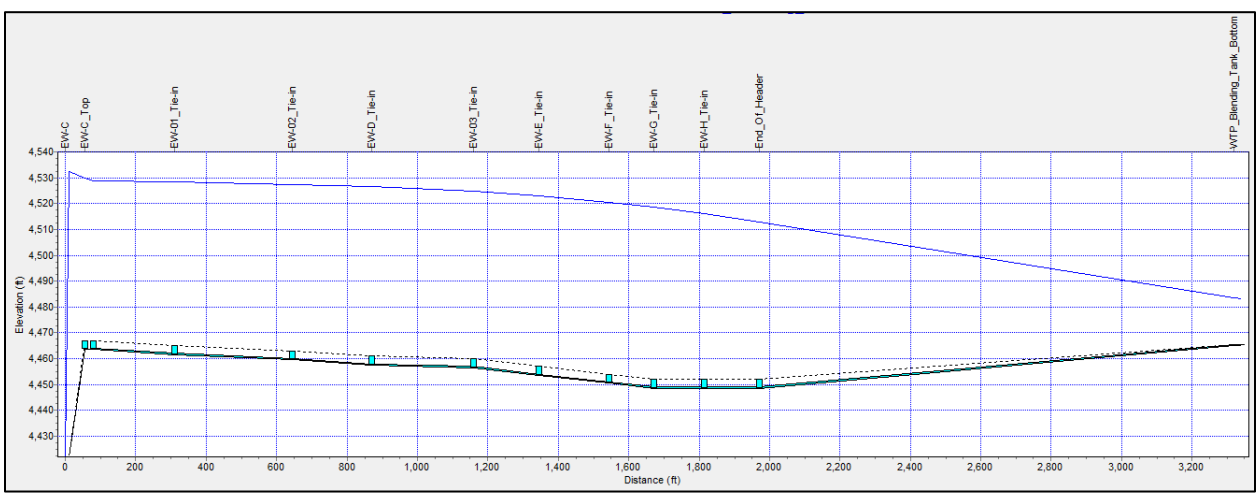


*Figure 10. Influent Pipeline Profile from EW-C to WTP*

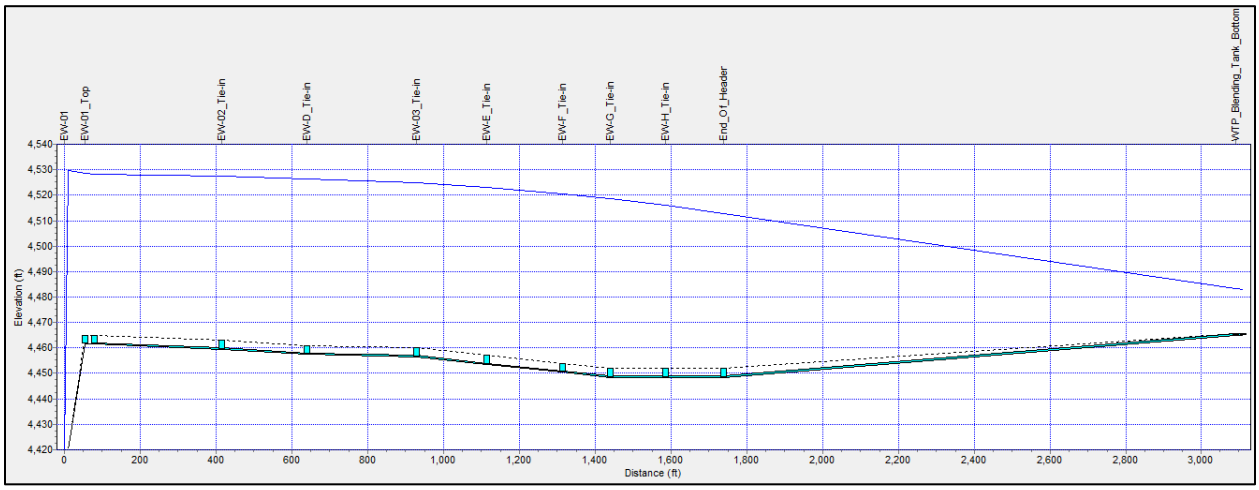


*Figure 11. Influent Pipeline Profile from EW-01 to WTP*

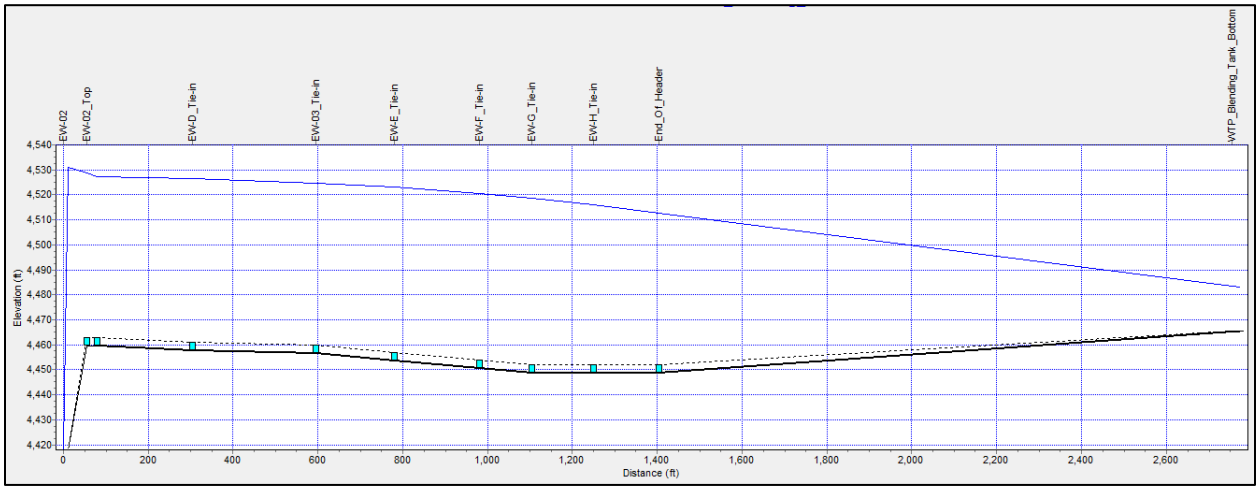


*Figure 12. Influent Pipeline Profile from EW-02 to WTP*

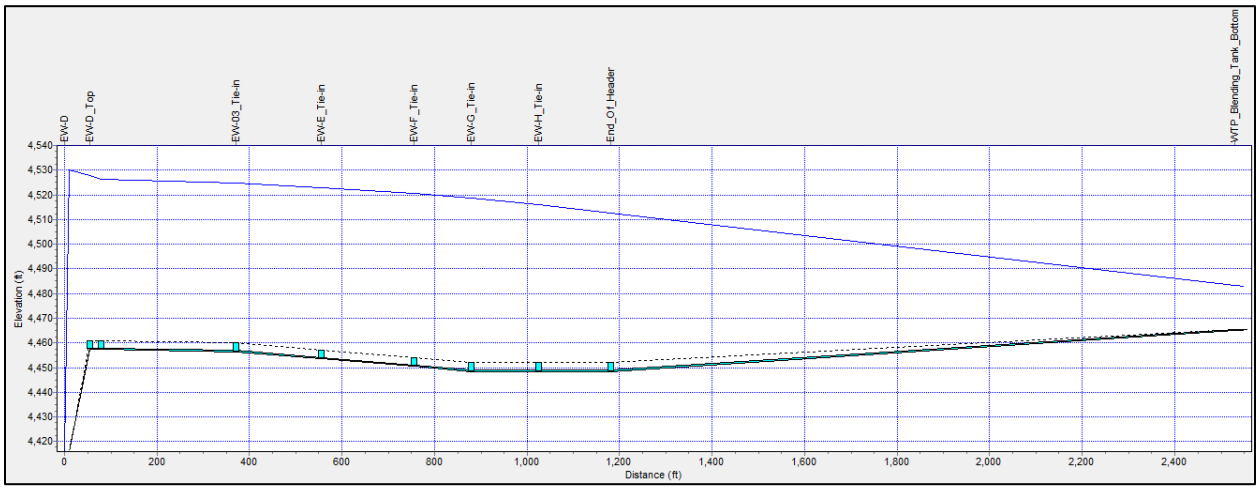


*Figure 13. Influent Pipeline Profile from EW-D to WTP*

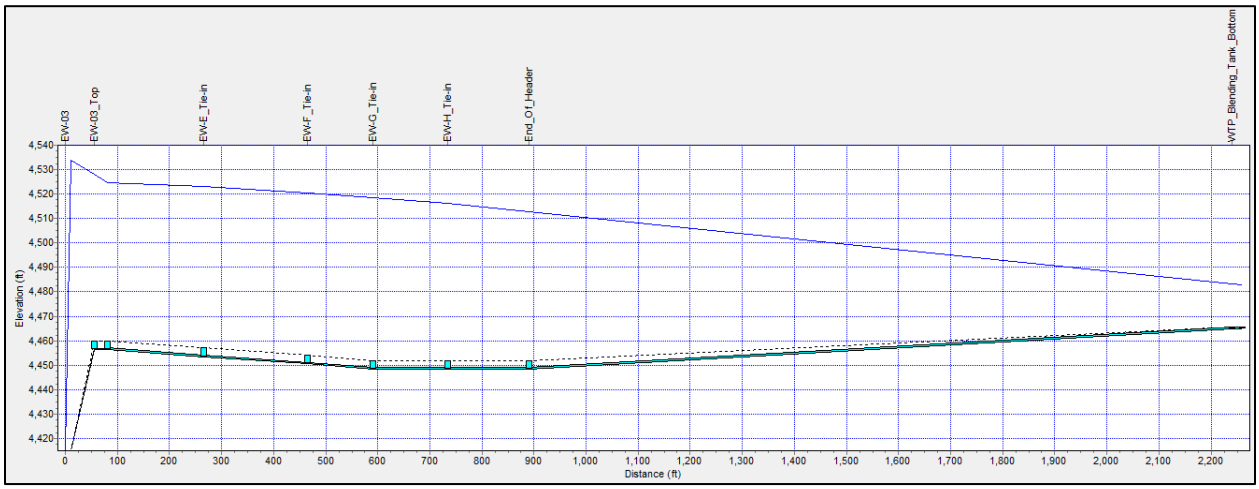


*Figure 14. Influent Pipeline Profile from EW-03 to WTP*

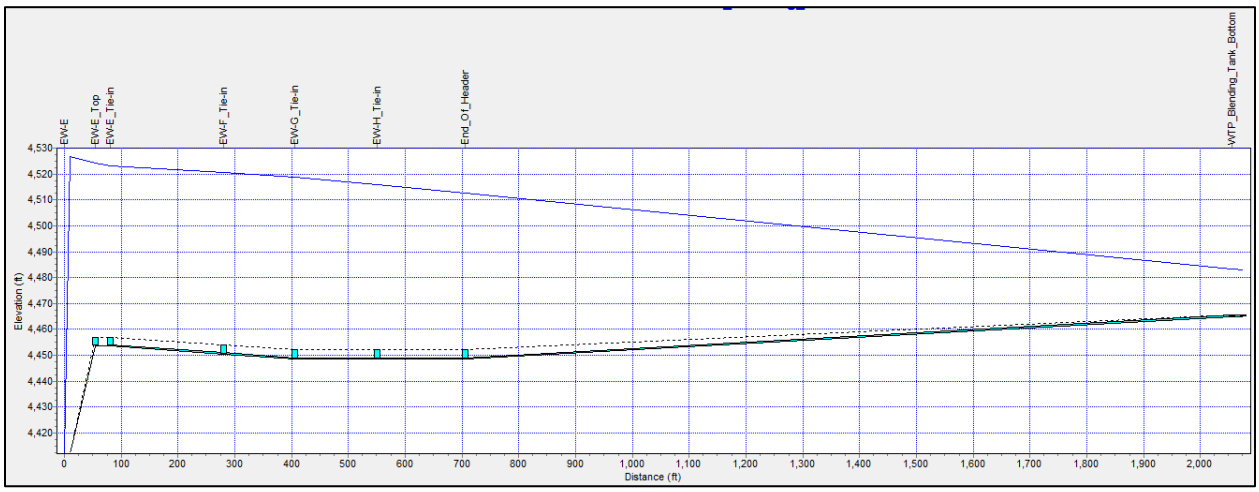


*Figure 15. Influent Pipeline Profile from EW-E to WTP*

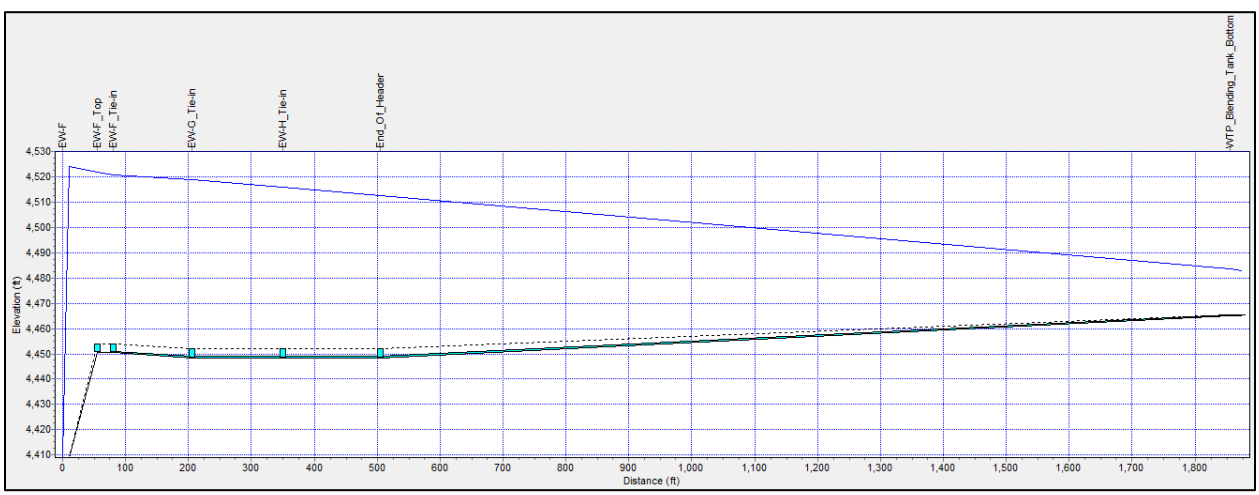


*Figure 16. Influent Pipeline Profile from EW-F to WTP*

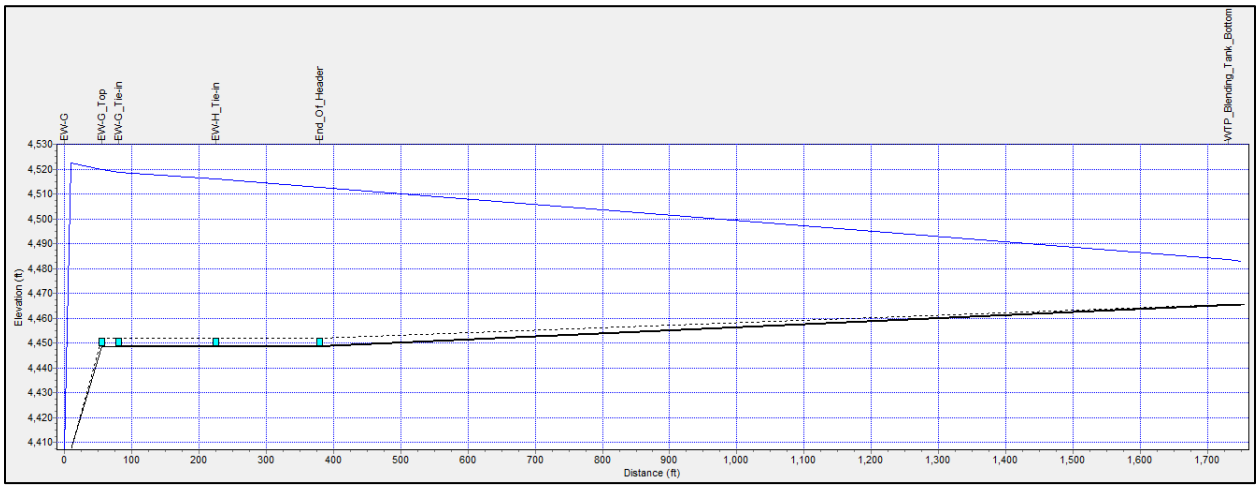


*Figure 17. Influent Pipeline Profile from EW-G to WTP*

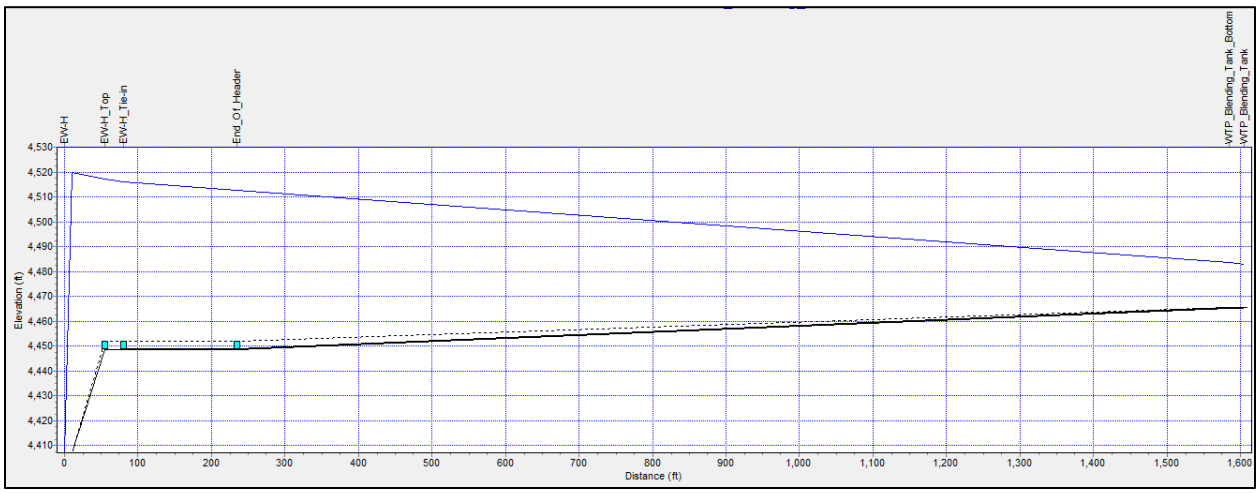


*Figure 18. Influent Pipeline Profile from EW-H to WTP*

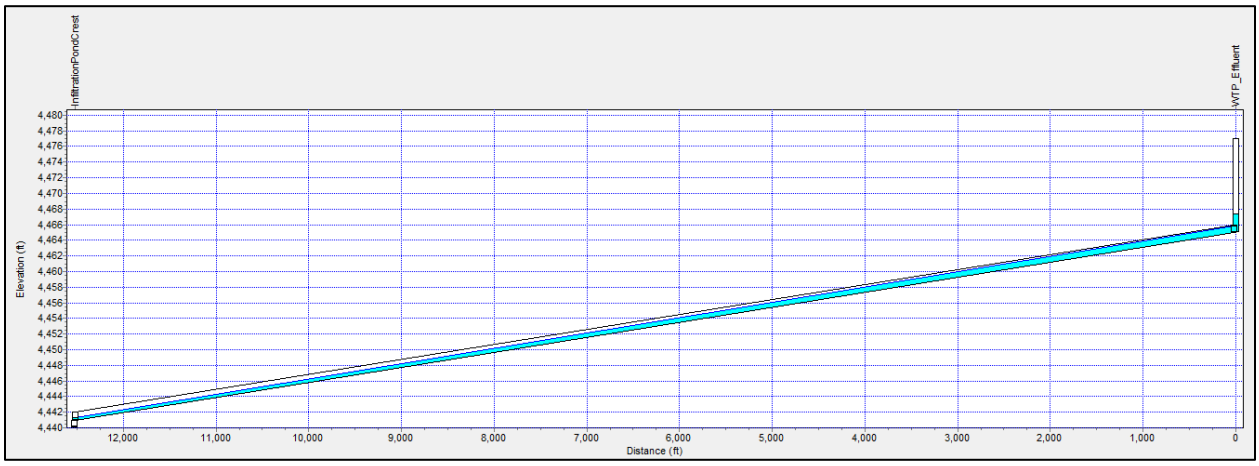


*Figure 19. Effluent Pipeline Profile from Infiltration Pond to the WTP*

# APPENDIX D

## List of Specifications

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**01018 Construction Surveying**
**01025 Measurement and Payment**
**01111 Prevention of Water Pollution, Abatement of Air Pollution, and Abatement of Noise**
**01300 Contractor Submittals**
**01310 Progress and Payment Schedule**
**01400 Quality Control**
**01505 Mobilization**
**01510 Temporary Utilities**
**01520 Security**
**01530 Protection of Existing Facilities**
**01532 Site conditions Surveys**
**01550 Site Access and Storage**
**01551 Construction Access Roads**
**01552 Staging and Stockpile Areas**
**01560 Temporary Environmental Controls**
**01585 Green and Sustainable Practices**
**01600 Products, Materials, Equipment and Substitutions**
**01700 Project Closeout**

## DIVISION 02 - SITEWORK

**02100 Site Preparation**
**02120 Road Maintenance**
**02130 Temporary Traffic Control**
**02160 Sediment and Erosion Control**
**02212 Grubbing, Stripping, and Stockpiling**
**02222 Earthwork**
**02594 High Density Polyethelene Pipe**
**02831 Chain Link Fencing and Gates**

# DIVISION 03 - CONCRETE

**03100 Concrete Formwork**
**03200 Reinforcement Steel**
**03290 Joints in Concrete**
**03300 Cast-In-Place Concrete**
**03315 Grout**
**03495 Precast Manholes and Vaults**

# DIVISION 04- ARCHITECTURAL

**042115 Masonry Veneer**

**042200 Reinforced Concrete Block Masonry**

## DIVISION 05

**05100 Structural Steel Framing**
**05300 Metal Decking**
**05400 Cold Formed Metal Framing**
**05521 Aluminum railings**
**05800 Expansion control**
**055000 Miscellaneous metalwork**

# DIVISION 06 – WOODS AND PLASTICS

**06100 Rough Carpentry**
**06200 Finish Carpentry**
**06610 Fiberglass Reinforced Plastic Fabrications**

# DIVISION 07 – THERMAL AND MOISTURE PROTECTION

**07210 Building Insulation**
**07920 Sealants and Caulking**
**07100 Dampproofing**

## DIVISION 08- DOORS AND WINDOWS

**08100 Steel Doors and Frames**
**084113 Aluminum Entrances and Storefronts**
**08330 Overhead Coiling Doors**
**08710 Finish Hardware**
**08800 Glazing**

# DIVISION 09 - FINISHES

**09250 Gypsum Board**
**09310 Ceramic Tile**
**09500 Acoustical Ceiling**
**09640 Resilient Flooring**
**09800 Protective Coating**

## DIVISION 10- SPECIALITES

**101116 Markerboards and Tackboards**
**10400 Signage**
**10520 Fire Protection Specialties**
**10670 Metal Storage Shelving**
**10800 Toilet Accessories**

## DIVISION 11- EQUIPMENT


**11000 Equipment General Provisions**
**11100 Pumps, General**
**11116 Horizontal Frame-Mounted End Suction Pumps**
**11155 Submersible Well Pumps**
**11200 Mixers and Flocculators, General**
**11201 Mechanical Mixers**
**11202 In-Line Mixers**
**11225 Rapid Mix, Reactor, and High Rate Clarifier System**
**11258 Chemical Feeding Equipment, General**
**11263 Polymer Blending Units**
**11268 Calibration Columns**
**113113 Kitchen Equipment**
**115213 Projection Screen**

# DIVISION 12- FURNISHINGS

## 122113 Horizontal Louver Blinds

# DIVISION 13 – SPECIAL CONSTRUCTION

**13121 Pre-Engineered Metal Buildings**
**13653 Welded Steel Pressure Vessels**
**13675 Polyethylene Tanks**
**13679 Fiber Glass Reinforced Plastic Tanks**

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**15000 Piping, General**
**15005 Piping Identification**
**15006 Pipe Supports**
**15025 Steel Pipes (ASTM A53/A106, Modified)**
**15058 Common Motor Requirements for HVAC Equipment**
**15060 PVC Pressure Pipes (ASTM D1785, Modified)**
**15061 Hangers and Supports for Plumbing Piping and Equipment**
**15068 Vibration Controls for HVAC**
**15073 Vibration and Seismic Controls for Plumbing Piping and Equipment**
**15073 Identification for Plumbing Piping and Equipment**
**15077 Identification for HVAC Piping and Equipment**
**15085 Plumbing Piping Installation**
**15086 Duct Installations**
**15092 Sleeves and Sleeve Seals for Plumbing Piping**
**15093 Sleeves and Sleeve Seals for HVAC Piping**
**15097 Escutcheons for Plumbing Piping**
**15098 Escutcheons for HVAC Piping**
**15111 General- Duty Valves for Plumbing Piping**
**15126 Meters and Gages for Plumping Piping**
**15140 Domestic Water Piping**
**15145 Domestic Water Piping Specialties**
**15150 Sanitary Waste and Vent Piping**
**15155 Sanitary Waste Piping Specialties**
**15183 Refrigerant Piping**
**15196 Facility Liquefied- Petroleum Gas Piping**
**15200 Valves, General**
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**15202 Butterfly Valves**
**15203 Check Valves**
**15204 Ball Valves**
**15206 Gate Valves**
**15208 Elastomeric Check Valves**
**15215 Pressure Reducing Valves**
**15218 Pressure Relief Valves**
**15230 Miscellaneous Valves**
**15412 Emergency Plumbing Fixtures**
**15414 Residential Plumbing Fixtures**
**15421 Commercial Lavoratories**
**15422 Commercial Sinks**
**15440 Plumbing Fixtures**
**15486 Fuel-Fired Water Heaters**
**15564 Indoor Indirect Gas-Fired Heating and Ventilating**
**15570 Fan Equipment**

**15700 Heating, Ventilation, and Air Conditioning, General**
**15763 Fan- Coil Units**
**15785 Air to Air Energy Recovery Equipment**
**15815 Metal Ducts**
**15816 Nonmetal Ducts**
**15820 Duct Accessories**
**15838 Power Ventilators**
**15855 Diffusers, Registers, and Grilles**
**15900 HVAC Instrumentation and Controls**
**15950 Testing, Adjusting, and Balancing**

# DIVISION 16- ELECTRICAL


**16050 Electrical Work, General**
**16110 Electrical Raceway Systems**
**16111 Underground Raceway Systems**
**16120 Wire and Cable**
**16140 Wiring Devices**
**16431 Protective Device Studies**
**16450 Grounding**
**16454 Active Harmonic Filters**
**16455 Variable Frequency Drive Units**
**16460 Electric Motors**
**16470 Panel Boards and General Purpose Dry Type Transformers**
**16480 Low Voltage Motor Control Centers**
**16481 Solid State Reduced Voltage Starters**
**16485 Local Control Stations and Miscellaneous Electrical Devices**
**16500 Lighting**
**16620 Standby Generator Systems**
**16780 Alarm and Detection Systems**
**16850 Electric Heat Tracing**
**16950 Electrical Tests**

## DIVISION 17- INSTRUMENTATION


**17000 Prequalification for Process Control and Instrumentation Systems**
**17100 Process Control and Instrumentation Systems**
**17102 In-Line Liquid Flow Measuring Devices**
**17103 Liquid Flow Detection Devices**
**17106 Level Measuring Systems**
**17107 Level Detection Switches**
**17108 Pressure Measuring Systems**
**17109 Pressure Detection Switches**
**17110 Temperature Measuring Systems**
**17112 Process Analysis Measuring Systems**
**17200 Control Panels**
**17202 PLC Enclosures**
**17300 Control Strategies**
**17510 PLC-Based Control Systems Hardware**
**17520 PLC-Based Control Systems Software**
**17700 Graphic Presentation Systems, General**
**17710 Graphic Presentation Systems Hardware**
**17720 Graphic Presentation Systems Software**

# APPENDIX E

## Construction Quality Assurance Plan

FMC Idaho LLC, Pocatello, Idaho

# CONSTRUCTION QUALITY ASSURANCE PLAN for the FMC OU GROUNDWATER REMEDY

December 2014

MWH

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Attachment 4 Weekly Progress Report

## FIGURES

**(Figures follow text)**

Figure 2-1 CQA Organizational Chart

## ACRONYMS

| | |
|---|---|
| ASTM | American Society for Testing and Materials |
| ASME | American Society of Mechanical Engineers |
| AWWA | American Water Works Association |
| | |
| CQA | construction quality assurance |
| CQAP | Construction Quality Assurance Plan |
| CQC | construction quality control |
| | |
| EP | exploration and production |
| EPA | Environmental Protection Agency |
| | |
| HASP | Health and Safety Plan |
| | |
| IDEQ | Idaho Department of Environmental Quality |
| | |
| OSHA | Occupational Safety and Health Administration |
| OU | operable unit |
| | |
| PM | project manager |
| | |
| QA | quality assurance |
| QC | quality control |
| | |
| RA | remedial area/remedial action |
| RD | remedial design |
| RCP | Reinforced Concrete Pipe |

# 1.0 GENERAL

## 1.1 INTRODUCTION

This Construction Quality Assurance Plan (CQAP) describes the quality control (QC) and quality assurance (QA) activities associated with the Groundwater Remedial Action (RA) at the FMC OU. This document has been written in accordance with the Guidance of Quality Assurance Environmental Technology Design, Construction, and Operation (EPA, 2005).

The work consists of construction of a groundwater extraction system, construction of a groundwater treatment plant and associated infrastructure and the construction of an effluent pipeline and infiltration basin for disposal of treated groundwater.

## 1.2 PURPOSE

During the RA, QA activities will involve the review of submittals, inspections and observations of the Work as it is completed, and field and laboratory testing of construction materials. A major function of the QA is to properly and adequately document that the Work and associated quality control (QC) testing is completed in accordance with the approved Construction Drawings and Technical Specifications.

Procedures presented in this CQAP are intended to identify problems that may occur during construction and to document that any problems are corrected before accepting the construction. The objective of the CQAP is to ensure that the constructed groundwater remedial action facilities meet or exceed all design criteria, plans and specifications, and relevant Performance Standards.

The QC testing described in this CQAP is intended to be implemented by a QC firm, independent of the Construction Contractor. The QC firm will be supported by a number of QC Monitors necessary to implement the requirements in this CQAP and to document the work.

## 1.3 SCOPE

This CQAP establishes general administrative and documentation procedures that will be applicable for selected activities of construction. With respect to responsibilities, personnel qualifications, and specific inspection and testing activities, this CQAP addresses all activities associated with the Groundwater RA. Specific procedures relating to the construction quality assurance (CQA) activities that are not addressed in this CQAP will be performed in accordance with manufacturers' recommendations.

## 1.4 REMEDIAL ACTION SUMMARY

The selected remedy for the site groundwater at the FMC OU includes the following components:

- Install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby preventing contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU and/or adjoining springs or the Portneuf River. Extracted groundwater will be treated within the FMC OU to drinking water standards and/or risk-based cleanup levels and discharged to an infiltration basin(s) within the FMC OU, where it would percolate down to recharge groundwater or evaporate into the atmosphere. An alternate method of disposal for treated groundwater, consisting of discharging to the Pocatello publically owned treatment works (POTW), was evaluated but eventually rejected as a viable option following a rejection letter from the POTW to receive the treated groundwater.

- Implement a long-term groundwater monitoring program to evaluate the performance of the soil and groundwater remedial actions to determine their effectiveness in reaching the cleanup levels, and provide information needed for developing a final groundwater remedy protective of human health and the environment if the current interim remedy cannot meet cleanup requirements within an acceptable timeframe. The long-term groundwater monitoring program will be based on the currently approved Interim CERCLA Groundwater Monitoring Plan (MWH, 2010b).

- Implement and maintain institutional controls that include environmental land use easements which prohibit activities that may disturb implemented remedies (such as digging in capped areas) and restrict the use of contaminated groundwater;

- Construction of the facilities to implement the Groundwater RA includes the following main components:

    - Groundwater Extraction - Installation of 8 new extraction wells each drilled to an approximate depth of 110 feet bgs, installation of instrumentation and controls at the extraction wells and construction of pipelines to convey the extracted groundwater to the water treatment plant.

    - Treatment - Construction of a chemical precipitation/flocculation water treatment plant (WTP) that will primarily remove arsenic and phosphorous from extracted groundwater.

    - Disposal – Installation of an approximately 2-mile long effluent pipeline from the WTP to an infiltration basin located in the Western undeveloped Area. The infiltration basin will be constructed during the capping phase of the Soil RA and is not part of the scope of this CQAP.

## 1.5 DOCUMENT ORGANIZATION

The remainder of this document consists of the following sections:

- Section 2.0 Project Organization– Details the organization structure for the project.
- Section 3.0 Personnel Qualifications and Training – Presents a summary of the minimum qualifications and training for QA/quality control (QC) personnel.
- Section 4.0 Definitions Related to Construction Quality Assurance – Provides project definitions for QC/QA.
- Section 5.0 Applicable Organizations and Standards – Defines the applicable organization standards for the project as they relate to QC testing and QA.
- Section 6.0 Construction Quality Control Procedures – Details the construction phases and inspections to be performed for the project as they pertain to QA.
- Section 7.0 Sampling Requirements– Presents a summary of the minimum sampling activities necessary during the construction phase.
- Section 8.0 Construction Activities and Submittal Requirements – Defines the minimum QC testing for project earthworks.
- Section 8.0 Construction Quality Assurance Documentation – Defines the minimum documentation requirements for QA testing.
- Attachment 1 Record of Non-Complying Test Form
- Attachment 2 Daily Progress Report Form
- Attachment 3 Notice of Non-Compliance Log
- Attachment 4 Weekly Progress Report

# 2.0 PROJECT ORGANIZATION

This section describes the project organization for construction and associated CQA activities. The following subsections address the organizations involved in the construction, their respective roles in construction activities, and the methods of interactions between organizations. An organization chart is presented in Figure 2-1 that illustrates the organizational structure pertaining to this CQAP.

## 2.1 RESPONSIBILITY AND AUTHORITY

The project organization consists of the Contractor, FMC's (the Company's) Construction Manager, a Design Engineer, a QA Engineer, QC Contractor and the QC Monitor(s). The responsibilities for the project and field team members are provided in the subsections below:

### 2.1.1 CONTRACTOR

The Contractor is responsible for completing the work in accordance with the project Drawings and Specifications. The Contractor will be responsible for subcontracting directly a third party firm to provide construction quality control (CQC). The Contractor will report directly to the Company's Construction Manager.

### 2.1.2 QC CONTRACTOR

The QC contractor shall be an independent firm that shall be responsible for performing inspections, and testing as required by this CQAP.

### 2.1.3 QC SITE MONITOR(S)

The QC Site Monitor(s) is/are responsible for implementation of the QC testing program under this CQA Plan under the direction of the QC Contractor. The QC Site Monitor(s) will have responsibility for QC activities related to the construction including testing and observations in accordance with the Drawings, Technical Specifications, and this CQAP. The QC Site Monitor(s) will control the day-to-day QC tasks, including communicating and coordinating daily field tests with the Contractor, correctly completing all necessary field data sheets on a daily basis, photographing construction progress, keeping a field and photograph log book that describes the construction activities, completing and providing a daily field report to the Construction Manager, maintaining files and correspondence on a daily basis, and preparing any samples for shipment off site. The QC Site Monitor(s) will report to the QA Engineer.

### 2.1.4 CONSTRUCTION MANAGER

The Construction Manager will be designated by the Company and will have overall responsibility for coordinating directly with the Remedial Design/Remedial Action (RD/RA)

Contractor Project Manager and have close communication with the Design Engineer and the QA Engineer. The Construction Manager directs all field activities on behalf of the Company and provides administrative and accounting services. Functionally, the Construction Manager will be responsible for relaying any issues regarding QA/QC to the CONTRACTOR identified by the QA Engineer. In addition, the QA PM will provide a monthly progress report to the Company, which will consider scope of work, budget, schedule, account tracking, and advice on the progress of the project. Reviewing and approving invoices, as well as providing a monthly accrual to the Company, is also part of the Construction Manager's responsibilities.

### 2.1.5 FIELD CONSTRUCTION SUPPORT TEAM

The Field Construction Support Team will report directly to the Construction Manager and will be present during all major construction activities. A Professional Engineer (P.E), registered in the State of Idaho, will be a part of the Field Construction Support Team to provide oversight of well construction activities. The duties and responsibilities of this team will include:

- Visual inspection of materials imported to the site;
- Observing field sampling and testing performed by the contractor and reviewing test results;
- Observing and recording observations regarding the storage and handling of equipment and materials;
- Preparing daily reports documenting all contractor activities

### 2.1.6 DESIGN ENGINEER

The Design Engineer is responsible for preparing construction drawings and technical specifications, addressing all constructability issues, addressing clarifications or requesting changes to the specifications or drawings, approving final QA submittals, and addressing unknown field issues. The Design Engineer will closely monitor all construction and QA activities and address issues that may arise during construction. The Design Engineer will coordinate with the Construction Manager and have close communication with the QA Engineer to ensure all issues are being addressed. Significant design changes shall be approved by the EPA and local governing authority. The Design Engineer will ultimately be responsible for certifying that the Work has been performed in accordance with the approved plans and technical specifications and will be a Registered Professional Engineer in the State of Idaho.

### 2.1.7 QA ENGINEER

The QA Engineer will have the overall responsibility for ensuring compliance with this CQAP and will work closely with the Construction Manager and QC monitors. The QA Engineer will be responsible for reviewing QC testing reports and documenting to the Construction Manager

and Design Engineer that, in his opinion, the construction has been completed in compliance with the approved Drawings and Specifications, and any approved changes. The QA Engineer also has the responsibility to recommend remedial actions to the Construction Manager and Design Engineer, if the construction contractor is not adhering to this CQAP.

### 2.1.8 HEALTH AND SAFETY OFFICER

The Health and Safety (H&S) Officer will be designated by the Company and will be independent of the Contractor's H&S officer and will support the Field Team in ensuring that all work activities are performed in a safe manner and in accordance with the Contractor's project-specific Health and Safety Plan (HASP). The H&S officer will be responsible for routine and random site H&S site audits and observations, weekly safety meetings with all safety leadership, provide safety incident investigations management and document lessons learned from near miss reporting, observations and audits.

### 2.1.9 QC TESTING LABORATORY

The QC Testing Laboratory will provide independent testing as directed by the QA Site Monitor(s). The QC testing will be in accordance with this CQA Plan and the Technical Specifications.

## 2.2 PROJECT MEETINGS

This section includes a discussion of the various progress and status meetings that will be held throughout the performance of the WORK. The purpose of the meetings is to discuss work progress, planning, and other issues related to construction. A portion of these meetings can be dedicated to CQA issues, as necessary, to provide an opportunity for the CQA team to express concerns regarding quality, to relay test results, and to provide regular communication between all organizations involved in the construction.

### 2.2.1 PRE-CONSTRUCTION MEETING

A pre-construction meeting will be scheduled prior to beginning construction to ensure all parties involved in the project understand and agree to the goal, objectives, schedule, submittal, documentation, and QC processes; and inspection and testing requirements and procedures. At a minimum, the meeting will be attended by FMC, CONTRACTOR Project Manager, QC Contractor representative, Design Engineer, the Construction Manager, and QA Engineer. This pre-construction meeting may be combined with the UAO-required pre-construction inspection and meeting or may be held subsequent to that meeting. The pre-construction meeting will include discussion of QA/QC topics as follows:

- Reviewing safety responsibilities and requirements.
- Reviewing the responsibilities of each organization.

- Reviewing lines of authority and communication for each organization.
- Providing each organization with all relevant CQA and CQC documents and supporting information.
- Familiarizing each organization with this CQAP and its role relative to the design criteria, plans, and specifications.
- Determining any changes to this CQAP that may be needed to document that the facility will be constructed to meet or exceed the specified design requirements.
- Discussing the established procedures or protocol for observations and tests, including sampling strategies.
- Discussing the established procedures, or protocol, for handling construction deficiencies, repairs, and retests, including "stop work" conditions.
- Reviewing methods for documenting and reporting inspection data.
- Reviewing methods for distributing and storing documents and reports.
- Reviewing work area security and safety protocol.
- Reviewing the proposed project schedule.
- Discussing procedures for locating and protecting construction materials and for preventing damage of the materials from inclement weather or other adverse events.
- Conducting a site walk-around to review construction materials and inspect equipment storage locations.
- Action items, assigned actions, and minutes will be recorded and transmitted to the required distribution list and to meeting attendees.

### 2.2.2 DAILY MEETINGS

The Contractor's Project Manager will conduct daily pre-shift briefings at the work area. The participants will include, at a minimum, the construction field personnel (including subcontractors) and QC Monitor(s), and Construction Manager. The primary purpose of these meetings is to address the day's planned activities and health and safety issues. Following the daily pre-shift meeting, the QC Monitor(s) will meet to discuss QC activities planned for that day with the QA Engineer and relay their needs with the construction personnel. The topics typically covered include:

- Discuss any health and safety issues.

- Review the previous day's activities and accomplishments.
- Review the work location and activities for the day (plan of the day).
- Discuss the construction subcontractor's personnel and equipment assignments for the day.
- Address scheduling of resources for upcoming work.
- Review any new test data.
- Discuss any potential construction problems, including unexpected subsurface conditions.
- Discuss QC-planned activities and interface needs.

### 2.2.3 WEEKLY PROGRESS MEETINGS

Weekly meetings will be held at the site or via phone conference to discuss construction progress. At a minimum, the weekly progress meetings will be attended by the Contractor's Project Manager, Construction Manager, the QC Monitor(s), the QA Engineer, and possibly the surveyor, as needed. The purpose of the meeting is to accomplish the following:

- Review safety incidents or safety topics
- Review the previous week's activities and accomplishments
- Review planned activities for the upcoming week
- Finalize resolution of problems from the previous week
- Discuss the potential problems with the work planned for the upcoming week

Minutes will be recorded by a party identified by the Contractor's Project Manager and transmitted to the required distribution list and meeting attendees.

### 2.2.4 PROBLEM OR WORK DEFICIENCY MEETINGS

Meetings will be convened, as necessary, to address inspection deficiencies and nonconformance. Deficiencies observed during construction by the QC Monitor(s) will be brought to the attention of the Contractor's Project Manager and QA Engineer immediately. These deficiencies will be tracked in the QC Monitor's field log book until resolved, and included in the daily summary report. These documents will include the description of the deficiency and actions taken or to be taken to resolve the deficiency.

# 3.0 PERSONNEL QUALIFICATIONS AND TRAINING

This section describes the qualifications and training required for CQA personnel. All documentation relating to qualifications will be maintained with the project CQA records.

## 3.1 CONTRACTOR'S PROJECT MANAGER

The Constructor Project Manager will have a minimum of 10 years of construction project management experience with manufacturing / processing facility construction projects.

## 3.2 CONSTRUCTION MANAGER

The Construction Manager will have project management experience and will, at a minimum, have 15 years of experience and will have sufficient practical, technical, and managerial experience to successfully support the project. The Construction Manager's qualifications will be documented by training records and a professional resume showing significant field experience in construction management.

## 3.3 QA ENGINEER

The QA Engineer will have construction experience and will and will have sufficient practical, technical, and managerial experience to successfully support the QA activities discussed in this CQAP. The QA Engineer's qualifications will be documented by training records and a professional resume showing significant field experience with manufacturing / processing facility construction.

## 3.4 QC MONITOR(S)

At a minimum, the QC Site Monitor(s) will have a high school diploma and at least five years of construction-related experience, including at least three years of experience in manufacturing / processing facility construction, or a Bachelor of Science degree from a four-year college or university, and at least two years of experience conducting CQC monitoring for earthwork construction. The QC Site Monitor(s) must be capable of performing work with little or no daily supervision. Qualifications of the QC Monitor(s) shall be documented by training records and professional resumes and shall be reviewed by the Certifying Engineer.

## 3.5 HEALTH AND SAFETY OFFICER

The H&S Officer will have at least 10 years serving as a H&S Officer/Representative on large environmental and/or civil engineering projects. The H&S Officer will also be required to hold a certification in H&S training. A diploma as a Certified Industrial Hygienist is preferred but not required.

## 3.6 QC TESTING LABORATORY

The QC testing laboratory will be selected by the QA Certifying Engineer and will provide conformance testing required by this CQA Plan, as requested by the QA Site Monitor(s) and/or QA Certifying Engineer. The QC testing laboratory will be a third-party, independent testing laboratory, unaffiliated with the Design Engineer, materials supplier or manufacturer, or Construction Contractor or subcontractors.

## 3.7 SURVEYOR

All surveyors performed as part of this CQAP shall be performed or approved by an Idaho licensed registered land surveyor, subcontracted to the Contractor and approved by the CQA Engineer.

# 4.0 DEFINITIONS RELATING TO CONSTRUCTION QUALITY ASSURANCE

## 4.1 CONSTRUCTION QUALITY ASSURANCE AND CONSTRUCTION QUALITY CONTROL

**Construction Quality Assurance (CQA**) — A planned and systematic pattern of the means and actions designed to provide adequate confidence that items or services meet contractual and regulatory requirements, and will perform satisfactorily in service.

**Construction Quality Control (CQC)** — The actions that provide a means to measure and control the characteristics of an item or service to meet contractual and regulatory requirements.

## 4.2 USE OF THE TERMS IN THIS CQA PLAN

The definitions used in the context of this CQA Plan are provided below:

- CQA refers to means and actions employed by the QA Engineer to assure conformity with this CQAP, the Technical Specifications, and the Construction Drawings. CQA is provided by a party independent from the product manufacturer and construction contractor.

- CQC refers to those actions taken by manufacturers, suppliers, or Construction Contractors, including their designated representatives, to ensure that the materials and the workmanship meet the requirements of the Technical Specifications and the Construction Drawings.

# 5.0 APPLICABLE ORGANIZATIONS AND STANDARDS

## 5.1 APPLICABLE ORGANIZATIONS

Organizations whose standards are referenced in this CQAP include:

- ASTM — American Society for Testing and Materials
- ASME – American Society of Mechanical Engineers
- AWWA – American Water Works Association
- EPA — U.S. Environmental Protection Agency
- OSHA — Occupational Safety and Health Administration

## 5.2 APPLICABLE STANDARDS

Any reference to the standards of any society, institute, association, or governmental agency will pertain to the edition in effect as of the date of this CQAP, unless stated otherwise. Specific test standards for tests cited in this CQAP are provided in the Technical Specifications. These standards may be modified due to technological advances since completion of the Technical Specifications.

# 6.0 CONSTRUCTION QUALITY CONTROL PROCEDURES

Construction quality control procedures follow the standards established in the Final Design to address many of the aspects of system construction such as site selection and development, reviewing resources and suppliers, materials management, inspection, testing, control and tracking, certifications, and approvals.

This section describes the three construction control phase components of the remedy: pre-construction, construction, and post-construction. Each control phase includes a minimum requirement for inspection to maintain the level of quality throughout the construction process. The general procedures for each control phase and the minimum requirements of inspection and testing for each of the following components of the Groundwater RA are described below:

- Extraction Wells and Piezometer Construction – A subcontractor, through the Contractor, will be selected to execute the scope of work to meet the specifications outlined in the contract documents to install the additional extraction wells and collocated piezometers and additional piezometers specified in the Final Design.
- Extraction Wells Enclosures – The Contractor shall construct the well enclosures (pitless adapters, and install all necessary mechanical components, as outlined in the contract documents.
- Conveyance Pipelines Construction - The Contractor shall install conveyance pipeline to:
    1. Convey groundwater from the extraction wells to the WTP; and
    2. Convey treated water from the WTP to the infiltration basin in the WUA.
    3. Convey potable water from existing water supply well to WTP.
- Water Treatment Plant – The Contractor will be responsible for executing the scope of work associated with the WTP, as outlined in the contract documents, to procure, install, and test the WTP.

## 6.1 PHASES OF CONTROL

This section describes the three phases of control for execution of each component of construction:

1) pre-construction preparation;
2) construction phase; and
3) 3) post-construction phase.

Implementation of the phases provides the opportunity to verify compliance with the approved plans, specifications, and procedures. The Construction Quality Assurance Manager is responsible for ensuring that discrepancies identified during each phase of control are documented and resolved.

### 6.1.1 PRE-CONSTRUCTION PREPARATION

The first phase of control is the pre-construction preparation which leads to mobilization for executing construction activities. Completion of this phase establishes relationships and communication lines between the necessary parties and verifies the scope of work and that the design guidelines have been laid out in the Final Design.

During pre-construction preparation, the contractor shall review the site, scope of work, and contract documents. Prior to scheduled field activities, there will be a meeting between the Project Manager, the Contractor, and the Design Engineer, to discuss discrepancies and alternative construction recommendations if needed. The following items shall be addressed during the pre-construction preparation:

- The Contractor will review the construction quality assurance task requirements with the Construction Task Leader (e.g. subcontractor).
- The Contractor will submit to the Design Engineer for review and approval, the name of the materials' supplier with specification of all construction supply materials included in but not limited to those listed in the Final Design. The availability of the required materials and equipment will be confirmed by the Contractor.
- The Contractor will submit a site specific H&S Plan specific to the daily tasks performed for review and approval by the H&S Coordinator.
- The Contractor will examine the materials and equipment to confirm compliance with approved procedures.
- The Contractor will develop a submittal register and inspection and testing log.

### 6.1.2 CONSTRUCTION PHASE

During the construction phase, the Contractor and Construction Manager will establish acceptable quality and assurance levels that are met through documentation, observations, inspections, and testing. During the construction phase, specific deficiencies will be identified and addressed in an efficient manner to avoid schedule delays or additional project costs. Follow up inspections will be conducted to ensure that deficiencies are corrected before continuation of work that may be affected by such deficiencies. The information to be written in the daily progress reports will be communicated between the Contractor, subcontractor, QA Engineer, and Construction Manager to ensure results meets the design criteria and standards of the Final Design. The following items will be addressed during the construction phase to maintain the standards set in the Final Design:

- The Contractor will provide guidance to the Construction Manager to manage and resolve conflicts during construction activities. The QC Monitors and QA Engineer will be on notice to observe execution of field testing activities.
- The Contractor and Construction Manager will also establish the quality of workmanship and housekeeping required to meet the requirements of the contract documents.
- The Construction Manager will ensure the Contractor is compliant with the respective outside organizations' constructions, testing, and inspection requirements for all tasks. The Construction Manager will ensure waste is disposed or treated at a facility in compliance with the Project Transportation and Off-Site Disposal Plan (TODP).

### 6.1.3 POST-CONSTRUCTION PHASE

Towards completion of the construction, the QA Engineer shall conduct an internal inspection for evaluation of workmanship quality. In this post-construction phase, inspection will include line items of non-conformance, deliverables expected, and achieved requirements outlined in the Final Design. The Contractor will provide the Construction Manager with documentation to comply with disposal methods outlined in the Final Design. The Contractor will schedule and complete requirements required by the permits, to obtain approval of all tasks of each component of construction.

## 6.2 INSPECTIONS AND TESTING

The QC Monitors and QA Engineer will conduct inspections to verify construction quality and compliance with the Final Design. Inspections will be conducted during each control phase. The inspections will verify that materials and equipment are defect free, deficiencies are being corrected, the contractor is meeting or exceeding test requirements, and construction activities are in line and in compliance with the Final Design and any permit requirements.

This section defines the inspection and testing requirements for:

- Extraction well and piezometer construction and inspection;
- Water treatment plant; and
- Conveyance pipeline construction and inspection.

### 6.2.1 EXTRACTION WELL AND PIEZOMETER CONSTRUCTION AND INSPECTION

The following testing and inspection items shall be addressed during construction of the extraction wells and piezometer installation components of construction activities to comply with the Final Design:

- Inspection of well casing and screen for defects prior to installation;
- Proper installation of the additional extraction wells and collocated piezometers and additional piezometers to the specified depths as noted in the Final Design, including well

construction materials; screen depth, length and slot size; and filter pack and bentonite seal;

- Inspection of well development activities.
- Verification of proper construction of pitless adapters and inspection of associated valving and controls;
- Verification of barriers and/or fencing around extraction wells;

### 6.2.2 WATER TREATMENT PLANT

During construction, the QC Monitors will be responsible for providing field support to the Contractor by overseeing Contractor activities. The following items will be addressed during the construction of the water treatment plant construction component to comply with the Final Design:

- Verification of concrete foundations meeting testing requirements of cylinder test (ASTM C 31, ASTM C 39, and ASTM C 172), slump test (ASTM C 143), and structural concrete (American Concrete Institute 318);
- Verification of mechanical flow of the Work;
- Verification that structural foundations comply with the construction standards ( concrete forming, water tightness, water stops, steel reinforcement, all other details as noted in the Final Design);
- Verification of heating ventilation and cooling system controls testing;
- Verification of inspection of epoxy coated anchors;
- Verification of proper installation of sanitary sewer system and potable water lines ( as outlined in 6.2.3);
- Verification of proper communication and electrical wiring installation;
- Inspection of power drop and transformer from overhead power pole;
- Verification of proper general site grading, as noted in the Final Design;
- Verification of controls testing of equipment, as noted in the Final Design to include, level sensor switches, automated shutdowns, and equipment alarm pressures;
- Verification of relay and controls testing of integration of extraction pumps and treatment system controls;
- Verification of removal of all temporary testing valves and appurtenances upon final approval of the Work;

- Special Inspection and Testing : Third Party concrete aggregate testing to comply with ASTM C33; and

- Permit required inspections by outsides organizations.

### 6.2.3 CONVEYANCE PIPELINE CONSTRUCTION AND INSPECTION

The following testing and inspection items will be addressed during construction of the conveyance pipeline construction component to comply with the Final Design:

- Verification of proper location and installation of influent, effluent and potable water pipelines as noted in the Final Design;

- Verification of proper infiltration basin grading as noted in the Final Design;

- Verification that soils testing complies with tolerances noted in the Final Design;

- Verification that compaction and moisture conditions are achieved by ASTM D 698, ASTM D1556 or ASTM D2922, D3017, ASTM D1557,ASTM D4253 and D4254, ASTM D75;

- Verification of trench and backfill;

- Verification of pressure piping by American Society of Mechanical Engineers (ASME) B31;

- Verification testing of backflow prevention valves;

- Verification of disinfection of water mains by American Water Works Association C 601 and de-chlorination of test water (AWWA C 651) prior to disposal, if applicable;

- Observation of the execution of hydrostatic and pneumatic leak testing;

- Verification of successful pipeline leak test completion;

- Coordination of trench inspection and backfill inspections with respective organizations; and

- Special inspection by third-party certified chlorination and testing subcontractor to perform chlorination of water mains; where applicable. ;

# 7.0 SAMPLING REQUIREMENTS

Sampling activities during construction will encompass initial system performance testing. Samples to be collected include influent, intermediate, and effluent water samples during initial system performance testing.

The analytical laboratory will provide sample containers, coolers, and trip blanks if needed.

## 7.1 SAMPLE COLLECTION

Samples will be collected from sample ports installed on the blending, clarifier and effluent tanks . Each sample will be labeled with a unique identification name, date, and time. Additional sample information including number, type of containers, preservation method, requested analytical methods, and laboratory turnaround time will be recorded on a supplied chain of custody (CoC) form. A copy of the CoC will be kept on file.

## 7.2 LABORATORY PROCEDURES

When received, the analytical laboratory will accept custody of the sample and sign the CoC. Each sample will be given a unique laboratory identification number through a computerized Laboratory Information Management System (LIMS) and this information will be stored and tracked until the analytical process is completed and the sample is ready for disposal.

# 8.0 CONSTRUCTION ACTIVITIES AND SUBMITTAL REQUIREMENTS

## 8.1 CONSTRUCTION ACTIVITIES

This section describes the construction activities and submittal requirements that will be performed by the CONTRACTOR's during the project. This CQAP addresses the following activities of construction:

- Extraction Well and Piezometer
- Wastewater Treatment Plant
- Conveyance pipelines

Prior to the start of construction activities, the QC Monitor(s) will review and become familiar with the Construction Drawings and Technical Specifications. The QC Monitor(s) should also be familiar with the most recent construction schedule so that adequate resources (i.e., laboratory, field testing equipment, staff, and QC forms) including contingencies (e.g., backup equipment, alternate laboratory, and alternate QC staff) for CQC activities will be commensurate with the anticipated construction productivity and work schedule. All necessary measures should be taken to avoid delaying construction activities and the completion of the Work.

## 8.2 SUBMITTAL AND ACCEPTANCE REQUIREMENTS

The following section details the submittals required to start the work, and the sequencing protocol between the Contractor, QA Engineer, and the Construction Manager for releasing finished portions of the work.

### 8.2.1 EARTHWORK AND PIPE INSTALLATION

The Contractor will provide the submittals required by this section to the QA Engineer in accordance with the Drawings and Specifications. When an area of the work site has been completed to the satisfaction of the Contractor, he/she will mark the area and communicate with the QC Engineer that the area has been released for final QA approval. Once the QC testing has been performed in accordance with this CQAP, the QA Engineer will communicate, in writing, to the Construction Manager that the area marked by the Contractor meets all requirements set forth within the Drawings and Specifications. Approval from the Construction Manager must be obtained, in writing, prior to the Contractor being able to perform subsequent tasks in the QA approved area. The Contractor will be operating under the risk that it may not be approved and re-work will need to be performed if the contractor decides to proceed without the Construction Manager approval.

# 9.0 CONSTRUCTION QUALITY ASSURANCE DOCUMENTATION

## 9.1 DOCUMENTATION

A major function of CQA is to ensure that the Work has been properly and adequately document in accordance with the Contract Documents. This section describes the minimum required documentation. The QA Engineer may recommend to the QC Monitor(s) additional documentation for performing CQC tasks that are for certification. The QC Monitor(s) will prepare forms, field data sheets, sample labeling schemes, and chain-of-custody procedures.

### 9.1.1 QA/QC TESTING DOCUMENTATION

The collection of all samples and performance of all tests for QA and QC will be documented on field forms by the QA Engineer or QC Monitor(s), respectively.

### 9.1.2 DAILY REPORTS

Daily reports will be completed by the QC Monitor(s). All CQC personnel will be assigned field books, which will be labeled with a unique number. Each QC Monitor will record all field observations and the results of field tests either in their assigned field book or on field data sheets. When not in use, all field books will be left in the field records file. After each book is filled (or at the end of the project), the field book will be returned to the Project Manager and routed to the project files.

Each page of the field book will be numbered, dated, and initialed by the QC Monitor(s). At the start of a new work shift, the QC Monitor(s) will list the following information at the top of the page:

- Job name
- Job number
- Date
- Name
- Weather conditions
- Page number (if pages are not pre-numbered).

The remaining individual entries will be prefaced by an indication of the time at which they occurred. If the results of test data are being recorded on separate sheets, it will be noted in the field book. Entries in the field book will include, but not be limited to, the following information:

- Reports on any meetings held and their results.
- Equipment and personnel being used in each location, including construction subcontractors.
- Descriptions of areas being observed and documented.
- Descriptions of materials delivered to the site, including any quality verification (vendor certification) documentation.
- Descriptions of materials incorporated into construction.
- Calibrations, or recalibrations, of test equipment, including actions taken as a result of recalibration.
- Decisions made regarding use of material and/or corrective actions to be taken in instances of substandard quality.
- Unique identifying sheet numbers of inspection data sheets and/or problem reporting and corrective measures reports used to substantiate the decisions described in the preceding item.

At the end of each day, the field QC Monitor(s) will summarize the day's activities on a Daily Field Monitoring Report (Field Report) provided as Attachment 2. The Field Report will include a brief summary of the day's activities and highlight any unresolved issues that must be addressed by the QA Engineer or by the QC Monitor(s) the following day. The daily field monitoring report will be filled out in triplicate or photo copied. The QC Monitor(s) will attach a copy of the field book notes for that day to each copy of the Field Report. The three copies will be distributed as follows:

- Original will be filed in the field office.
- One copy will be transmitted to the QA Engineer.
- One copy will be transmitted to the Construction Project Manager.

### 9.1.3 INSPECTION DATA SHEETS

All observed field and laboratory test data will be recorded on an Inspection Data Sheet and stored in the project file. At a minimum, each Inspection Data Sheet will include the following information:

- Unique identifying sheet number for cross-referencing and document control.
- Description of the inspection activity.

- If appropriate, location of the inspection activity or location from which the sample was obtained.
- Type of inspection activity and/or procedure used (reference to standard method when appropriate).
- Any recorded observation or test data, with all necessary calculations.
- Results of the inspection activity and comparison with specification requirements.
- Identification of any personnel involved in the inspection activity.
- Signature of the individual(s) performing the CQC activity.

### 9.1.4 RECORD DRAWING MAINTENANCE

The Contractor will maintain a complete set of Construction Drawings labeled "Red-Line" as-built drawings. At the completion of the project, the as-built drawings will be produced in electronic format and submitted to the Design Engineer. The Design Engineer will review the completed set of as-built drawings and certify the drawing set as the Record Drawings.

### 9.1.5 NONCONFORMANCE REPORTING

A nonconformance is considered to be a deficiency in characteristics, documentation, or procedures that renders the quality of an item or activity unacceptable or indeterminate. If a deficiency cannot be repaired or replaced to the satisfaction of the QA Engineer within the guidelines established by this CQA Plan, then such a deficiency will be considered a nonconformance and will be documented in a nonconformance form (Attachment 3). The nonconformance will be referred to the Construction Manager for disposition and initiation of a corrective action process. All situations will be brought to the attention of the Design Engineer, Construction Manager, and the QA Engineer for concurrence. All documentation relating to these situations will be retained in the project QA records. A deficiency that is discovered during the work that has a process already established to correct the deficiency (i.e., failed compaction test) will be tracked by the QC Monitor(s) until it is corrected. A nonconformance report is not required in these cases.

### 9.1.6 PROGRESS REPORTS

The Contractor's Project Manager will prepare a progress report each week, or at time intervals established at the Pre-construction Meeting. At a minimum, this report will include the following information:

- A unique identifying sheet number for cross-referencing and document control.
- The date, project name, location, and other information.

- A summary of work activities accomplished during the progress reporting period.
- Identification of areas or items inspected and/or tested during the reporting period that is addressed by the report.
- A summary of the quality characteristics being evaluated, with appropriate cross-references to specifications and/or drawings.
- References to the specifications or drawings defining the acceptance criteria for each inspected characteristic.
- A summary of inspection and test results, failures, and retests.
- A summary of construction situations, deficiencies, and/or defects occurring during the progress reporting period.
- A summary of other problem resolutions and dispositions.

A sample of the Weekly Progress Report from is provided in Attachment 6. The progress report will be submitted to the Construction Manager no more than two days after the last reporting day in the progress reporting period.

### 9.1.7 FINAL DOCUMENTATION

All daily inspection summary reports, inspection sheets, problem identification and corrective measures reports, acceptance reports, photographic records, progress reports, drawings, drawing revisions, and other pertinent documentation will be retained as permanent project QA records. At the completion of the project, a final CQA report that incorporates all such information, along with as-built drawings, will be prepared by the CQA team and submitted to the Company and EPA. The report will include documentation of each construction component monitored by CQA personnel and will be signed, stamped, and certified by the Design Engineer.

The Design Engineer will coordinate the completion of the as-built record drawings, which will be generated by a land surveyor licensed in the State of Idaho. The as-built records will include scale drawings depicting depths, plan dimensions, elevations, and fill thicknesses. The final as-builts drawings will be submitted to the Construction Manager for approval and forwarded to the agencies for approval.

### 9.1.8 STORAGE OF RECORDS

During the construction, the QC Monitor(s) will be responsible for all CQC documents. This includes: the QC Monitor's copy of the design criteria, plans, procedures, and specifications; the CQA Plan; and the originals of all the data sheets and reports. The field records will be kept in metal cabinets, or on metal shelving, within a facility protected by a fire alarm and/or a communication system that provides fire department response and/or fire suppression systems.

At the completion of the project, all completed documents will be routed to the QA Engineer including all the original field books, maintenance of a records index, access control, and duplicate records requirements. One copy of the final CQA Report and drawings will be retained on-site as part of the Operating Record.

### 9.1.9 STORAGE OF ARCHIVE CONSTRUCTION MATERIAL SAMPLES

The QC Monitor(s) will be responsible for storing construction material samples collected during the duration of the project. All samples will be stored neatly in a cool, dry location as approved by the QA Engineer. The QC Monitor(s) will coordinate with the QA Engineer to determine which samples will be archived at the project completion.

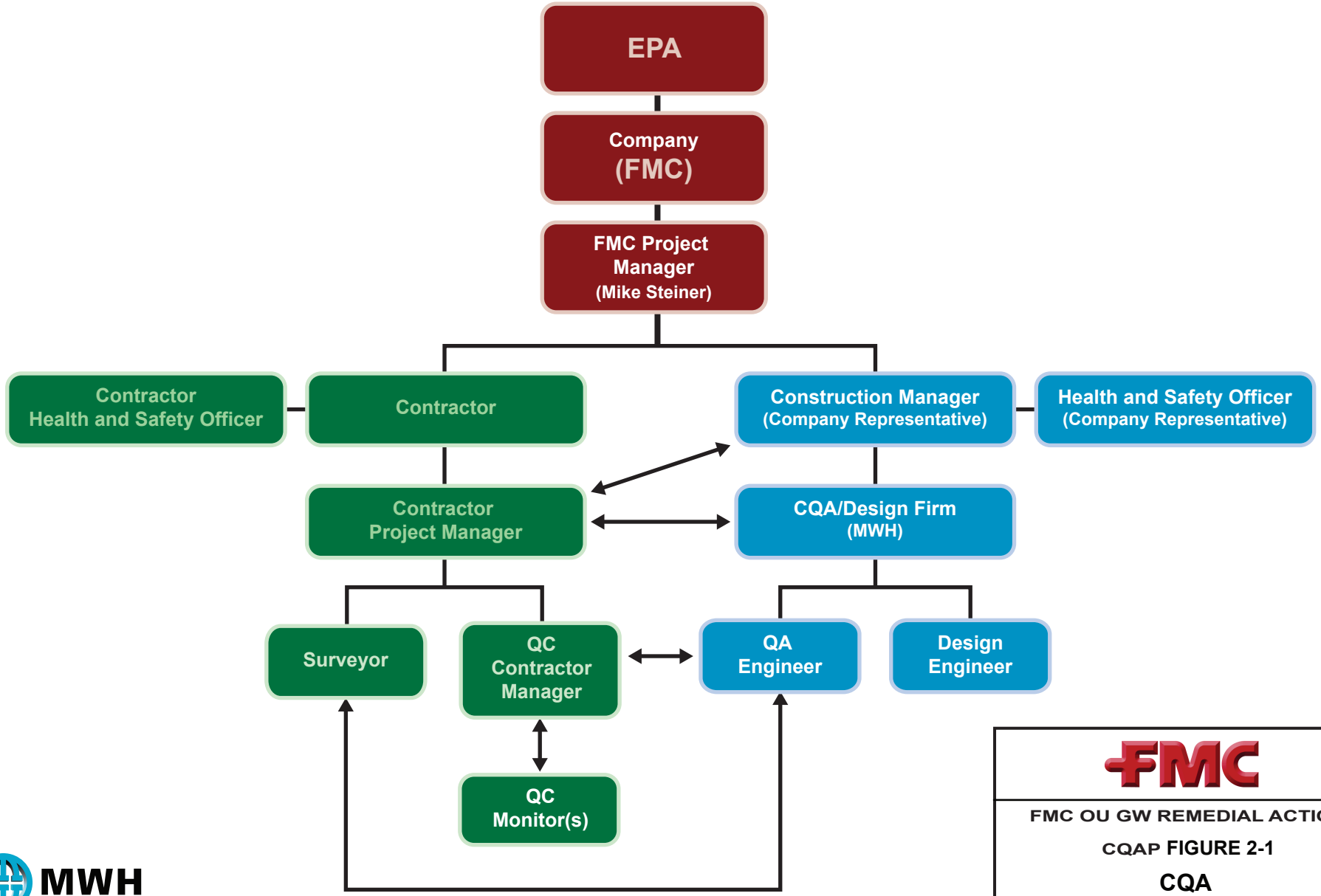
# 10.0 REFERENCES

American Society for Testing and Materials (ASTM). 1997. 1997 Annual Book of ASTM Standards, Volume 4.08: Soil and Rock (I). American Society for Testing and Materials, Philadelphia, Pennsylvania.

U.S. Environmental Protection Agency. 2005. Guidance of Quality Assurance for Environmental Technology Design, Construction, and Operation. EPA QA/G-11. January.

# Figures

FILE *Fig 2-1_CQA Org Chart2_Feb2014.ai* *27 Feb 2014*




MWH

FMC

FMC OU GW REMEDIAL ACTION

CQAP FIGURE 2-1

CQA
ORGANIZATION CHART

# Attachments

# Attachment 1

# Record of Non-Complying Test Form

# *Attachment 1 Record of Non-Complying Tests*

Project Title _____ Project No. _____ Contract No. _____

Contractor _____ Type of Work _____

| General information as to type of test, results, and other available pertinent data<br><br>(Cite ASTM, ACI, ANSI, AWS, etc., as applicable) | Quantity Involved | Action Taken |
|---|---|---|
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# Attachment 2

# Daily Progress Report Form

# *Attachment 2*
# *Inspector's Daily Report of Work Progress*

Date _____

For submittal to Resident Project Rep. to compile Daily Construction Report

Project Title _____

Project No. _____

Feature _____

Contractor _____

Type of Work _____

| Day | S | M | T | W | Th | F | S |
|---|---|---|---|---|---|---|---|
| Weather | Brite Sun | Clear | | Over cast | Rain | | Snow |
| Temp. | <32 | 3<32 | | 50-70 | 70-85 | | 85> |
| Wind | Still | Moder | | High | Report No. | | |
| Humidity | Dry | Moder | | Humid | | | |

Contractor's Work Force (Indicate classifications, including subcontractor personnel) _____

Equipment in Use or Idled (Identify which) _____

Materials or Equipment Delivered

Non-Conforming Materials or Work (Describe reason for non-conformance) _____

Field Problems (Which could result in delay or claim) _____

Quantities of Pay Items Placed _____

Summary of Construction Activities _____

Follow-up Inspections of Previously Reported Deficiencies _____

Distribution:
1. Field Office
2. Inspector

Inspector _____

CM 403 (Revised 9/16/02)

# Attachment 3

# Notice of Non-Compliance Log

# *Attachment 3 Notice of Non-Compliance Log*

Project _____ Owner _____

Job No. _____ Contractor _____

| Date Issued | Description | Date Res | Resolution |
|---|---|---|---|
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CM 418 (Revised 9/16/02)

# Attachment 4

# Weekly Progress Report

# *Attachment 4*
# *Inspector's Weekly Progress Report*

Week Ending _____ No. _____

Project _____ Job No. _____

Owner _____

Contractor _____

Summary of Construction Activities:

Remarks:

Signed _____