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OPERATIONS AND MAINTENANCE MASTER PLAN FOR THE AQUIFER RESTORATION AND WASTEWATER PROJECT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

DECEMBER 1999

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

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LIST OF ACRONYMS

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ARAR	applicable or relevant and appropriate requirement
ARWWP	Aquifer Restoration and Wastewater Project
AWWT	advanced wastewater treatment [facility]
BRSR	Baseline Remedial Strategy Report
BSL	biodenitrification surge lagoon
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
D&D	decontamination & demolition
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
FFCA	Federal Facility Compliance Agreement
FRL	final remediation level
FS	feasibility study
gpm	gallons per minute
HNT	high nitrate tank
hr	hour
IAWWT	interim advanced wastewater treatment
IEMP	Integrated Environmental Monitoring Plan
kg	kilograms
ℓ	liter
lbs	pounds
MG	million gallons
mg	milligrams
mgy	million gallons per year
mg/kg	milligrams per kilogram
mg/ℓ	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	on-site disposal facility
PSP	project specific plan
PTI	permit to install
PTO	permit to operate
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RD	remedial design

LIST OF ACRONYMS
(Continued)

RD/RA	remedial design/remedial action
RI	remedial investigation
ROD	record of decision
SCEP	Soil Characterization and Excavation Project
SDF	slurry dewatering facility
SOP	standard operating procedure
SPIT	South Plume interim treatment
STP	sewage treatment plant
SWM	Storm Water Management Pond (Operable Unit 1)
SWRB	Storm Water Retention Basin
SWURB	Southern Waste Units Retention Basins
VOC	volatile organic compound
WPASRC	Waste Pit Area Storm Water Runoff Control Facility
WPRAP	Waste Pits Remedial Action Project

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Section 1.0

1.0 INTRODUCTION

This document is the Operations and Maintenance Master Plan (OMMP) for the Aquifer Restoration and Wastewater Project (ARWWP) at the U.S. Department of Energy's (DOE's) Fernald Environmental Management Project (FEMP). The scope of the ARWWP includes the design, construction, and operation of the principal groundwater, storm water, remediation wastewater, and sanitary wastewater management facilities that support the FEMP's overall cleanup mission. The ARWWP encompasses all of the water-related elements within Operable Unit 5 and the FEMP's other source-control operable units (Operable Units 1 through 4) that are necessary to meet their storm water, sanitary, and wastewater treatment and discharge needs.

1.1 SCOPE AND OBJECTIVES

The OMMP is a formal remedial design deliverable originally prepared to fulfill Task 2 of the Operable Unit 5 Remedial Design (RD) Work Plan (DOE 1996c). This revision has been prepared to address changes which have been required since approval of the original plan. The plan establishes the decision logic and priorities for the major flow and water treatment decisions needed to maintain compliance with the FEMP's NPDES permit and ROD-based surface water discharge limits.

The fundamental objectives of the OMMP are to guide and coordinate the extraction, collection, conveyance, treatment, and discharge of all groundwater, storm water, sanitary, and remediation wastewater generated sitewide over the life of the FEMP's cleanup program. Compliance with discharge limits includes a plan of the commitments, performance goals, operating schedule, treated water flow rates, direct discharge flow rates, system-by-system sequencing, and other operating priorities. This plan also allows for balanced sitewide water management and provides the approach for the management of treatment residuals (treatment sludges, retention basin sediments, and spent resins/filtration media) that are by-products of the FEMP's wastewater treatment processes.

The OMMP serves as a comprehensive statement of management policy to ensure that planned modes of operation and maintenance for the ARWWP are consistent with regulatory requirements and satisfy the FEMP's remedy performance commitments for groundwater restoration and wastewater treatment. This document presents a comprehensive plan that provides the overall management philosophy and decision parameters to implement the day-to-day flow routing, critical-component maintenance, and treatment priority decisions. It is not intended to provide detailed, specific operating or maintenance procedures for the ARWWP. The plan also serves to inform EPA and OEPA of the planned operational approaches and strategies that are intended to meet the regulatory agreements made during the Operable Unit 5 Remedial Investigation/Feasibility Study (RI/FS) process and documented in the Operable Unit 5 Record of Decision (ROD) (DOE 1996b).

Internally, the plan is the focal point for coordinating and scheduling wastewater conveyance and treatment needs with other site projects throughout the duration of the remediation process at the FEMP. As such, the plan provides the basis for development of more detailed internal operating procedure documents (e.g., Standard Operating Procedures, Standing Orders, and Preventive Maintenance Plans) that are required for execution of work at the FEMP. The existing detailed procedural documents that govern the performance of water-related operations and maintenance activities at the FEMP are expected to be updated (revised, combined, or eliminated) as required to conform with the general strategies, guidelines, and decision parameters defined in this plan.

In Section 2.3 of the RD Work Plan, the FEMP committed to providing a compliance crosswalk that demonstrates the substantive, permit-related regulatory requirements associated with groundwater restoration and wastewater treatment and how overall compliance with water-related Applicable or Relevant and Appropriate Requirements (ARARs) will be achieved. The format of the compliance crosswalk is largely based on a June 12, 1995, letter (DOE - 1055-95) from DOE to EPA and OEPA that outlined the FEMP's strategy for compliance with permit-related substantive regulatory requirements at the site. The strategy outlined in the letter identified the development of compliance crosswalks for ARARs (including substantive permitting requirements) as a substitute for a formal permitting plan. These compliance crosswalks are to be supplied with the remedial design submittals to EPA and OEPA. The compliance crosswalk for all Operable Unit 5 groundwater and wastewater treatment activities was to be submitted with the original version of the OMMP, however several design submittals had already been supplied with their accompanying permit information summaries. In addition, many of the key wastewater facilities were already in place, having been installed under OEPA-approved Permit to Install (PTI) or Permit to Operate (PTO) documents, therefore, since approval of the initial OMMP, future design submittals will include permit information summaries as appropriate rather than including them in updated versions of the OMMP.

1.2 BASIS AND NEED

The need for the OMMP arose as DOE and regulators realized that the various water and wastewater flows that originate from FEMP remediation activities are in direct competition with one another for treatment resources. The wastewater treatment capacities at the FEMP must, therefore, be prioritized so that: 1) discharge limits can be maintained; 2) a range of flow conditions at various time intervals can be accommodated; and 3) the detrimental effects of exceptional operating circumstances can be effectively managed. The need for treatment (and the accompanying hierarchy of treatment priorities) will vary over the span of the site remedy as new projects come on line, others are completed, and aquifer restoration activities come up to full system configurations.

It was recognized during the development of the Operable Unit 5 ROD, that the 20 parts-per-billion (ppb) discharge limit for total uranium could probably be met under average operating conditions, but that consistency within this limit may not be attained during periods of exceptional operating conditions. It was further recognized that the application of the discharge limit was not considered as a required component of the remedy to ensure protectiveness, but rather as an appropriate performance-based objective that appeared reasonably attainable through the application of an appropriate level of water treatment. It was recognized that the performance-based discharge limit must be able to accommodate exceptional operating conditions anticipated to occur over the duration of the remedy. Two exceptional operating conditions were actually cited in the Operable Unit 5 ROD that would permit relief allowances from the 20 ppb total uranium discharge limit, when necessary, for:

- Storm water bypasses during high precipitation events
- Periodic reductions in treatment plant operating capacity that are necessary to accommodate scheduled maintenance activities.

It was agreed, at the time the ROD was signed, that the OMMP would define the operating philosophy for: 1) the extraction/re-injection and treatment systems; 2) establishment of operational constraints and conditions for given systems; and 3) establishment of the process for reporting and instituting corrective measures to address exceedances of discharge limits. The OMMP also contains details of the manner in which exceptional operating conditions are to be accommodated and reported in the demonstration of discharge limit compliance.

The OMMP will be modified during the course of the remedy to accommodate expansions of the system or the retirement of individual restoration modules from service, once area-specific cleanup levels are achieved. The plan is intended to serve as a living guidance document to instruct operations staff in implementing required adjustments to the system over time. The OMMP will thus be evaluated periodically to ensure the most recent instructions regarding treatment priorities and flow routing decisions are available to system operators. Proper notifications for reporting bypasses and maintenance shutdowns of the system, and the reporting and application of corrective measures to address exceedances of discharge limits also are identified in the OMMP.

1.3 RELATIONSHIP TO OTHER DOCUMENTS

The OMMP functions in tandem with several other major design support plans prepared to support the ARWWP. The environmental monitoring activities conducted in support of aquifer restoration performance decisions are being conducted and reported through the Integrated Environmental Monitoring Plan (IEMP) (DOE 1998a), which was approved by EPA and OEPA (Task 9 of the Operable Unit 5 RD Work Plan). Information obtained through the IEMP will be used to: 1) appraise groundwater restoration progress; 2) assess the need for changing groundwater extraction or re-injection flow rates; and 3) assess the durations of groundwater extraction and/or re-injection activities over the life of the remedy.

The design flow rates, planned installation sequence, detailed design basis, and overall restoration strategy for the aquifer restoration modules comprising the groundwater remedy were developed in the Baseline Remedial Strategy Report for Aquifer Restoration (BRSR) (DOE 1997a) which was submitted to EPA and OEPA as Task 1 of the Operable Unit 5 RD Work Plan (DOE 1996c). The IEMP and the BRSR identified the need to conduct start-up monitoring activities for the new aquifer restoration modules prior to formal long-term operations under the terms of the OMMP. A start-up monitoring project specific plan (PSP) is to be developed for each new module to define start-up monitoring activities and necessary adjustments in flow rates based on initial in-the-ground field performance. Once start-up monitoring activities and adjustments have been completed, the long-term operations and remedy performance monitoring activities for any new modules will be based on the OMMP and IEMP, respectively.

The first of these start-up monitoring plans, the Re-injection Demonstration Test Plan, was submitted to EPA and OEPA in the summer of 1997. The first two of these start-up monitoring plans, the Re-injection Demonstration Test Plan (DOE 1997c) and the Start-up Monitoring Plan for the South Field Extraction and South Plume Optimization Modules (DOE 1998e), were implemented in 1998 in conjunction with the start-up of those Modules. In addition to start-up monitoring activities, the Re-injection Demonstration Test Plan defines the criteria and decisions for determining whether to proceed with full-scale incorporation of re-injection into the groundwater remedy. Until the re-injection demonstration testing and decision-making activities have been completed, the Re-injection Demonstration Test Plan will continue to serve as the controlling document for the operation of the re-injection system. If full-scale re-injection is deemed appropriate, following completion of the Re-injection Demonstration Test Plan activities, necessary operating refinements gained from the testing program will be incorporated into appropriate revisions of this OMMP. Additional start-up monitoring PSPs also will be prepared for each of the new extraction and re-injection modules (or combinations of modules), as they approach completion of construction.

The Remedial Action (RA) Work Plan (DOE 1997c) for Aquifer Restoration (submitted to EPA and OEPA as Task 10 of the Operable Unit 5 RD Work Plan) conveyed the enforceable RA construction schedule for the initial restoration modules brought on-line in 1998 (the Re-injection Demonstration Module, the South Field Extraction System Module, and the South Plume Optimization Module). It also contains the planning-level RA construction schedule for the remaining modules to be brought online in later years (the South Field Extraction System Phase II Module, the South Field Re-injection Module, the Plant 6 Area Extraction Module, and the Waste Storage Area Extraction Module). These schedules will determine when new modules can be expected to be brought online for operations planning, and when the start-up monitoring PSPs need to be prepared.

The OMMP functions in tandem with several other RD or design support plans prepared by other project organizations outside the ARWWP. The Soils Characterization and Excavation Project (SCEP) prepared the Sitewide Excavation Plan (DOE 1998d) and continues to prepare a series of area-specific detailed design plans, (termed Integrated Remedial Design Packages, or IRDPs), that define the approach and commitments for management of storm water, intercepted perched groundwater, and sediment during soil remediation activities. The Waste Pits Remedial Action Project (WPRAP) has developed design documents that define the management of storm water and remedial wastewater within that project's boundaries, and the plan for coordinating the treatment of the streams by the ARWWP. The On-site Disposal Facility (OSDF) Project has developed design documents that define the management of storm water and leachate within the boundaries of that project, and the planned hand-offs for delivering these streams for treatment to the ARWWP. The Silos Project (SP) will produce similar design documentation to coordinate the management and delivery of their process remedial wastewater for treatment by the ARWWP. Lastly, the facility-specific implementation plans developed by the Facilities Decontamination and Demolition (D&D) Project present the coordination strategy for wastewater generated by D&D activities for treatment by the ARWWP. Each of these project organizations is responsible for ensuring that their respective regulatory requirements and commitments for effective management of storm water and remedial wastewater within their project boundaries are met and integrated with ARWWP.

1.4 PLAN ORGANIZATION

The plan is generally organized around the major wastewater streams being managed by the ARWWP: groundwater, storm water, remediation wastewater, and sanitary wastewater. The sections and their contents are as follows:

Section 1.0 Introduction: presents an overview of the plan, its objectives, and its relationship to other documents, and its organization.

Section 2.0 Summary of Regulatory Drivers and Commitments: discusses the ARARs compliance crosswalk and provides a summary of the other commitments and guidelines that have been activated for the ARWWP by the Operable Unit 5 ROD.

Section 3.0 Description of ARWWP Major Components: identifies the major collection, conveyance, and treatment components comprising the FEMP's system for managing the major wastewater streams, the treatment capacities that are available, and a schedule of major ARWWP activities throughout the aquifer restoration process.

Section 4.0 Projected Flows: provides an estimate of flow generation rates and durations for each of the major wastewater streams. Estimates of the summary yearly flows developed are used in Section 5.0 to evaluate the treatment systems discussed in Section 3.0.

Section 5.0 Operations Plan: establishes the operations philosophy, treatment priorities and hierarchy, treatment operational decisions, well field operational objectives and decisions, maintenance priorities, controlling documentation, management and flow of operations information to successfully operate the groundwater and wastewater systems to achieve regulatory requirements and commitments.

Section 6.0 Operations and Maintenance Methods: addresses the general methods, guidelines, and practices used in managing equipment operation and maintenance; discusses some of the dedicated organizational resources and management systems that will help to assure meeting the requirements in the ROD, describes the key parameters used to monitor the performance of the groundwater and wastewater facilities, and describes the principal features and maintenance needs for the overall operation.

Section 7.0 Organizational Roles, Responsibilities, and Communications: this section presents the organizational roles and responsibilities with respect to implementation of this OMMP. Also presented are information needs and communications protocol for coordination with other FEMP project organizations outside the ARWWP and interaction with the EPA and OEPA.

Appendix A Calculations Supporting Storm Water Flow Projections

Appendix B Calculations Supporting Remediation Wastewater Flows

Appendix C ARWWP Standard Operating Procedures

Appendix D Groundwater Restoration Well Performance Monitoring and Maintenance Plan

1.5 PROGRAM MODIFICATIONS AND REVISIONS

The OMMP will remain in place for the duration of the FEMP's remediation activities. Periodic reviews of the OMMP will be conducted to respond to needed changes in program emphasis or the addition of new components, as appropriate. It is envisioned that an annual strategy meeting will be held with EPA and OEPA to review overall operational performance, aquifer restoration progress, upcoming technical or operational issues, and any necessary revisions to the OMMP or its objectives.

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Section 2.0

2.0 SUMMARY OF REGULATORY DRIVERS AND COMMITMENTS

Section 2.1 summarizes the FEMP's pertinent regulatory-based requirements, commitments, and operating constraints that have a bearing on either the implementation of or the reporting obligations for the OMMP activities. A review and listing of pertinent requirements was conducted to help ensure that the scope of the OMMP: 1) satisfies the regulatory obligations for operations and maintenance activities that have been activated by the CERCLA process; and 2) meets the expectations of other pertinent criteria that have been developed through the remedial design (RD) process.

Section 2.2 provides the formal permit crosswalk required for inclusion in the OMMP by the RD Work Plan (DOE 1996c), and discusses additional ARARs and To Be Considered requirements. The suite of ARARs and To Be Considered requirements in the FEMP's approved CERCLA Operable Unit 5 ROD (DOE 1996b) was examined to identify the subset with specific operations and maintenance requirements or permitting issues affecting the OMMP. The FEMP's existing compliance agreements issued outside the CERCLA process, such as the National Pollutant Discharge Elimination System (NPDES) permit and existing Air and Wastewater Permits to Install (PTI), Permits to Operate (PTO), and Permit Information Summaries also were reviewed.

2.1 GENERAL COMMITMENTS AND CONSTRAINTS FOR THE ARWWP

General commitments and constraints for the ARWWP can be divided into those applicable to aquifer restoration, storm water management, and wastewater treatment. The general commitments, operating constraints, and performance goals that have originated as part of the post-ROD remedial design process were identified for inclusion in this section.

2.1.1 Aquifer Restoration

The general remedy performance commitments and constraints which have been agreed to with EPA and OEPA regarding aquifer restoration are summarized in the following list. These commitments and constraints were derived from the Operable Unit 5 ROD and subsequent remedial design remedial action (RD/RA) documentation as noted:

- Aquifer Restoration Approach - The FEMP has received EPA and OEPA approval for the accelerated aquifer restoration approach contained in the Baseline Remedial Strategy Report for Aquifer Restoration (DOE 1997a). This approved approach initiates the commitments for well locations, installation sequence, and projected pumping and injection schedules needed over the life of the groundwater remedy. The approach represents the controlling vision for when the various groundwater flow streams are expected to come on line, and the life-of-remedy groundwater treatment and injection water demands that have been estimated through computer modeling.

Aquifer Cleanup Levels - Targeted groundwater final remediation levels (FRLs) were presented in the Operable Unit 5 ROD. In general, the FRLs were based on maximum contaminant levels (MCLs) for drinking water (or 10^{-5} incremental lifetime cancer risk or 0.2 hazard index when no MCL was available). For example, uranium had a proposed MCL of 20 μg/L (ppb), therefore 20 ppb was selected as the FRL for uranium. Groundwater remediation is expected to continue until all the constituent-specific FRLs have been achieved or, if necessary, until a technical impracticability (TI) waiver is justified in the event the FRLs cannot be achieved. Alternative best available technologies existing at that time will be considered prior to requesting a TI waiver.

- Discharge Limits - During site remediation, significant amounts of both treated and untreated water will be discharged to the Great Miami River. Treatment will be applied to storm water, remediation wastewater, and recovered groundwater to the extent necessary to limit the total mass of uranium discharged through the FEMP outfall to the Great Miami River to no more than 600 pounds per year. This mass-based discharge limit became effective upon issuance of the Operable Unit 5 ROD. Additionally, the necessary treatment will be applied to these streams to limit the concentration of total uranium in the blended effluent to the Great Miami River to no greater than 20 ppb. The 20 ppb discharge limit for uranium will be based on a monthly average and became effective January 1, 1998.

  Up to 10 days per year are allowed by the ROD for emergency bypass due to storm events. Uranium contained in these bypass events will only be counted in the annually discharged mass, but not in the monthly average concentration calculations. When bypass days in excess of the 10 allowed are required, both the uranium mass and flow weighted concentration of the bypassed water are to be counted toward the 600 pound annual limit and the 20 ppb monthly average discharge. Required relief from the discharge limits is also provided by the ROD to accommodate scheduled treatment plant maintenance activities. Approval by the EPA must be obtained in advance by notification of these planned maintenance periods. The notification must be accompanied by a request for the uranium concentrations in the discharge not to be considered in the monthly averaging performed to demonstrate compliance with the 20 ppb total uranium limit. The FEMP will make every reasonable effort to prevent bypass of storm water during treatment plant shutdowns for maintenance, including scheduling maintenance shutdowns during the times when dry weather is expected. The NPDES permit will govern all remaining nonradionuclide discharges to the Great Miami River.

- Groundwater Treatment Capacity - A committed or reserved groundwater treatment capacity of at least 2000 gpm on an annual average will be provided. The major portion of this capacity is to be achieved by the existing Advanced Wastewater

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Treatment (AWWT) Expansion treatment facility which began operation in the Spring of 1998. The remaining treatment capacity is to be available from other existing facilities, particularly during dry seasons or when the other site remediation-related wastewater flows decrease.

- Groundwater Treatment Decisions - The piping networks that convey on-property extracted groundwater have, or will have as appropriate, double headers, one connected to the main line to treatment and the other to the main discharge line. As agreed to with the EPA, this design feature is not applicable to the off-property South Plume Recovery Well System or the South Plume Optimization System. The extracted groundwater is sent to either the treatment facilities or directly to the discharge outfall; thus, the treatment or discharge decision is to be made on a well-by-well basis. The combined South Plume Recovery Well System and South Plume Optimization System discharge is to be routed for treatment as a whole, or in part, based on the combined concentration. As identified in the Final Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (DOE1997a), when the extracted groundwater exceeds the treatment capacity, groundwater from wells which have relatively higher uranium concentrations will be treated preferentially. The remaining extracted groundwater will bypass treatment and be directly discharged. The combined treated and untreated discharge will comply with the 20 ppb discharge limit and the 600 pound per year mass-based limit as described above under Discharge Limits.

- Extraction Rate - The net groundwater extraction rate should not exceed the recharge rate of the regional aquifer or cause excessive water table drawdown. Therefore, based on groundwater modeling, 4000 gpm was established as the limit for the net extraction rate in the Operable Unit 5 FS Report (DOE 1995b). The maximum pumping rate for each individual well should not exceed 500 gpm in order to prevent excessive local drawdown and improve uranium mass removal efficiencies. Hydraulic impacts to the groundwater contamination under the Paddys Run Road Site south of the existing South Plume recovery wells should also be minimized; reversing groundwater flow from the Paddys Run Road Site into the South Plume Recovery System needs to be prevented.

- Injection Rate and Quality - Injection technology has been incorporated into the approved approach (if proven to be successful at the field scale) to reduce groundwater drawdown and to increase the groundwater flushing rate through the plume. Based on results of a short-term field injection test, an injection rate as high as 450 gpm per well is achievable in the Great Miami Aquifer. However, due to areas of high iron concentrations in the Great Miami Aquifer and the existence of iron bacteria, the issue of geochemical compatibility between water types when injecting water into the aquifer needs to be considered in order to maintain long-term efficiency of groundwater injection in any well. The first short-term injection test conducted in October 1995, used untreated (not treated for iron) groundwater from the South Plume area and rapidly resulted in a significant well-plugging problem (DOE 1995d). Results of the second short-term injection test, conducted in March 1996 (DOE 1996a), indicate that significant plugging did not occur after five days of continuous injection at 200 gpm when treated groundwater (treated by the South Plume Interim Treatment system [Section 3.3.3]) with relatively low iron concentrations was used. A longer-term, full-scale injection demonstration evaluation began in September 1998, when the five wells comprising the Injection Demonstration Module became operational. This test is being conducted in accordance with the ARWWP's Re-Injection Demonstration Test Plan (DOE 1998c).

In calculating the overall groundwater flow balance for the Baseline Remedial Strategy Report, it was assumed that all water used for injection is to consist of treated groundwater, and no treated process wastewater or storm water (or untreated groundwater) would be utilized as an injection water source. It was also stipulated that water with uranium concentrations greater than 20 ppb should not be used for injection. The treatment decision logic contained in this OMMP employ this assumption and stipulation as general operating constraints.

2.1.2 Storm Water Management

The requirements for controlling storm water runoff (and associated sediment loads) at the point of origin are beyond the scope and intent of this document and are the specific responsibility of the source-control projects at the FEMP. The decision to provide pretreatment must be made in concert with ARWWP recognizing surface water FRLs, NPDES limits, and hydraulic capacity.

The ARWWP is responsible for:

- Providing treatment for designated streams, upon delivery at the ARWWP treatment headworks
- Sediment clean out of the ARWWP treatment headworks
- Coordination and review to ensure similar strategies and criteria for source control in other projects.

In general, all storm water management activities conducted sitewide need to adhere to the commitments and design criteria contained in the FEMP Storm Water Pollution Prevention Plan.

2.1.3 Wastewater Treatment

The ARWWP is responsible for the following commitments for wastewater treatment:

Outfall Uranium Concentration and Uranium Mass Loading

- Coordinate the accurate projection of influent quantity, quality, and timing for all the remedial wastewater sources to be received from other generator projects

- Strive to maintain high mass removal efficiency of the treatment facilities through regularly scheduled maintenance activities

- Strive to minimize the bypass volume of contaminated runoff during high or sequential rain fall events

- Help coordinate the identification of cost-effective pretreatment at sources of wastewater when appropriate.

Minimize the System Downtime

- Incorporate preventive maintenance considerations into the system design
- Operate within the design envelope
- Establish effective preventive maintenance procedures
- Prepare for potential corrective maintenance needs.

Manage Treatment Residuals within the terms of the Operable Unit 5 ROD

- Characterize residuals for compliance with OSDF waste acceptance criteria

- Arrange for the transport and offsite disposal of residuals not attaining onsite waste acceptance criteria

- Pursue treatment techniques to treat the residuals to attain waste acceptance criteria in the event offsite disposal capacity becomes unavailable or cost prohibitive.

2.2 ANALYSIS OF REGULATORY DRIVERS & EXISTING PERMIT REQUIREMENTS

The following section provides a summary of the regulatory drivers governing activities initiated under this OMMP, including applicable ARAR/To Be Considered criteria, DOE Orders, FEMP legal agreements, and existing environmental permits. This section has been organized based on criteria related to: 1) point source air emissions; 2) surface water and treated effluent discharges; 3) groundwater restoration activities; 4) hazardous waste management requirements; and 5) substantive permitting requirements mandated by existing environmental permits and permit information summaries.

The information provided fulfills the commitment made in Section 2.3 of the RD Work Plan to provide a compliance crosswalk that demonstrates how these requirements will be met. The format of the compliance crosswalk is based on mutually agreed format described in the June 12, 1995, letter from DOE to EPA (DOE-1055-95).

2.2.1 Point Source Air Emissions

Any emissions from sources associated with future modifications or expansions to AWWT facilities or other wastewater treatment units will be compared to the following requirements to make sure that activities are conducted in compliance with applicable requirements. Any continuous emission monitoring that may be required for National Emissions Standards for Hazardous Air Pollutants (NESHAP) Subpart H point sources will be described in future compliance crosswalks submitted in the appropriate plans. Future point source air emissions associated with activities within the scope of the OMMP will be evaluated against the following regulatory drivers:

- 40 Code of Federal Regulations (CFR) Part 61, NESHAP Subpart H, which specifies that all radiological emissions (except radon) from the FEMP site must not cause any member of the general public to receive a dose equivalent in excess of 10 mrem/year. In addition to the 10 mrem/year site-wide standard, NESHAP Subpart H requires that an application for approval be filed with EPA for those sources that exceed a 0.1 mrem/year dose equivalent to members of the public. Continuous emission monitoring is required for stacks or vents that have the potential, under normal operating conditions but without emission control devices, to cause a member of the public to receive a dose equivalent in excess of 0.1 mrem/year. Demonstration of source-specific compliance with the 0.1 mrem/year dose standards is achieved through computer modeling. Site-wide radiological emissions from the entire site are reported annually in the Annual FEMP NESHAP Subpart H Report.

- Ohio Administrative Code (OAC) 3745-31 and OAC 3745-35, Permits to Install and Permits to Operate, require the installation of Best Available Technology (BAT) when installing, modifying, and operating air contaminant sources. Such requirements associated with any future expansions or modifications to the AWWT or other wastewater treatment units will be included in the project specific design submittals for these projects.

2.2.2 Surface Water and Treated Effluent

The FEMP's wastewater treatment systems are subject to substantive permitting requirements for wastewater treatment units. Treated wastewater effluent is discharged through the Parshall Flume to the Great Miami River. The site discharge is fully subject to discharge permitting requirements. The following regulatory drivers govern these surface water and treated effluent discharges associated with FEMP site-wide wastewater treatment units:

- FEMP NPDES Permit (OEPA Permit No. 1IO00004*ED) triggers a variety of operational and maintenance requirements designed to ensure discharges of treated effluent are conducted in compliance with the terms and conditions of the permit.

These requirements include process control sampling and maintenance activities at sampling stations and treatment units.

- OAC 3745-31, Wastewater Permits to Install (PTI) are required for new installations or modifications to existing wastewater treatment units. Wastewater Permits to Install are issued provided the newly installed/modified treatment unit will not adversely impair water quality or cause a violation of applicable effluent standards. All near-term projects requiring a PTI have already been addressed. Compliance with the substantive PTI requirements associated with future projects will be demonstrated in their corresponding project-specific design packages.

2.2.3 Groundwater Restoration

The regulatory drivers governing groundwater-related operation and maintenance activities include only those required as part of the Underground Injection Control (UIC) Program. The injection wells installed under the Injection Demonstration, and under subsequent aquifer restoration modules, must comply with the substantive requirements of this program. This policy is also cited as a To Be Considered requirement in the Operable Unit 5 ROD. The OEPA has primacy for this program, and has put out a Policy for those Class V injection wells installed for purposes of groundwater remediation, as described below:

- OEPA Policy 5X26 Aquifer Remediation Projects states that such wells do not need a PTI/PTO if the owner/operator complies with the policy. Many of the elements in this policy fall under the Injection Demonstration Test Plan and subsequent start-up plan for later modules. Long-term operation of the injection wells for the later modules, however, will fall under this OMMP. The requirements that fall under the OMMP Plan (for long-term injection) include submittal of monthly operating reports including the analysis of the injectate, the volume and rate of the injected fluids, and a description of any well maintenance and rehabilitation procedures. The policy also requires all Class V injection wells to be permanently plugged and abandoned within 120 days of ceasing operations, in a manner that will prevent migration of fluids into an underground source of drinking water. The use of this policy is allowed so long as injectate does not exceed Safe Drinking Water Act MCLs or Health Advisory Limits (HALs). If these limits were to be exceeded in our injectate, then full compliance with all additional substantive requirements for UIC permits would be necessary.

2.2.4 Hazardous Waste Management

Small quantities of wastewater that are known to contain one or more Resource Conservation and Recovery Act (RCRA) listed hazardous waste constituents will be treated in the on-site wastewater treatment system (AWWT Phase II). The DOE and OEPA negotiated a regulatory mechanism under the Mixture Rule Exclusion found at OAC 3745-51-03(A)(2)(e) allowing that wastewaters containing listed constituents could be appropriately managed through existing FEMP wastewater treatment systems and exempt from associated RCRA listing. Compliance with this exclusion eliminates the need for pre-treatment of wastewaters containing listed constituents and further eliminates the associated listing that would have otherwise been applied to treatment plant residuals (e.g., sludges). This policy was articulated in DOE letter DOE-0678-98 dated April 15, 1998 and approved by OEPA on May 14, 1998.

2.2.5 Existing Environmental Permits and Permit Information Summaries

Tables 2-1 and 2-2 list the environmental permits and permit information summaries, respectively, that are applicable to ARWWP activities initiated under this plan. These tables identify the status of the permits for various wastewater treatment operations and list their corresponding substantive requirements. Cross references to the appropriate Standard Operating Procedures or site documents that describe the manner in which these requirements are addressed in detail are also provided in the tables.

TABLE 2-1
ACTIVE PERMITS TO INSTALL & OPERATE

Permit No.	Description of Source	Effective Date	Substantive OMMP Requirements	Cross Reference[a]
Wastewater Permits to Install				
05-0944	Sewage Treatment Plant Ultraviolet Disinfection Unit	June 28, 1984	• Lamps will be cleaned periodically.	SOP 43-C-368
05-1043	Storm Water Retention Basin (SWRB)	November 18, 1987	• Periodic assessment of sediment depths and sediment clean out once six inches of deposition has occurred. • Water collected in basin chambers will be removed by means of floating outlet structures.	Inspection/removal status documented through separate correspondence with EPA.
05-2872	Changes to Biosurge Lagoon	December 16, 1987	• Periodic assessment of sediment depths and sediment clean out once 500,000 gallons of sediment has occurred. • Sediment removal schedule will be extended if measured sediment is less than 500,000 gallons.	Inspection /removal status is documented through separate correspondence with EPA.
05-5722	FEMP Advanced Wastewater Treatment Facility	December 3, 1992	• PTI has been withdrawn. AWWT is currently considered part of a CERCLA Response Action. Substantive permit requirements include the following bulletized items. • Maximum process rate for the AWWT will be 557,118 pounds per hour (lbs/hr). The allowable limit for particulate is 0.894 lbs/hr and from uranium the rate is 1.34E-08 lbs/hr.	SOP 43-C-340
Air Permits to Install & Operate				
46-003	Methanol Storage Tank (T127)	September 23, 1993	• Tank no longer in operation. Requirements applicable until residual methanol is removed from tank system. • Tank is equipped with submerged fill and an internal floating pontoon roof with double seals. • The roof seals, man hole, piping seals, and secondary containment will be inspected on an annual basis.	Internal Regulatory Compliance oversight directs annual inspection

[a] See Section 6.0 for a discussion of ARWWP Standard Operating Procedures (SOPs).

TABLE 2-2
PERMIT INFORMATION SUMMARIES[a]

Description of Source	Submittal Date	Substantive Requirements	Cross Reference[b]
Permit Information Summaries			
AWWT Slurry Dewatering Facility	December 7, 1995	• Filter cake will be drummed and managed as low-level waste. • All chemical storage tanks (caustic, acid, sludge conditioners) must be equipped with submerged fill devices. • Residual particulate and radiological emissions must be controlled via high energy particulate air (HEPA) filtration devices.	SOP 43-C-358
AWWT Multi-Media Filter Project	November 12, 1996	• Backwash from the carbon and multi-media filters will be collected and discharged to the headworks of the AWWT Facility.	SOP 43-C-340
AWWT Expansion Project	December 20, 1996	• Tanks associated with the multimedia filtration and ion exchange columns operate under pressure in a closed system.	SOP 43-C-367
Sludge Removal Project	July 28, 1998	• Ensure BSL & SWRB sludges are removed to maintain necessary hydraulic capacity and the sludges are managed efficiently .	SOP 43-C-371

[a]Previously submitted to fulfill substantive permitting requirements for various CERCLA response/removal action pursuant to the requirements of CERCLA 121(e), 40 CFR 300-National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Paragraph XIII.A of the Amended Consent Agreement (DOE 1991).
[b]See Section 6.0 for a discussion of ARWWP Standard Operating Procedures (SOPs).

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Section 3.0

3.0 DESCRIPTIONS OF MAJOR ARWWP COMPONENTS

The major operating system components of Operable Unit 5 aquifer restoration and wastewater treatment required to accomplish the associated Operable Unit 5 remedy commitments and goals are described in this section. The existing and currently proposed FEMP conveyance and treatment system components for managing the major wastewater streams are identified as are treatment capacities. This section also describes key linkages between the components.

Figure 3-1 provides a current schedule of major ARWWP activities throughout the aquifer restoration process. Figure 3-1 varies from schedules presented in the OU5 RAWP and the BRSR, to present the most recent projection of when major elements of the ARWWP will begin operation. Activities in the Waste Pit Area and the Plant 6 Area have been pushed out to more closely match the soil excavation schedules for these areas and as a result the overall completion date for the ARWWP has been extended approximately three years. However, the OMMP text and figures contained within present the original, more aggressive schedule developed in the BRSR, as the ARWWP continues to strive to achieve that schedule.

3.1 GROUNDWATER COMPONENT

The remediation of the Great Miami Aquifer will be achieved by completing area-specific groundwater restoration modules in accordance with the approved Remedial Design/Remedial Action (RD/RA) Work Plans (DOE 1996c and 1997c) for Operable Unit 5 and the Baseline Remedial Strategy Report for Aquifer Restoration (DOE 1997a). This section describes currently operating and proposed modules. The modules consist of extraction wells or a combination of extraction and injection wells as described in the following subsections. The modules are presented in two categories: currently operating modules (Section 3.1.1) and future modules (Section 3.1.2).

3.1.1 Current Groundwater Restoration Modules

Groundwater restoration modules currently in operation are:

- South Plume/South Plume Optimization
- South Field Extraction System Phase I
- Re-Injection Demonstration.

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The geographical locations of each of these modules and associated wells are provided in Figure 3-2. A description of each of the modules is provided in the following subsections.

3.1.1.1 South Plume Module

Five extraction wells were installed in 1993 at the leading edge of the off-property South Plume as part of the South Plume removal action to gain an early start on groundwater restoration. The South Plume removal action well system began pumping in August 1993. The primary intent of the original five well system was to prevent further off-property migration of contamination within the groundwater plume. Two additional extraction wells came online in July 1998 for the active restoration of the central portion of the off-property plume. These two new wells, known as the South Plume Optimization Module have now been incorporated into the South Plume Module for purposes of remedy performance tracking and reporting.

Four of the five original wells are currently targeted to pump a summed total of 788 million gallons per year (mgy) (1500 gallons per minute [gpm]). The fifth, easternmost well has been abandoned in place at the current time per agreement with EPA and OEPA. Each of the four operating wells is equipped with a submersible pump and flow rate controls and has a maximum pumping capacity of about 500 gpm. The two new optimization wells (EW-6 and EW-7) are located on private property adjacent to the FEMP (Figure 3-2). Each well is equipped with a submersible pump and flow rate controls and is designed to have a maximum pumping rate of about 400 gpm. These two wells are currently being operated at approximately 250 gpm each. A common discharge header conveys the combined recovered groundwater from the six operating wells to the existing South Plume System discharge header.

The combined flow from this module is routed to the South Field Valve House, where the flow is automatically diverted to treatment or routed to the Great Miami River, depending on available treatment capacity.

An additional well location (3N) (also located on private property) has been identified as a contingency, should additional pumping be necessary in the future. The Baseline Remedial Strategy Report provides the criteria for determining if and when this contingency well location will be installed. If Well 3N is determined to be necessary, an addendum to the RA Work Plan will be submitted to include milestone activities and dates for its construction and operation.

The RA Work Plan established a schedule for the optimization wells (Table 3-1) that included the award of subcontracts for well installation and construction of the associated infrastructure, the completion of well installation and construction, and initiation of operations (start-up). These dates were all met and the optimization wells were placed online on August 9, 1998.

3.1.1.2 South Field Module - Phase I

The South Field Extraction System Module consists of Phase I and Phase II. South Field Extraction System Phase I Module includes 10 extraction wells. In 1996, as part of an EPA-approved early start initiative, nine of the 10 extraction wells were installed on FEMP property in the vicinity of the south field/storm sewer outfall ditch. These wells are removing groundwater contamination in an on-property area where uranium contamination levels are highest (Figure 3-2).

The construction and start-up schedule for this module is provided in Table 3-1. It includes the award of subcontracts for well installation and construction of the associated infrastructure, the completion of well installation and construction, and initiation of operations (start-up). These dates were all met and the module was placed online July 13, 1998.

Phase I also included construction and installation of the tenth extraction well, new electrical high-voltage power service, approximately 6000 feet of trenching for placement of 12,000 feet of high density polyethylene piping, variable speed submersible pumps, new access roadways, instrumentation and controls, 10 well houses, and one valve house.

Each well is equipped with a submersible pump and flow rate controls. Each well has a maximum capacity of about 300 gpm. Two discharge headers are provided to convey recovered groundwater from each well; one header will convey flow to treatment systems and the other header will convey flow to untreated discharge. Each well discharge has valving to direct its flow to one of the selected headers.

3.1.1.3 Injection Demonstration Module

Groundwater injection was determined to be a potentially viable strategy for enhancing aquifer restoration in the Baseline Remedial Strategy Report. To test this technology at the field scale, a five-well injection demonstration module (Task 4 in the RD Work Plan) was constructed. If successful, then injection wells may be added to other aquifer restoration modules. The five injection wells were located along Willey Road on the southern boundary of the FEMP (Figure 3-2). Each well has an injection rate of approximately 200 gpm.

During the demonstration period (1998-1999), the operation and maintenance of this module including monitoring is being governed by the Injection Demonstration Test Plan. If, at the close of the demonstration period, re-injection is proven to be a viable enhancement to the aquifer remedy, operation and maintenance of this module will be incorporated into a revision of this OMMP. It is necessary to separate the operation and maintenance costs and scope for this module, during the demonstration period, to distinguish it from the remainder of the groundwater remedy. This will allow comprehensive assessment of its viability as part of the long-term groundwater remedy. The decision criteria for evaluating the viability of re-injection technology at the FEMP on a field scale focus on:

- Maintenance and operational costs of re-injection
- Vertical and horizontal expansion of the 20 μg/L total uranium plume
- Effectiveness in shortening the remedy
- Creation of a hydraulic barrier at the southern FEMP property boundary.

Section 1.3 of the Re-Injection Demonstration Test Plan (DOE 1998c) provides further details on these criteria.

The RA work plan established a schedule for this module (Table 3-1) that included the award of subcontracts for well installation and construction of the associated infrastructure, the completion of construction, and initiation of operations (start-up). These dates were all met and the module was placed online September 2, 1998.

The installation and construction of this module included: five injection wells, a 50,000-gallon surge tank, two pumps, individually rated at 1000 gpm @ 200 feet of Total Dynamic Head (TDH), electrical service, approximately 5000 feet of trenching and placement of high density polyethylene piping, fabrication of injection well downcomers, and instrumentation and controls.

3.1.2 Future Groundwater Restoration Modules

Planned modules are:

- South Field Injection Module
- South Field Extraction System Module, Phase II
- Waste Storage Area Module
- Plant 6 Area Module.

The geographical locations of each of these modules is provided in Figure 3-3. The RA Work Plan established Remedial Action Schedule for each of these long-term modules (Table 3-2). The RA Work Plan schedules are contingent upon completion of various other operable unit remediation activities, which, if delayed, may necessitate revised schedules for the future modules. Any such revised schedules would be submitted as addenda to the RA Work Plan. Descriptions of all planned modules are provided in the following subsections.

3.1.2.1 South Field Injection Module

If the Injection Demonstration Module (Section 3.1.1.4) results indicate that re-injection is a viable aquifer restoration enhancement technology, then the Aquifer Restoration Project will implement the South Field Injection System Module. This module includes all injection wells from the geographical areas of Phases I and II of the South Field Extraction System Module, installation of five injection wells, and the conversion of three existing extraction wells to injection wells. The South Field Injection System Module was not described in the Operable Unit 5 RD Work Plan because it is based on further development of the aquifer restoration strategy presented in the Baseline Remedial Strategy Report, which was submitted after the Operable Unit 5 RD Work Plan.

The South Field Injection Module is located in the south-central portion of the FEMP within the South Field area (Figure 3-3). Construction of this module as currently planned also includes the installation of one additional pump at the previously installed injection water surge tank, approximately 4000 feet of trenching and placement of high density polyethylene piping, instrumentation, and controls. Once completed, the construction will be inspected and accepted, and systems testing will be conducted. After successful testing and standard start-up review, operation of the module will begin.

The schedule dates for this module are provided in Table 3-2, and include the award of subcontracts for well installation and construction of the associated infrastructure, the completion of well installation and construction, and initiation of operations (start-up). If these dates must be revised in the future, due to schedule changes with the Operable Unit 2 Southern Waste Unit and associated soil remediation activities, an addendum to the RA work plan will be submitted to provide the new schedule.

3.1.2.2 South Field Module - Phase II

The nine-well, early-start South Field Extraction System Module-Phase I was designed to support the initial 27-year base case system presented in the Operable Unit 5 FS (DOE 1995b) and ROD (DOE 1996b). As presented in the Baseline Remedial Strategy Report, the proposed well field for the 10-year aquifer restoration includes additional extraction wells in the south field area. These additional extraction wells will comprise Phase II of the South Field Extraction System Module and will be located in the area depicted in Figure 3-3. Table 4-1 presents extraction/injection rates for the planned aquifer restoration. The Phase II extraction wells will be installed after Operable Unit 2 remedial activities for contaminated soils and source areas have been completed. Current plans for Phase II include installation and construction of nine extraction wells, approximately 1500 feet of trenching and placement of 3500 feet of high density polyethylene piping, electrical service to each well, submersible well pumps, instrumentation and controls, and nine well houses. Once completed, the construction will be inspected and accepted, and systems testing will be conducted. After successful testing and standard start-up review, operation of the module will begin.

The schedule dates for this module (Table 3-2) include the award of subcontracts for well installation and construction of the associated infrastructure, the completion of well installation and construction, and initiation of operations (start-up). Schedule dates are contingent on the completion of the source operable unit and soil remedial activities in this area. If these dates must change in the future due to changes in the remedial action schedule for Operable Unit 2 waste unit and soil remedial activities in this area, then an addendum to the RA Work Plan will be submitted to provide the revised schedule.

3.1.2.3 Waste Storage Area Module

The Waste Storage Area Module will recover contaminants from the portion of the Great Miami Aquifer that underlies the waste storage area (Operable Unit 1 and Operable Unit 4). The current plan is for the module to consist of 10 recovery wells located in and near the FEMP waste pit area. Each well will be equipped with a submersible pump and with flow rate controls. It is anticipated that each well will be designed to operate at a rate up to 200 gpm. Two discharge headers will be provided to convey recovered groundwater from the wells. One header will convey flow to treatment systems and the other header will convey flow to untreated discharge. Each well discharge will have valves to direct flow to the selected header.

Once this area is accessible (i.e., after the waste pit material and contaminated soil have been excavated and real-time data indicates the area is "clean"), construction of the module can be initiated within this area (Figure 3-3). The construction as currently planned includes installation of the ten extraction wells, 7000 feet of trenching and placement of 14,800 feet of high-density polyethylene piping, submersible pumps, new electrical high-voltage power service to the area, instrumentation and controls, and 10 well houses. Once completed, the construction will be inspected and accepted, and systems testing will be conducted. After successful testing and standard start-up review, operation of the module will begin.

The schedule dates for this module are provided in Table 3-2, and include the award of subcontracts for well installation and construction of the associated infrastructure, the completion of well installation and construction, and initiation of operations (start-up). These dates are contingent on the completion of the source operable unit and soil remedial activities in this area. If these dates must be revised, due to schedule changes during Operable Unit 1, Operable Unit 2, or Operable Unit 5 soil remediation activities, then an addendum to the RA Work Plan will be submitted to provide the new schedule.

3.1.2.4 Plant 6 Area Module

The Plant 6 Area Module will recover contaminants in the portion of the Great Miami Aquifer located beneath and east of Plant 6, which is located in the southeastern portion of the FEMP's former production area. The current plan is for the module to consist of two extraction wells located in this area (Figure 3-3). It is anticipated that each well will be designed to operate at approximately 400 gpm or less. Two discharge headers will be provided to convey recovered groundwater from the wells - one header will convey flow to treatment systems and the other header will convey flow to untreated discharge. Each well discharge will have valves to direct flow to the selected header.

After D&D of Plant 6, excavation of underlying contaminated soil, and real-time data indicates the area is "clean," the area will be accessible and construction of this module can begin. As currently planned, construction of the Plant 6 Area Module includes installation of the two extraction wells, 3300 feet of trenching and placement of high density polyethylene piping, electrical service, submersible pumps, instrumentation and controls, one valve house, and two well houses. Once completed, the construction will be inspected and accepted, and systems testing will be conducted. After successful testing and standard start-up review, operation of the module will begin.

The schedule for this module (Table 3-2) includes the award of subcontracts for well installation and construction of the associated infrastructure, the completion of well installation and construction, and initiation of operations (start-up). These dates are contingent on the completion of the source operable unit and soil remedial activities in this area. If these dates must be revised in the future, due to schedule changes with the Operable Unit 3 Plant 6 area D&D activities or related soil excavation, then an addendum to the RA Work Plan will be submitted to provide the new dates.

3.1.3 Groundwater Collection and Conveyance

An extensive system of collection and conveyance piping systems is required for the remediation of the Great Miami Aquifer. A major portion of that piping was installed as a part of Removal Action 3 (South Plume Removal Action) in the early 1990s (Figure 3-4). This included: 1) a major collection header and force main from the original five wells South Plume Recovery System back to the site SWRB valve house; 2) a continuing force main from the SWRB valve house across the site to the eastern edge of the site where the Parshall Flume is located; and 3) a gravity main from the eastern edge of the site to the Great Miami River.

This piping forms the infrastructure for the other module specific piping systems described herein. A design package for each of these new systems will be sent to the EPA and Ohio EPA for review prior to their construction.

New collection and conveyance systems for the remediation of portions of the aquifer under other portions of the FEMP (i.e., South Field Phase II, Waste Storage Area, and Plant 6 Area Modules) will not be installed until the soil remediation activities in those areas have been completed through pre-certification via real-time monitoring. This will avoid the need to maintain additional corridors of soil contamination. This is particularly important as it may be necessary to maintain these pipelines in service for years after anticipated termination dates based on bounce-back phenomena which has occurred at other remediation sites. Construction of these modules prior to soil remediation in these areas would delay the end of soil cleanup unnecessarily. Based on funding constraints, this may delay a cleanup of groundwater to a point beyond the planned 10-year time frame.

3.1.4 Great Miami Aquifer Remedy Performance Monitoring

Section 3 of the Integrated Environmental Monitoring Plan (IEMP) (DOE 1998a) provides for the routine remedy performance monitoring of the Great Miami Aquifer. The details of how this remedy performance data are being evaluated and the associated decision making process are located in Section 3.7 of the IEMP. Figure 3-5 illustrates the overall framework for the groundwater remedy performance decision-making process. If it is determined that aquifer restoration program expectations (as identified in the IEMP) are not being met, then the design and operation of the aquifer restoration system will be evaluated to determine if a change needs to be implemented. A change to the operation of the aquifer restoration system would be implemented by a modification to this OMMP. A groundwater monitoring change, if found to be necessary, would be implemented through the yearly reviews and two-year revisions of the IEMP, after approval. If additional characterization data is needed (e.g., to determine the nature of a newly detected FRL exceedance) a modification to the IEMP would be implemented, or a new sampling plan would be prepared depending upon the anticipated size of the activity.

Individual module start-up plans provide specifics on the frequency of water level and water quality data collection activities during each module start-up. These detailed project specific plans are developed for each module and are presented to the EPA and Ohio EPA for review and comment so that approval for system start-up is obtained prior to the scheduled start-up date. The site-wide groundwater data will be utilized to assess the performance of the site-wide groundwater remedy which is comprised of several individual modules. The module-specific start-up monitoring data (water levels and water quality) is collected at the same time as the site-wide groundwater monitoring data. The start-up monitoring is integrated with the IEMP groundwater monitoring such that area-wide interpretations can be made. Changes to the scope of the routine monitoring identified in the IEMP may be necessary based on the findings of the sampling specified in the start-up monitoring plans. These changes would be accommodated as necessary in the annual updates or biennial revisions.

The details of the quarterly and annual reporting of groundwater remedy performance information are also provided in the IEMP, Section 3.7. The reporting subsection provides the specific information to be reported at the quarterly meetings/reports and in the comprehensive annual report. It is recognized that the data evaluation and reporting for IEMP and the OMMP will evolve as consensus is reached on the desired content of the meetings/reports.

3.1.5 Perched Groundwater

As specified in the Operable Unit 5 ROD, the remediation of perched groundwater will be accomplished by the excavation and dewatering of soil containing the contaminated water. These remediation activities will be completed by the Soils Characterization and Excavation Project (SCEP) and are therefore not within the scope of this document. The ARWWP will, however, receive water from the SCEP as a result of the excavation dewatering efforts and from storm water runoff collection, as discussed in Section 4.0. Therefore, unless otherwise identified, the term "groundwater" will be used throughout the remainder of this document to mean groundwater from the Great Miami Aquifer.

3.2 OTHER SITE Wastewater SOURCES/SYSTEMS

3.2.1 Storm Water Component

3.2.1.1 Storm Water Collection and Conveyance

The existing storm water collection system for the former production area drains from north to south to the existing SWRB (see Section 3.4.1.1). Figure 3-6 shows the underground piping network for the existing storm water system. It is planned that soil remediation will generally occur from north to south as explained in the Sitewide Excavation Plan and discussed further in Section 4.2 of this plan. It is anticipated that, for the most part, the existing storm water collection system will be used to transfer runoff from the active soil remediation areas to the SWRB. As erosion control at the point of excavation will be utilized, a significant increase of the current accumulation rate of solids in the conveyance system is not anticipated.

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Areas which are remediated outside of the former production area such as areas 1 and 2 (see Figure 4-3) and construction of the OSDF have or will require the construction of new storm water collection and conveyance systems. These systems have been and will continue to be designed and constructed by either the SCEP and OSDF projects respectfully. The ARWWP has and will continue to be actively involved in design review of these facilities to ensure that existing hydraulic limitations are not exacerbated. Their design flows have been included in this OMMP, as described further in Section 4.0. Other systems may be required as remediation progresses.

3.2.1.2 Storm Water Monitoring

Analysis of the discharge from the SWRB will provide data to observe trends in overall influent contamination. Unusual or unanticipated trends will result in further review of influent streams.

The majority of the uncontrolled site runoff (that runoff not requiring treatment for uranium removal) flows to Paddys Run via four existing drainage pathways. Monitoring of these pathways and other locations where uncontrolled surface water leaves the FEMP currently exists under the IEMP sampling program. This monitoring will continue as described in Section 4 of the IEMP (DOE 1999a). Information collected will be reported semi-annually as part of the IEMP quarterly meetings/reports.

3.2.2 Remediation Wastewater Component

3.2.2.1 Remediation Wastewater Collection and Conveyance

The former production area wastewater collection and conveyance system will form the infrastructure of remedial wastewater collection and conveyance. All remedial wastewaters will be directed to either the existing Biodenitrification Surge Lagoon (BSL) or the existing high nitrate tank (HNT), the headworks for existing remediation wastewater treatment, as described in Section 3.4.1.

Each of the source projects will be responsible for: constructing new collection or conveyance systems, coordinating with ARWWP to utilize existing systems to transfer their wastewaters, or transporting flows by tanker truck or dumpster to these headworks.

Because of the increased quantity of flow which will be required from the BSL/HNT to the existing AWWT Phase II Facility (where this wastewater will be treated as discussed in Section 5), new pumps and transfer pipeline are being installed between these facilities. The increased pumping capability will also allow water to be sent to AWWT Phase I during abnormal conditions as discussed in Section 5.4.1.1.

3.2.2.2 Remediation Wastewater Monitoring

All projects that require pre-treatment for remediation wastewater will require personnel to monitor discharges sent to the headworks of the ARWWP wastewater treatment facilities. For example, as discussed in Section 4, the Waste Pits Remedial Action Project (WPRAP), will require pretreatment of some streams to address constituents which might cause operational problems at the AWWT (e.g. heavy metals). WPRAP will monitoring their pretreatment system. The ARWWP will periodically review the WPRAP monitoring to verify adequacy of their pretreatment. Each contributing project will be required to monitor the flow of wastewater from their project(s) to the existing headworks so that actual flows can be checked for consistency against anticipated flows. This information will be used to determine if flows are greater than anticipated and if adjustments to wastewater treatment facilities will be necessary. Also, equipment is installed to monitor the flow rate in the new BSL to AWWT transfer line.

3.2.3 Sanitary Wastewater Component

3.2.3.1 Sanitary Wastewater Collection and Conveyance

An extensive system of sanitary sewers currently exists at the FEMP. Figure 3-7 shows the underground piping network for the sanitary sewer system. The sanitary sewers in the former production area flow from north to south, to a main collector sewer located at the south end of the former production area, which runs west to east, to an existing lift station. Additional sewers from the administrative area run north and tie-in to the main collector sewer.

Soil remediation will generally be accomplished north to south preceded by D&D of existing facilities. As the existing facilities are removed, the need for the sanitary sewers decreases, so new sewers will not be required. Minor modifications (such as addition of new D&D changeout facilities) will require a minimal quantity of new sanitary wastewater collection and conveyance systems.

Because of the need to construct a new Sewage Treatment Plant (STP) to allow for the D&D of the existing STP, soil remediation of the underlying area, and construction of the OSDF; a new force main was constructed from the existing sewage lift station to the new STP which is located adjacent to the AWWT facility. A new force main from the new STP to the existing AWWT discharge header was also constructed which results in the new STP discharge being combined with other FEMP wastewaters and discharged through the Parshall Plume.

3.2.3.2 Sanitary Wastewater Monitoring

Monitoring of the effluent from the Sewage Treatment Plant is conducted per the requirements of the NPDES permit. Uranium concentrations are also monitored to track the impact this flow stream has on the FEMP's ability to maintain site effluent discharge limits to the Great Miami River.

3.3 TREATMENT SYSTEMS

Treatment will be applied to recovered groundwater, storm water, remediation wastewater, and sanitary sewage to the extent necessary to limit the concentration and total mass of uranium discharged through the FEMP outfall to the Great Miami River (limits detailed in the Operable Unit 5 ROD) and to meet NPDES permit limits. To attain these mass- and concentration-based uranium discharge limits, DOE committed to expanding the existing AWWT facility by installing an additional groundwater treatment capacity of 946 mgy (1800 gpm) (788 mgy [1500 gpm] nominal throughput rate) to achieve a total groundwater treatment capacity (combined existing and new treatment capacity of at least 1051 mgy [2000 gpm]). This facility became operational in April 1998. Figure 3-8 shows general locations of the these facilities. The following information summarizes the wastewater treatment systems and their expected throughput rates.

3.3.1 Advanced Wastewater Treatment (AWWT) Facility

The original AWWT, consisting of Phases I and II, is located in the southwest corner of the former production area. The AWWT was expanded to incorporate an additional capacity dedicated to groundwater treatment. The two original AWWT systems and the expansion system are all operated from a central control room.

3.3.1.1 AWWT Phase I

Figure 3-9 shows a simplified process flow diagram of the AWWT Phases I and II treatment processes. The Phase I system consists of the following unit processes:

- Flow equalization and pH adjustment with caustic (when required) in preparation for the downstream coagulation process
- Coagulation with alum and polymer, followed by clarification for reduction of suspended solids, uranium, and some unspecified assumed reduction in other radionuclides and heavy metals. Other coagulant chemicals may be tested as part of process optimization efforts.
- Filtration using multimedia filters to remove suspended solids from the clarifier overflow. The filters are cleaned by backwashing.
- pH adjustment with sulfuric acid if required (not used presently)
- Two trains of three ion-exchange resin vessels (each train) to remove uranium. The wastewater flows through two ion exchange resin vessels in lead/lag series with the third vessel available to be placed into service when needed.
- Final pH adjustment (if required - not presently used), filtration, and discharge. Both the Phase I and Phase II treated streams are combined in the pH mixing/recycle tank, filtered using multi-tubular filters, and discharged.

The Phase I operation has been prioritized to treat storm water collected in the SWRB. In the past, when the SWRB was down to a relatively low level, Phase I was switched over to treat groundwater. Recent operating changes have allowed, during periods of low rainfall and low levels in the SWRB, the AWWT Phase I system to treat a nominal "dry weather" flow of storm water combined with as much groundwater as the system can handle.

The installation of multimedia filters in 1997 to replace previously used multi-tubular filters has allowed for an anticipated average annual treatment capacity of approximately 315 million gallons per year (600 gpm). The operating capacity takes into account downtime for scheduled maintenance and unplanned interruptions of flow.

3.3.1.2 AWWT Phase II

The AWWT Phase II was installed for treatment of previous production wastewaters and site-contaminated remediation wastewater. The AWWT Phase II system is currently configured to allow concurrent treatment of site remediation wastewater, storm water, and groundwater. This system consists of the same unit treatment as the Phase I system, except that carbon filtration is included in the Phase II system to provide treatment of VOCs that may be present in the remediation wastewaters. Only one train of three ion exchange vessels is present in AWWT Phase II. The inflow to the Phase II system flows through two 80,000 gallon equalization tanks to accommodate fluctuating incoming flow streams.

The installation of multimedia filters in 1997 to replace previously used multi-tubular filters is expected to allow for an average annual treatment capacity of approximately 158 million gallons per year (300 gpm). The operating capacity takes into account downtime for scheduled maintenance and unplanned interruptions of flow.

3.3.1.3 AWWT Expansion

As prescribed in the Operable Unit 5 ROD, the existing capacity of the AWWT facility was expanded to the maximum achievable within the confines of Building 51, to enhance the FEMP's ability to treat groundwater. The design and initiation of construction of the expansion was accomplished as described by Task 8 in the RA Work Plan.

This treatment system went into operation on April 30, 1998. The unit processes of the AWWT expansion system include aeration, granular multimedia filtration, and ion exchange. The treated effluent from this facility is the source of water for aquifer re-injection. The aeration step is included to help remove iron, thereby reducing biofouling of the re-injection well screen. This treatment system is expected to process approximately 788 mgy (1500 gpm) on an annual average basis. The operating capacity takes into account downtime for scheduled maintenance and unplanned interruptions of flow.

3.3.2 Interim Advanced Wastewater Treatment (IAWWT) System

The IAWWT is located just north of the SWRB. Currently, either SWRB water or groundwater may be treated by the IAWWT system before it is discharged to the Great Miami River. The IAWWT system consists of two trailer-mounted treatment systems. Before the influent enters these two trailer systems, it is pumped through granular multimedia filters for suspended solids removal. Each trailer unit currently has two feed pumps and three ion exchange vessels in series (lead, lag, and one standby). The treated effluent is discharged through the FEMP outfall line to the Great Miami River. Backwash from the multimedia filters, prior to 1999, was routed to the General Sump for subsequent treatment in the AWWT Phase II system. The backwash was rerouted to the SWRB for subsequent treatment in the AWWT Phase I system as discussed in Section 3.3.1.2 and described in further detail in Section 3.7.2.

The IAWWT treatment system was sized as a 158 mgy (300 gpm) treatment system to treat uranium-contaminated storm water before the installation of the AWWT Phase I system. Since that time, the system has been used to treat mostly groundwater. However, the IAWWT is used to treat SWRB waters during periods of heavy rainfall. The IAWWT throughput is expected to be approximately 131 mgy (250 gpm). The operating capacity takes into account downtime for scheduled maintenance and unplanned interruptions of flow.

3.3.3 South Plume Interim Treatment (SPIT) System

The SPIT system was installed to provide treatment of approximately 92 million gallons per year of groundwater. This is based on an anticipated throughput of 175 gallons per minute. The operating capacity takes into account downtime for scheduled maintenance and unplanned interruptions of flow. The system is housed in a building located just north of the SWRB. The system consists of granular multimedia filtration for particulate removal and ion exchange for uranium removal. The SPIT system uses three ion exchangers in series (lead, lag, and one standby). The treated groundwater is discharged through the FEMP outfall line to the Great Miami River. Multimedia filter backwash, until late 1998, was pumped to the General Sump for subsequent treatment in the AWWT Phase II system. This flow was redirected to the SWRB for subsequent treatment in Phase I. The SPIT system will remain dedicated to the treatment of groundwater at the above-stated capacity.

A future project is planned to provide aeration of influent groundwater and a new discharge pipeline to the treated groundwater re-injection holding tank. This project will occur prior to the expansion of the planned re-injection system provided that re-injection technology is found to be a viable enhancement to aquifer restoration.

3.3.4 Volatile Organic Compound (VOC) Wastewater Treatment System

A 10 gpm treatment system at Plant 8 was constructed in 1991 for treatment of VOC-contaminated perched water collected from wells in and around Plants 2/3, 6, 8, and 9 (FEMP Removal Action 1). This system was discontinued with the safe shutdown of Plant 8.

Removal Action 1 ceased in December 1995, but some pumping operations continued in Plant 6 for maintenance purposes. Water with VOC contamination is currently being treated by activated carbon adsorption at the AWWT Phase II. It was originally planned that in early 1999, a new VOC pre-treatment system would be constructed to treat future wastewaters containing RCRA-listed hazardous constituents. As the design of VOC pre-treatment system proceeded, the underlying justification for the project was questioned and discussions with the EPA and Ohio EPA were initiated. EPA and Ohio EPA agreed with DOE and FDF that deleting the VOC treatment system was a sound technical decision based on an evaluation of RCRA QAC 3745-51-03(a)(2)(e) and 40 CFR 261.3(a)(2)(iv) and that there are sufficient administrative and engineered systems in place to allow the FEMP to manage wastewater streams containing RCRA F-Listed constituents within the intent of the mixture rule. The perched water from the sludge drying beds, fire training area, Hazardous Waste Management Units decontamination water, and containerized wastewaters presently in inventory meet the mixture rule exclusion criteria and can therefore be managed as a wastewater exempted from RCRA listing though the AWWT, Phase II. With this agreement in hand, the planned VOC treatment system was canceled (DOE 1998b).

3.3.5 Sewage Treatment Plant (STP)

Sanitary sewage and laundry wastewater, prior to April 1998, was treated at the FEMP sewage treatment plant, located southeast of the former production area. The plant was replaced by a new sewage treatment facility located near the AWWT Facility. The new sewage treatment facility was constructed using relocated equipment from the out-of-service biodenitrification (activated sludge) effluent treatment system and the old STP. The main components of the new sewage treatment plant are aeration, clarification, sludge thickener, and an ultraviolet disinfection system.

3.4 ANCILLARY FACILITIES

A number of facilities exist that are supplementary to the operation of the various treatment systems. These include system headworks for equalizing the flows to these systems, groundwater flow routing facilities, wastewater collection and transfer facilities, sludge processing facilities, and discharge monitoring facilities. These facilities are described below.

3.4.1 System Headworks

Headwork facilities exist for support of the various wastewater treatment facilities. In general, these facilities provide for flow equalization prior to discharging to the various treatment systems. Details of the headworks follow.

3.4.1.1 Storm Water Retention Basin (SWRB)

The SWRB, located south of the former production area, currently receives storm water runoff from the former production area, the southern waste units SWRBs, and the OSDF. The SWRB allows for flow equalization and settling of suspended solids. It has a retention capacity of approximately 10 million gallons. The basin consists of an east chamber and a west chamber. The basin consists of a primary bottom bentonite liner and an upper flexible synthetic membrane liner. An underdrain system beneath the synthetic liner is used to monitor and collect leakage through the synthetic liner. The discharge can be routed to the AWWT Phases I and II, IAWWT, or directly to the FEMP outfall line to the Great Miami River.

3.4.1.2 Biodenitrification Surge Lagoon (BSL)

The BSL is located in the southeast section of the waste storage area. It is an 8 million gallon, man-made lagoon that currently receives contaminated wastewater from controlled storm water runoff from the clearwell, waste pit area perimeter, OSDF leachate collection system, WPRAP SWM pond and Waste Pit 6. The storage volume available at the BSL allows the highly varying influent wastewater flow to be collected and discharged to treatment at a relatively consistent flow rate.

The lagoon has two synthetic membrane liners and a leachate collection system underneath each membrane liner. The bottom of the lagoon is lined with a 12-inch thick layer of bentonite. Wastewater is pumped from the lagoon to the AWWT Facility from a pump station located at the southeast corner of the lagoon.

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3.4.1.3 High Nitrate Tank (HNT)

The HNT is located southeast of the BSL. It has a 500,000 gallon capacity that was previously used for storing high nitrate-concentration wastewater during past FEMP operations. Concrete secondary containment surrounds the HNT. Discharged wastewaters from the HNT are combined with discharged wastewater from the BSL. It is anticipated that the HNT will be used as a holding tank for wastewater from the Silos Project and may also be used for other flows in the future.

3.4.1.4 Headworks Sludge Removal Systems

The procedures used in the past for removal of sediment from the SWRB and the BSL are very cumbersome and they require taking the basin/lagoon out of service for extended time periods. A project is currently underway to install three remotely operated solids removal systems (dredges) to address anticipated future quantities of sediment accumulation in these basins. One dredge will service the BSL. Because the SWRB consists of two chambers (east and west), two dredges will be used to avoid continuously moving a dredge from one chamber to the other. The dredges are scheduled to become operational during the Summer of 1999.

As required, the dredges will remove the sediment and discharge it into a mixing tank. The mixing tank contents will be slowly discharged into their respective headworks pump pits to be routed to the AWWT. The suspended solids will be settled out at the AWWT clarifiers and sent to the Slurry Dewatering Facility (Section 3.4.5) for dewatering in preparation for disposal. It is not anticipated at this time that solids buildup in the HNT is a concern, so no specific sludge-removal measures are planned for that facility.

3.4.1.5 Sanitary Lift Station

All sanitary flow is collected in the Sanitary Lift Station, which has a limited storage volume. Pumps automatically transfer accumulated wastewater to the STP when a certain storage level is reached.

3.4.1.6 Great Miami Aquifer

No specific headworks exist for groundwater. However, because this flow can be adjusted by regulating the extraction wells, the aquifer itself serves as a headworks for groundwater.

3.4.2 SWRB Valve House

The SWRB valve house is located just north of the SWRB west chamber. The valve house contains an extensive array of valves to allow diversion of storm water flow from the SWRB and groundwater flow to the various treatment facilities. This facility also serves as the point of convergence for the effluent from the treatment systems prior to discharge through the FEMP outfall pipeline. The valves also allow for untreated water from the SWRB to be discharged directly to the Great Miami River to assist in preventing the SWRB from overflowing to the Storm Sewer Outfall Ditch and Paddys Run, due to heavy rainfall or other operational difficulties. Flow monitoring and sampling equipment are also provided in the valve house.

3.4.3 South Field Valve House

As part of the South Field Extraction System Phase I construction, a new south field valve house was constructed, upstream of the SWRB Valve House. The primary purpose of this valve house is to receive the combined South Plume Recovery System and South Plume Optimization System groundwater. It directs all or portions of the combined flow toward treatment and/or to untreated discharge prior to combining with other groundwater flows.

3.4.4 General Sump

The General Sump is just northeast of Plant 8 in the former production area. The General Sump is a tank farm that, prior to 1999, was primarily a wastewater transfer facility. Historically it had also provided limited treatment consisting of neutralization, precipitation, pH adjustment, and decantation. The General Sump had received wastewater from various plant sources for transfer to the BSL. The streams which had been sent to the General Sump were rerouted to the SWRB or, in the case of minor flow, to batch trucking operations so that the planned D&D of this facility could occur. Therefore, it is no longer a part of the wastewater infrastructure at the FEMP.

3.4.5 AWWT Slurry Dewatering Facility (SDF)

The AWWT Slurry Dewatering Facility is adjacent to the AWWT facility. The primary purpose of the SDF is the processing (dewatering) of waste slurries and sludges from the AWWT facilities. The dewatering of miscellaneous site waste sludges (i.e., those from the SWRB, BSL, STP, etc.) is also to be performed at this facility. This facility is also used to pre-treat the eluate produced in the regeneration of ion exchange resins at the various treatment plants.

The slurry dewatering facility has a design treatment capacity of 30,000 gallons per day of slurry. The process consists of slurry conditioning (pH adjustment, coagulation/flocculation, filter aid addition), thickening, and pressure filtration. The dewatered waste material is packaged for on- or off-site disposal.

3.4.6 Resin Regeneration System

As described above, the primary process used at the FEMP for removing uranium from wastewater is ion exchange. The resin used to perform the ion exchange can be regenerated, to restore its chloride ion exchange form: To provide for this regeneration, a brine (sodium chloride) regeneration system was installed and became operational in early 1998. Much of the system utilizes shared equipment with the SDF.

3.4.7 Effluent Aeration Facility

The effluent aeration facility adds dissolved oxygen to the groundwater/wastewater effluent as necessary to meet NPDES permit minimum requirements of 5 parts per million (ppm) of dissolved oxygen. All treatment system effluents discharged are conveyed to the effluent aeration facility. The effluent aeration facility consists of a 60,000 gallon stainless steel aeration tank with overflow to an adjacent manhole. The splashing of the overflow into the manhole has provided sufficient aeration to achieve the NPDES requirement, therefore operation of the effluent aeration facility blowers has not been required. However, blowers may be used in the future, if necessary.

3.4.8 Parshall Flume

Downstream of the effluent aeration facility, the combined flows pass through a Parshall flume and an associated outfall monitoring station for FEMP discharge flow measurement and monitoring.

3.5 CURRENT TREATMENT PERFORMANCE

As described above, a number of treatment systems have been used at the FEMP to treat groundwater, storm water, and process-generated remediation wastewater. A description of the uranium removal performance of these systems, as well as a description of uranium contamination within sanitary sewage, are provided below.

3.5.1 Groundwater

The SPIT system was installed in 1994 to specifically remove uranium from groundwater recovered by the South Plume extraction well system. The SPIT system has consistently reduced the uranium concentration from about 20 ppb to less than 5 ppb utilizing new ion exchange resin. Based on this information, groundwater treatment modeling used 5 ppb as the performance value.

The AWWT expansion system came online in 1998 to accommodate the site's additional groundwater treatment needs. This system has consistently reduced the uranium concentration from about 70 ppb to less than 5 ppb utilizing new ion exchange resin.

However, for economic reasons, regenerated ion exchange resin will be utilized in the future rather than ongoing resin replacement in both the SPIT and in the AWWT Expansion facilities. The uranium removal performance of regenerated resin has not been established as of this time. Evaluations are currently being conducted to determine the viability of attaining and maintaining the treatment effluent concentration of 5 ppb uranium utilizing regenerated resin. Also, the concentration of uranium in groundwater being sent to treatment has risen from 20 ppb to approximately 70 ppb with completion of additional extraction wells in late 1998.

3.5.2 Storm Water

The IAWWT and AWWT Phase I systems have been used to remove uranium from storm water collected in the SWRB. Utilizing new ion exchange resin, the IAWWT has consistently reduced the uranium concentration from about 500 ppb to about 5 ppb. AWWT Phase I has been used for both groundwater and storm water and has required some system modification since its startup in 1995; consequently, its performance had not been consistent. With the addition of multi-media filters in mid 1997, its performance with new resin has provided an effluent of 10 ppb or less. Based on these performances, future storm water treatment modeling has used 10 ppb as the performance value.

However, for economic reasons, regenerated ion exchange resin will be utilized in the future rather than ongoing resin replacement. The uranium removal performance of regenerated resin has not been established as of this time. Evaluations are currently being conducted to determine the viability of attaining and maintaining the treatment effluent concentration of 10ppb uranium utilizing regenerated resin. In addition, future remediation efforts are expected to raise the current influent uranium concentration.

3.5.3 Remediation Wastewater

AWWT Phase II has been used to treat the more variable remediation-generated wastewater and, on occasion, groundwater. It also has required some troubleshooting and modification since 1995. With the addition of multi-media filters in mid 1997, its performance has reduced the uranium concentration from about 1500 ppb to 20 ppb or less, utilizing new ion exchange resin. Based on this performance, future remediation wastewater treatment modeling has used 20 ppb as the performance value.

However, for economic reasons, regenerated ion exchange resin will be utilized in the future rather than ongoing resin replacement. The uranium removal performance of regenerated resin has not been established as of this time. Evaluations are currently being conducted to determine the viability of attaining and maintaining the treatment effluent concentration of 20 ppb uranium utilizing regenerated resin. In addition, recycled flow from regeneration plus additional remediation flows are expected to raise the current influent uranium concentration.

3.5.4 Sanitary Sewage

The treatment of FEMP sanitary sewage is important with respect to compliance with the Clean Water Act and, more specifically, with the site NPDES permit requirements. It would not be significantly important to the remediation aspects of Operable Unit 5, except for the presence of uranium contamination in the collected sewage.

The daily uranium concentration of the STP effluent over the course of the last several years (since 1995) has fluctuated between 20 and 843 ppb. Recently, levels have averaged as high as 217 ppb monthly (December 1998). Levels greater than 20 ppb in the STP effluent have a negative effect on meeting the monthly average of 20 ppb in FEMP wastewater discharge to the Great Miami River. The elevated uranium concentrations in the STP effluent are therefore a concern to the FEMP with respect to its ability to achieve the goals and commitments outlined in this plan.

Preliminary investigation (sampling) of the sanitary sewer system has identified pipeline sections where the uranium concentration in sewage is elevated. Infiltration of contaminated water into the sewer pipeline is suspected as the source of the elevated uranium concentrations.

Between mid-1991 and mid-1994, the average monthly STP effluent uranium concentrations were normally less than 20 ppb (see Figure 3-10). This was attributed to the elimination of the Biodenitrification facility effluent from the STP. Since 1994, the uranium concentrations in the STP effluent have been increasing. This appears to correlate with the Plant 7 demolition implosion. It is theorized that the implosion may have loosened the underground piping joints, resulting in a greater potential for uranium-contaminated perched groundwater infiltration.

The contaminated perched water areas will be remediated by excavation and dewatering, soil disposition, and contaminated water treatment as described in the Operable Unit 5 ROD. The need and remedy for reducing the uranium concentration in the STP effluent, prior to perched water area remediation, to support the 20 ppb discharge criteria is currently being investigated. If interim corrective actions are determined to be necessary, the remedy will likely include one or more of the following actions:

- Installation and operation of a simple dedicated wastewater treatment unit (likely incorporating filtration and ion exchange) for the STP discharge
- Isolation of the highly contaminated sections of sanitary sewer piping and rerouting to storm sewers while accommodating the necessary site sanitary services in some alternate arrangement
- Rehabilitation of the sanitary sewer piping in the areas of contamination.

3.6 CURRENT AND PLANNED DISCHARGE MONITORING

Currently, discharge monitoring is completed under two sampling programs. Conventional pollutants are monitored under the NPDES. Radionuclides and total uranium are monitored under the Federal Facilities Compliance Agreement (FFCA). These two programs have been incorporated into the IEMP sampling program as described in Section 4 of the IEMP. These monitoring programs are described briefly in the subsections below.

3.6.1 NPDES Monitoring

There are six permitted FEMP wastewater discharge outfalls to State of Ohio waters that are regulated by the NPDES Permit Program (see Figure 3-11). There are also two internal monitoring points. The permit (Ohio EPA Permit No. 1IO00004*ED) is administered by the Ohio EPA and granted to the DOE at the FEMP. The effluent pollutant limitations, monitoring requirements, and reporting requirements are specified in the permit for each outfall and internal monitoring point.

Discharges through Outfall 4001 enter the Great Miami River at River Mile 24.73. The sampling and monitoring location for this outfall is the Parshall flume chamber immediately downstream from Manhole 176B. This outfall is the primary FEMP wastewater discharge outfall consisting of discharges from the AWWT facilities, IAWWT, SPIT, STP, untreated groundwater, and untreated storm water.

Discharge through Outfall 4002 enters Paddys Run at River Mile 2.50. The sampling and monitoring location for this outfall is the SWRB overflow spillway (location 4002O on Figure 3-11). Discharge at this outfall only occurs when the accumulation of storm water in the SWRB exceeds the capacity of the SWRB.

Discharges through Outfalls 4003, 4004, 4005, and 4006 are untreated storm water runoff drainage from site areas into Paddys Run. Runoff from eastern and southern areas of the site drains through Outfall 4003, which is just north of Willey Road. Runoff from the area north and west of the inactive flyash pile drains through Outfall 4004, which is just west of the flyash pile. Runoff from the western area of the site drains through Outfall 4005, which is just south of the K-65 Silos. Runoff from areas north of the site drains through Outfall 4006, which is north of Waste Pit 5.

Internal sampling station 4589 is the sampling of dewatered sludge from the STP. Internal sampling station 4601 is the sampling of final effluent from the STP at the Ultraviolet Disinfection Building.

3.6.2 Radionuclide and Uranium Monitoring

The FEMP site conducts a surface water sampling and analytical program for certain specific radionuclides which are potentially present in the regulated liquid effluent and in the uncontrolled storm water runoff from the site. Details of this program are provided in Section 4 of the IEMP. The program consists of uranium analysis of a daily flow-proportional composite sample of the site effluent and grab sampling at monthly and quarterly intervals. The monthly samples are analyzed for total uranium, radium-228 and technetium-99, while the quarterly samples are analyzed for lead-210, radium-226 and strontium-90.

The daily total uranium analysis of the site effluent to the Great Miami River is used to track compliance with Operable Unit 5 ROD established limits. Since the issuance of the Operable Unit 5 ROD in January 1996, the FEMP is obligated to limit the total mass of uranium discharged through the FEMP outfall to the Great Miami River to 600 pounds per year.

This daily effluent uranium analysis is also used to forecast the FEMP's ability to achieve a future requirement for a monthly average uranium concentration of 20 ppb uranium in the site discharge to the river. This requirement became effective January 1, 1998, as established in the Operable Unit 5 ROD. The Operable Unit 5 ROD does allow relief from this 20 ppb requirement during periods of excessive precipitation and for scheduled maintenance. (Excessive precipitation is an amount of precipitation combined with the projected weather forecast, that causes water levels in the basin to threaten the limit of the holding capacity of the basin.) The uranium concentration in the effluent to the river on up to 10 storm water bypass days a year may be deleted when calculating the monthly average. Section 9.1.5 of the Operable Unit 5 ROD stipulates that notification will be provided to EPA and OEPA within seven days of the implementation of such a direct bypass. The purpose of the bypass is to minimize the possibility of SWRB overflow to Paddys Run.

The average monthly uranium concentration is calculated by multiplying each daily flow by the uranium concentration of the flow-weighted composite sample for that respective day. The sum of the values obtained by multiplying the flow times the concentration is then divided by the sum of the flows for the month. The result is a flow-weighted average monthly uranium concentration. The daily flow-weighted concentrations are then multiplied by 8.35 (lb/gal) to obtain the daily pounds of uranium discharged. The sum of the daily masses for the year is used to compare against the 600-pound-per-year limit.

After the average monthly uranium concentration has been calculated, the 10 allowable bypass concentrations will be accounted for as follows: If any by-pass days occur during a particular month which equal or exceed 12 hours in duration, the flow-weighted concentration for those days will be dropped, the days will be added to the yearly tally of bypass days, and the average will be recalculated. If additional bypass days of less than 12 hours occur during a month (partial bypass days), and the monthly average is still above 20 ppb, then the highest flow-weighted concentration will be dropped and the average will be recalculated. This method will be repeated until the 20 ppb limit is achieved or all of the allowable partial bypass days have been expended.

EXAMPLE: Storm water bypasses occurred on March 2, 3, and 4, 1997. The bypassing started at 12:00 a.m. on March 2 and ended at 9:30 a.m. on March 4. Therefore two full days of bypassing occurred equal to or greater than 12 hours of bypassing and one partial bypass day occurred. The flow-weighted average for the month was 33 ppb. By dropping the daily flow-weighted concentration of the two fully bypassing days, the average was reduced to 18 ppb. Thus, although the bypass occurred over three calender days which were reported to the agencies, only two of the 10 allowable bypass days were expended to meet the 20 ppb limit.

If the adjusted average monthly uranium concentration exceeds the 20 ppb limit after the flow-weighted concentrations for all allowable by-pass days have been removed, the excursion will be reported to the agencies.

If a sequence of months (i.e., not a random occurrence) indicate an exceedance of the 20 ppb monthly average, and there has not been above average rainfall, then corrective measures will need to be evaluated. Depending on the reason for the sequence of exceedances, corrective actions could include: modifications to parts of the FEMP wastewater system as discussed in Section 3.5.4 or 5.4.1.2; segregation of the South Plume Optimization wells discharge from the combined SPO/South Plume Recovery System header to reduce the concentration of uranium in flow bypassing treatment, or other such actions.

The need for corrective measures will be discussed with the EPA and Ohio EPA in periodic meetings/reports. (Summary reporting of how the FEMP is doing with respect to compliance with the 20 ppb uranium discharge limit and the use of bypass days will be included in the meetings/reports.) In the event that corrective measures are deemed necessary, the situation will be outlined to the EPAs in order to reach consensus regarding what action (if any) is required.

3.6.3 IEMP Surface Water and Treated Effluent Monitoring Program

Significant portions of the current and past programs (NPDES and FFCA) have been incorporated into the IEMP. Section 4 of the IEMP describes these two programs in more detail and also how these two programs have been integrated into the IEMP surface water and treated effluent sampling program. The IEMP also provides for additional monitoring above that required by the NPDES permit and the FFCA. This additional monitoring is performed as a supplement in order to monitor surface water and treated effluent for potential site impacts to various receptors during remediation. Figure 3-11 shows the current NPDES, FFCA, and the IEMP treated-effluent and surface-water sampling locations. In addition to identifying the sampling program requirements, the IEMP provides a comprehensive data evaluation, and associated decision-making and reporting strategy for surface-water and treated-effluent. Figure 3-12 depicts the IEMP treated-effluent and surface-water data evaluation strategy and associated actions.

TABLE 3-1

AQUIFER RESTORATION REMEDIAL ACTION SCHEDULE FOR CURRENTLY OPERATING MODULES

Module	Well Installation Contract Award	Infrastructure Contract Award[a]	Complete Construction	Commence Operations[c]
Injection Demonstration	NA	September 5, 1997 (August 13,1997 A)	June 1, 1998 (June 12,1998 A)	**September 30, 1998** (September 2, 1998 A)
South Plume Optimization	November 1, 1997 (October 20,1997 A)	January 2, 1998 (August 13,1997 A)	July 1, 1998 (June 12,1998 A)	**September 1, 1998** (August 9, 1998 A)
South Field Extraction System Phase I	NA[b]	February 1, 1998 (August 13,1997 A)	August 1, 1998 (June 12,1998 A)	**August 1, 1998** (July 13, 1998 A)

NA = Not Applicable because RA Work plan did not establish a date.
A = Dates designated with an "A" identify the actual dates the milestones were achieved.
[a]The infrastructure contract for the groundwater extraction modules included all construction activities other than well drilling (e.g., installation of electrical, instrumentation, pipelines, pumps and associated equipment). (A) indicates actual dates completed.
[b]Nine of the 10 Phase I South Field Extraction System Module wells were installed previously under the 1995 Project-Specific Plan for the Installation of the South Field Extraction System (DOE 1995c).
[c]The dates provided for commencing operations (start-up) were the enforceable milestones for the aquifer restoration remedial action. All other dates are provided for information purposes to demonstrate their relationship to the enforceable (commence operations) milestones.

TABLE 3-2

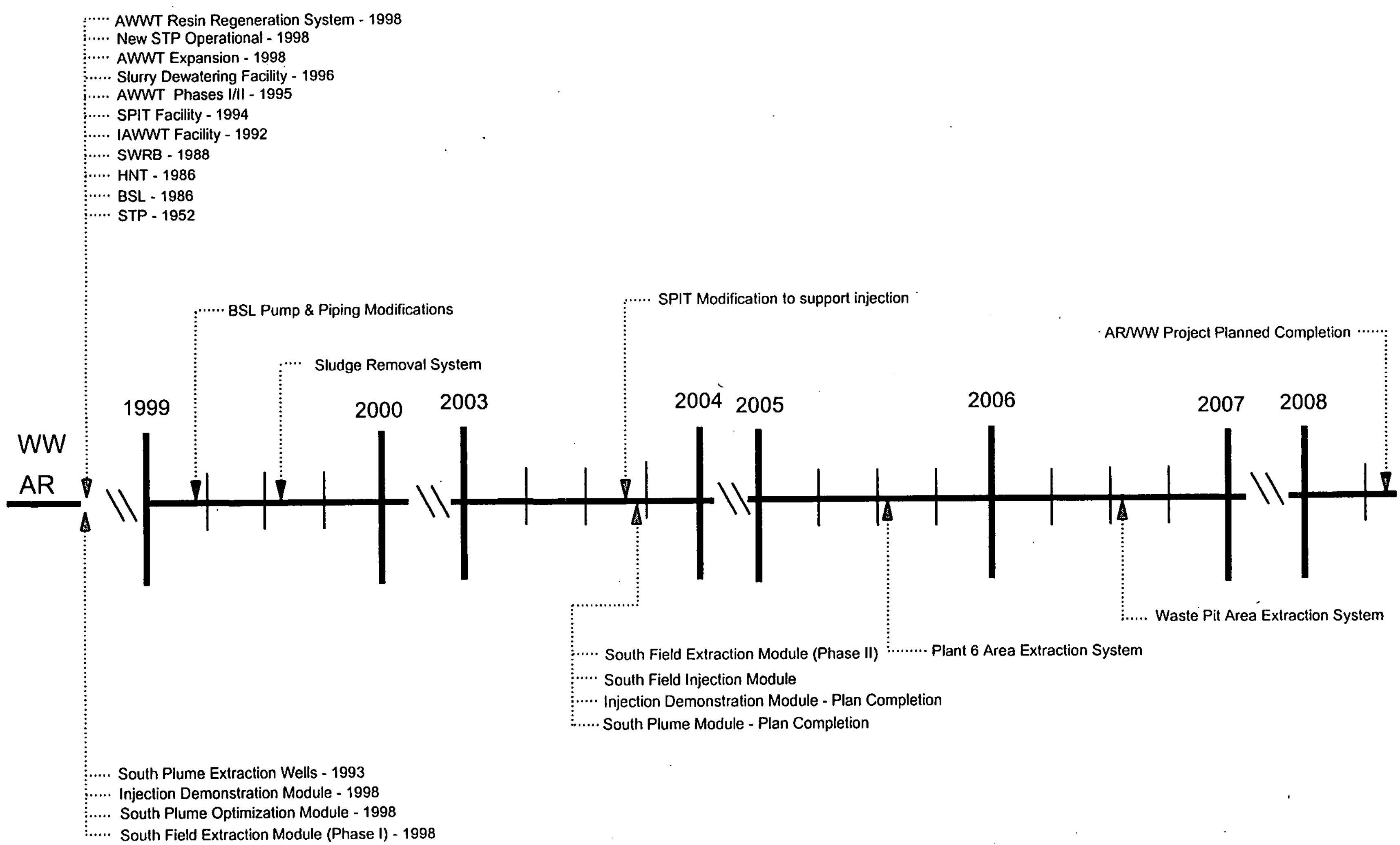
AQUIFER RESTORATION REMEDIAL ACTION SCHEDULE FOR FUTURE ACTIONS[a]

Module	Well Installation Contract Award	Infrastructure Contract Award[b]	Complete Construction	Commence Operations
South Field Injection System	October 1, 2002	December 31, 2002	August 1, 2003	October 1, 2003
South Field Extraction System Phase II	November 30, 2002	December 31, 2002	August 1, 2003	October 1, 2003
Waste Pit Area Extraction System	October 31, 2002	December 1, 2002	August 1, 2003	October 1, 2003
Plant 6 Area Extraction System	February 1, 2003	March 1, 2003	August 1, 2003	October 1, 2003

[a]The long-term projected dates are contingent upon completion of OU1, OU3, and/or OU2/OU5 remedial activities in the module areas. If these projects are delayed, then revised schedules will be submitted as addenda to the RA Work Plan for Aquifer Restoration.
[b]The infrastructure contract for the groundwater extraction modules includes all construction activities other than well drilling (e.g., installation of electrical, instrumentation, pipelines, pumps and associated equipment).

Figure 3-1

ARWWP Timeline



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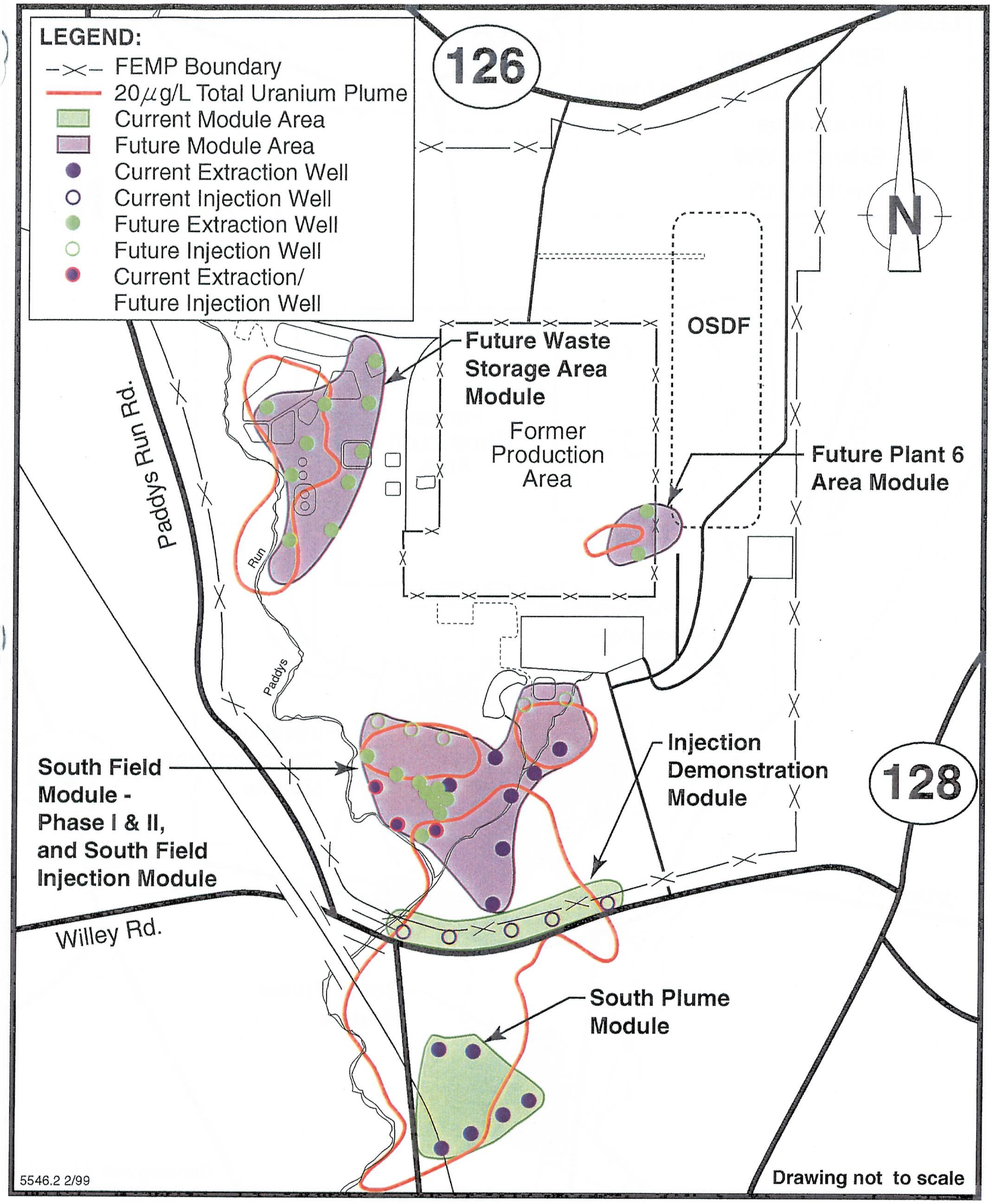

Figure 3-3. Current and Future Aquifer Restoration Modules

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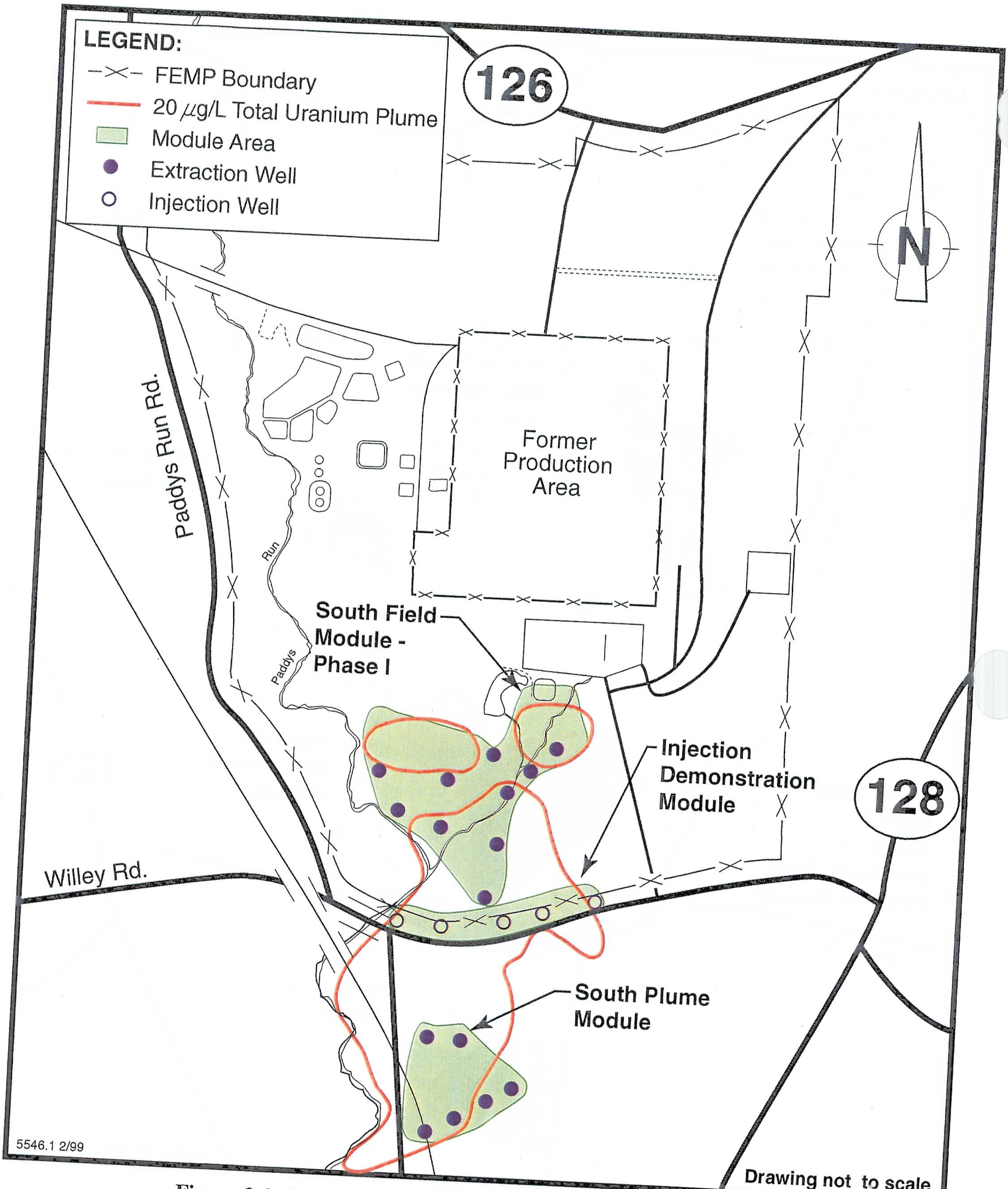

Figure 3-2. Currently Operating Aquifer Restoration Modules

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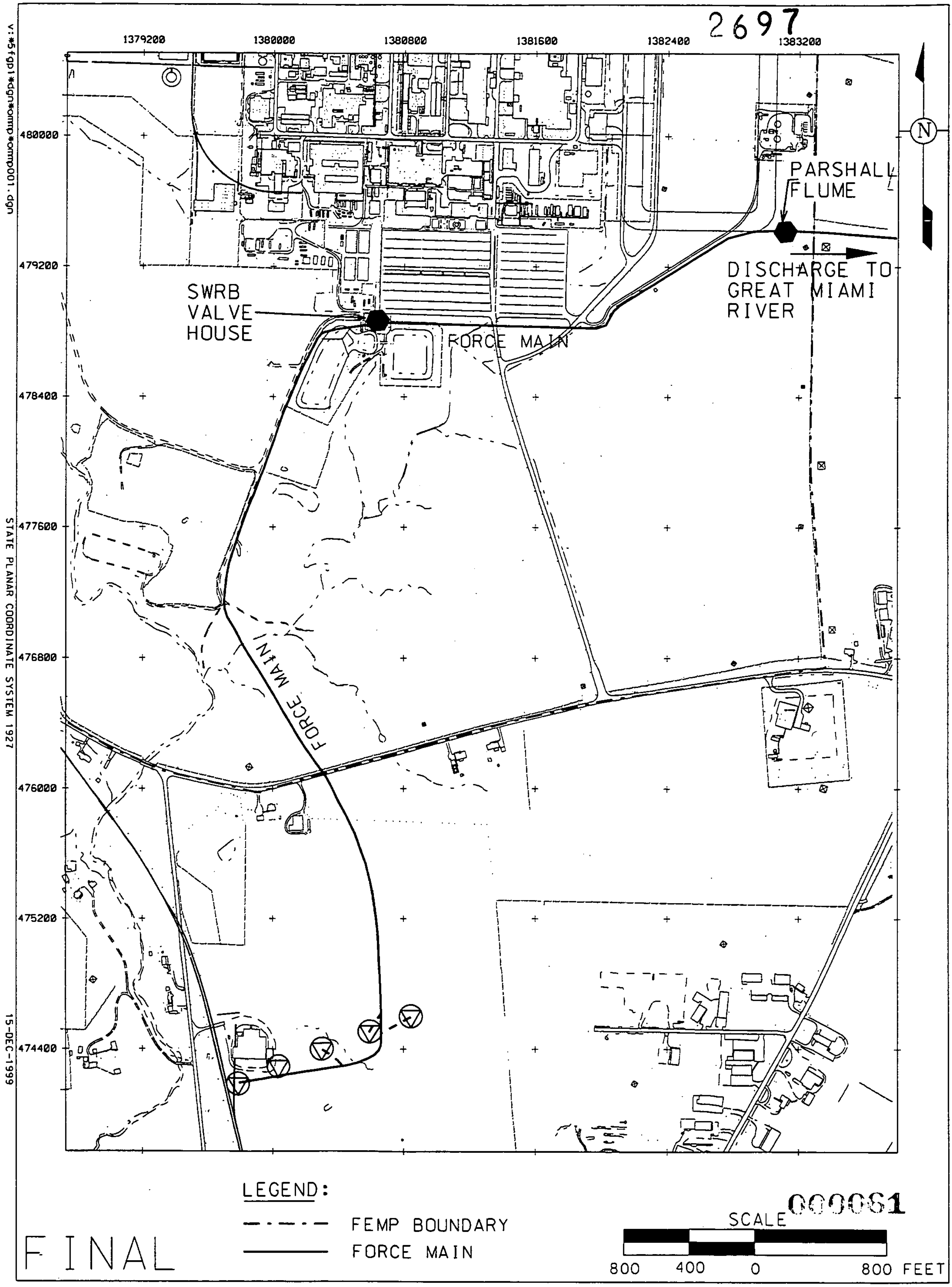

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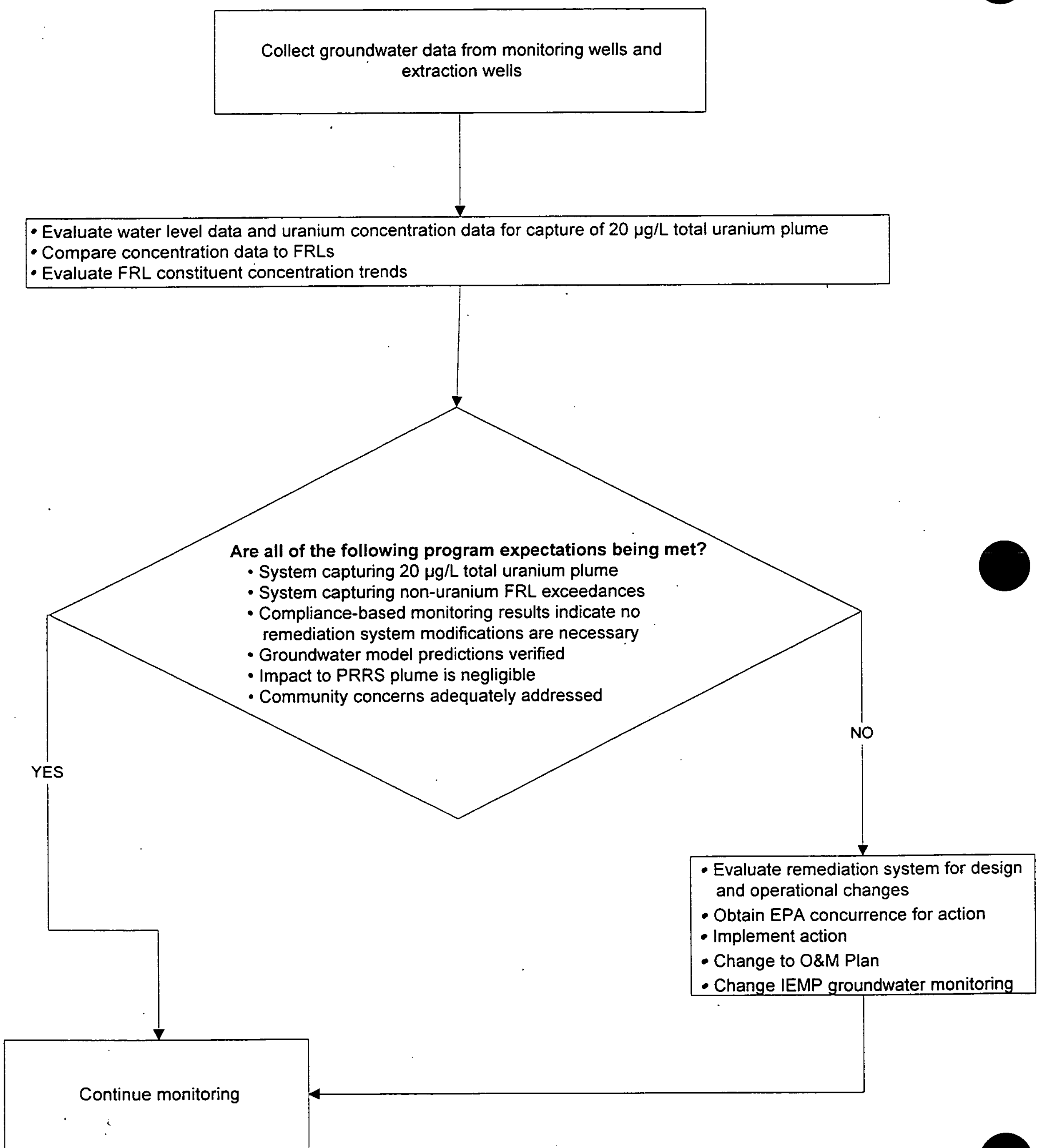
FIGURE 3-4. REMOVAL ACTION 3 GROUNDWATER CONVEYANCE SYSTEM

FIGURE 3-5
GROUNDWATER MONITORING DECISION-MAKING PROCESS FOR 1999 AND 2000



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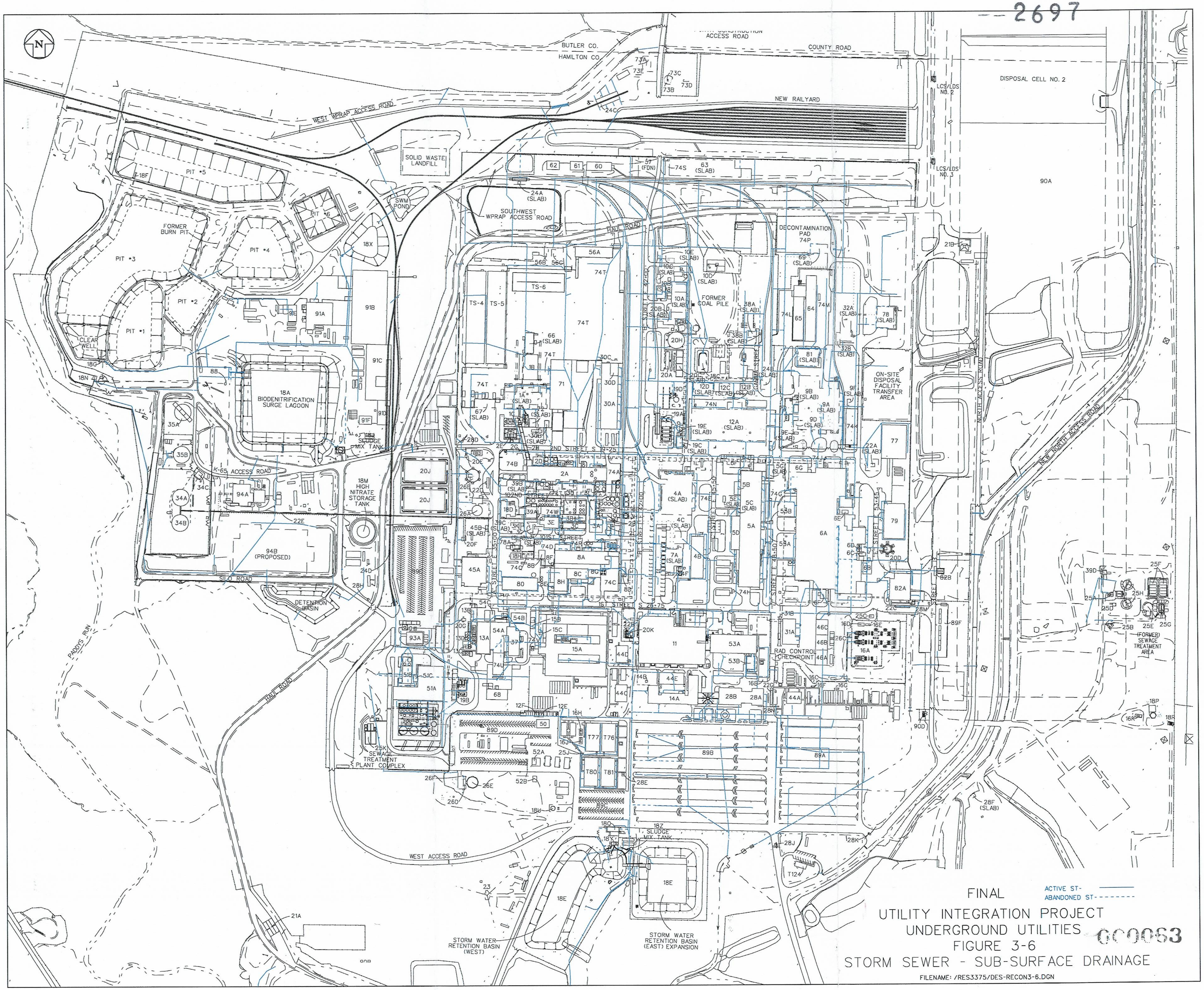

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UTILITY INTEGRATION PROJECT
UNDERGROUND UTILITIES
FIGURE 3-6
STORM SEWER - SUB-SURFACE DRAINAGE
ACTIVE ST-
ABANDONED ST-
FILENAME: /RES3375/DES-RECON3-6.DGN
BUTLER CO.
HAMILTON CO.
COUNTY ROAD
DISPOSAL CELL NO. 2
NEW RAILYARD
WEST WPRAP ACCESS ROAD
SOLID WASTE LANDFILL
SOUTHWEST WPRAP ACCESS ROAD
HAUL ROAD
FORMER BURN PIT
PIT #1
PIT #2
PIT #3
PIT #4
PIT #5
CLEAR WELL
BIODENITRIFICATION SURGE LAGOON
HIGH NITRATE STORAGE TANK
K-65 ACCESS ROAD
SILO ROAD
DETENTION BASIN
SEWAGE TREATMENT PLANT COMPLEX
WEST ACCESS ROAD
STORM WATER RETENTION BASIN (WEST)
STORM WATER RETENTION BASIN (EAST) EXPANSION
SLUDGE MIX TANK
FORMER COAL PILE
DECONTAMINATION PAD
ON-SITE DISPOSAL FACILITY TRANSFER AREA
NORTH ACCESS ROAD
NEW NORTH ACCESS ROAD
RAD CONTROL CHECKPOINT
(FORMER) SEWAGE TREATMENT AREA
PADDYS RUN

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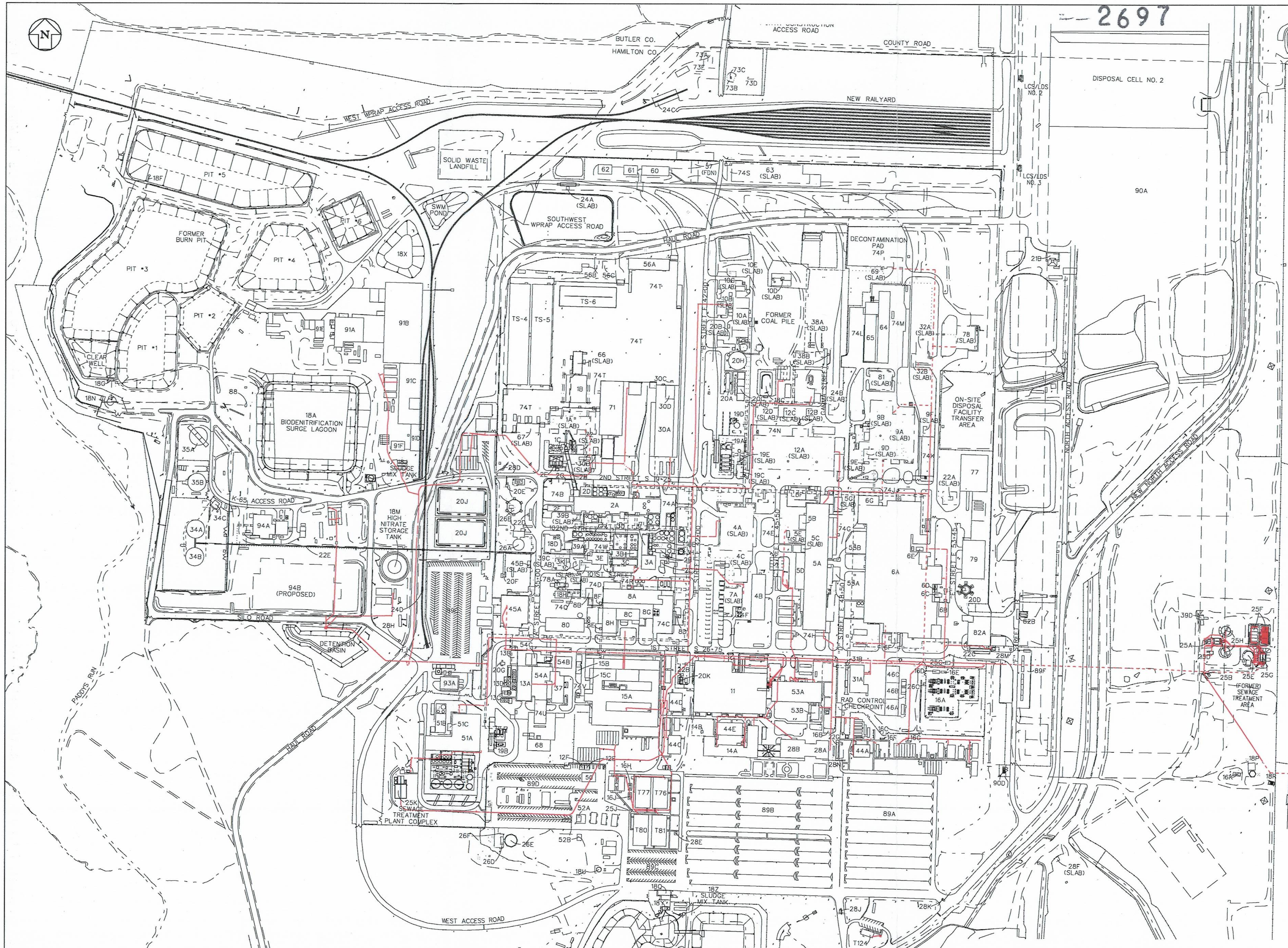

FINAL

UTILITY INTEGRATION PROJECT
UNDERGROUND UTILITIES
FIGURE 3-7
SANITARY SEWER LINES

FILENAME: /RES3375/DES-RECON3-7.DGN

000064

-- 2697

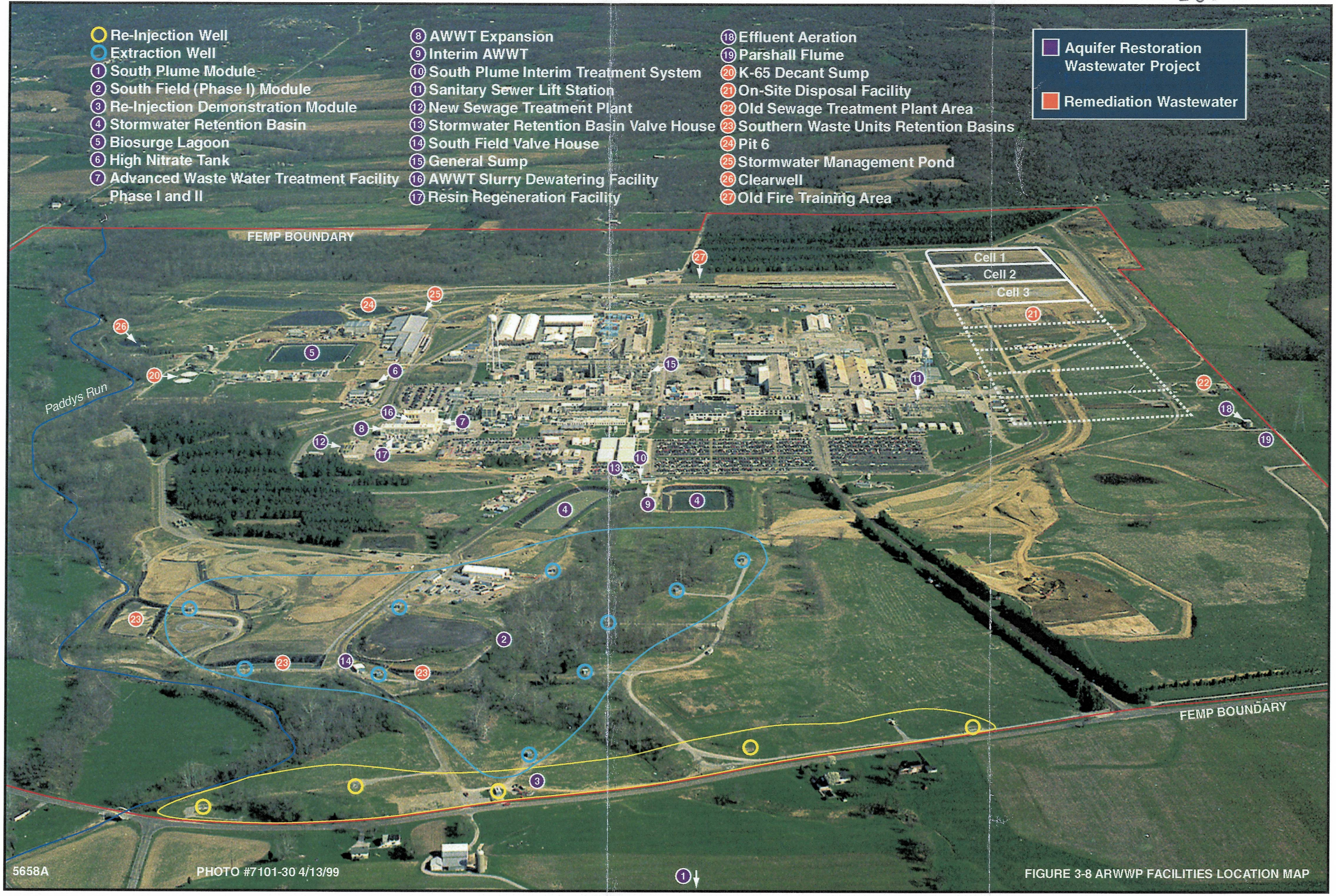

FIGURE 3-8 ARWWP FACILITIES LOCATION MAP

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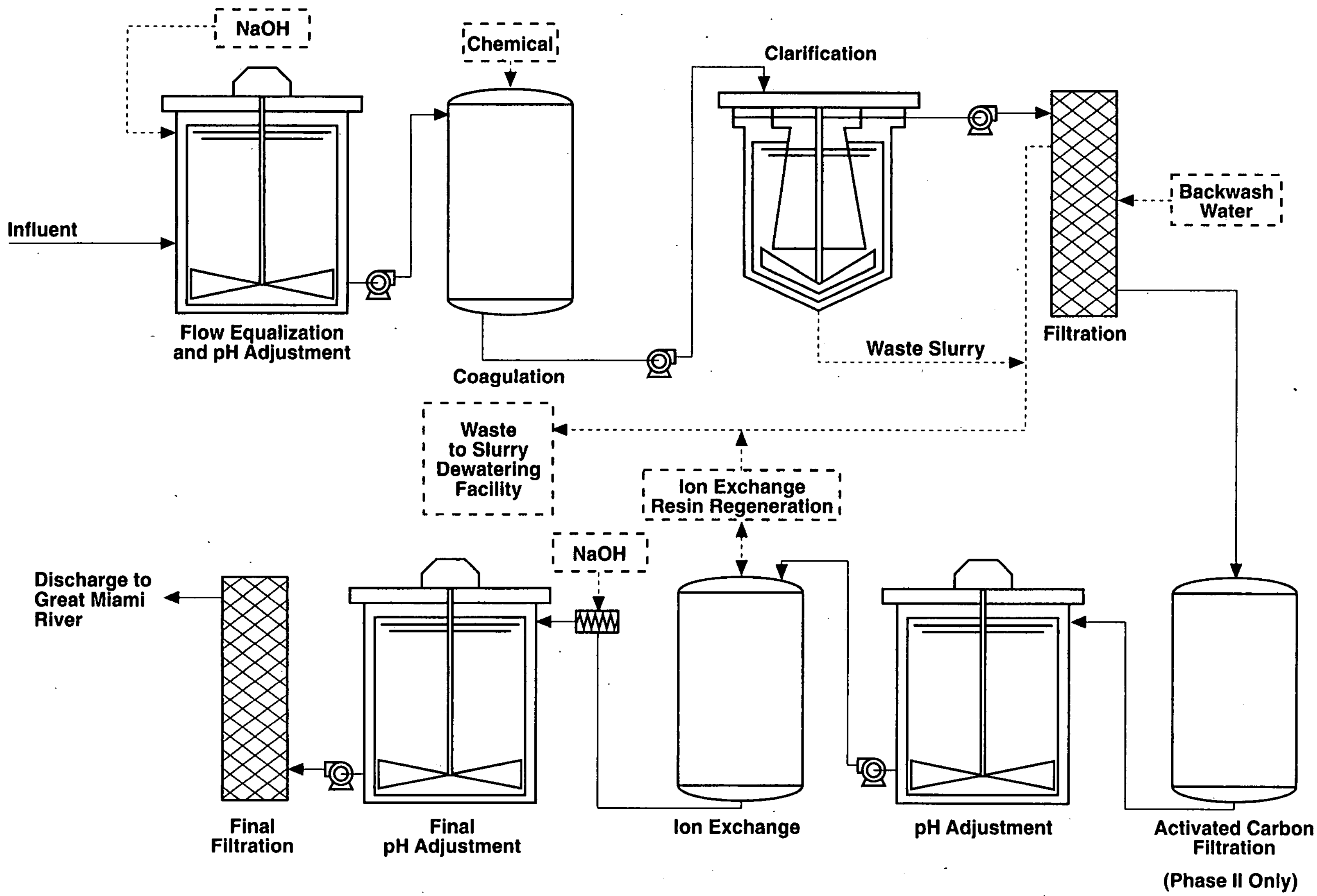

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ADVANCED WASTEWATER TREATMENT PLANT (AWWT) SIMPLIFIED PROCESS DIAGRAM

Graphics #4648 3/99

FIGURE 3-9

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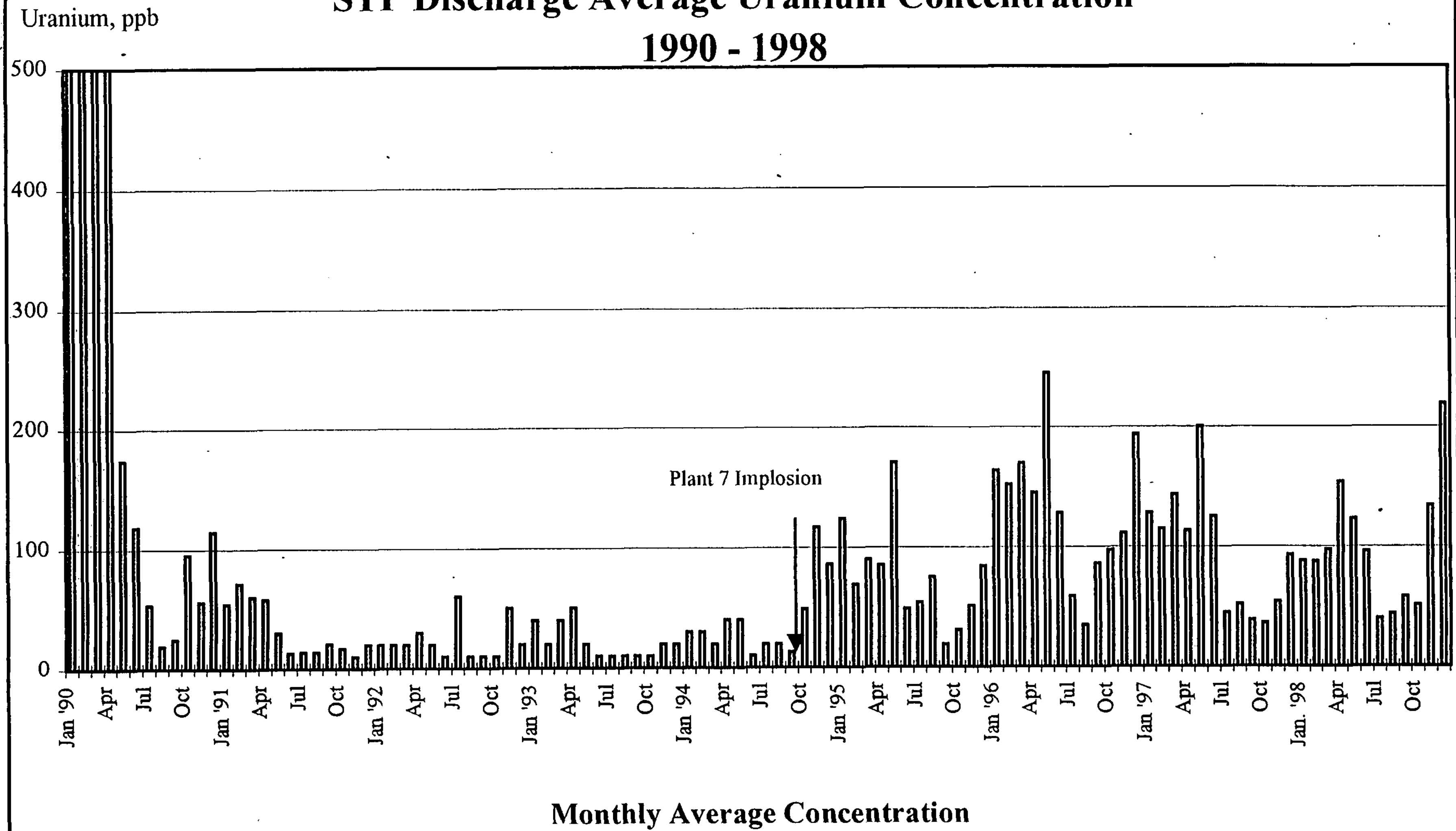
Figure 3-10
STP Discharge Average Uranium Concentration
1990 - 1998



Each bar represents a monthly average

2300007

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OMMP\99OMMP\1299\SECTION3\F3-10TEMP.XLS

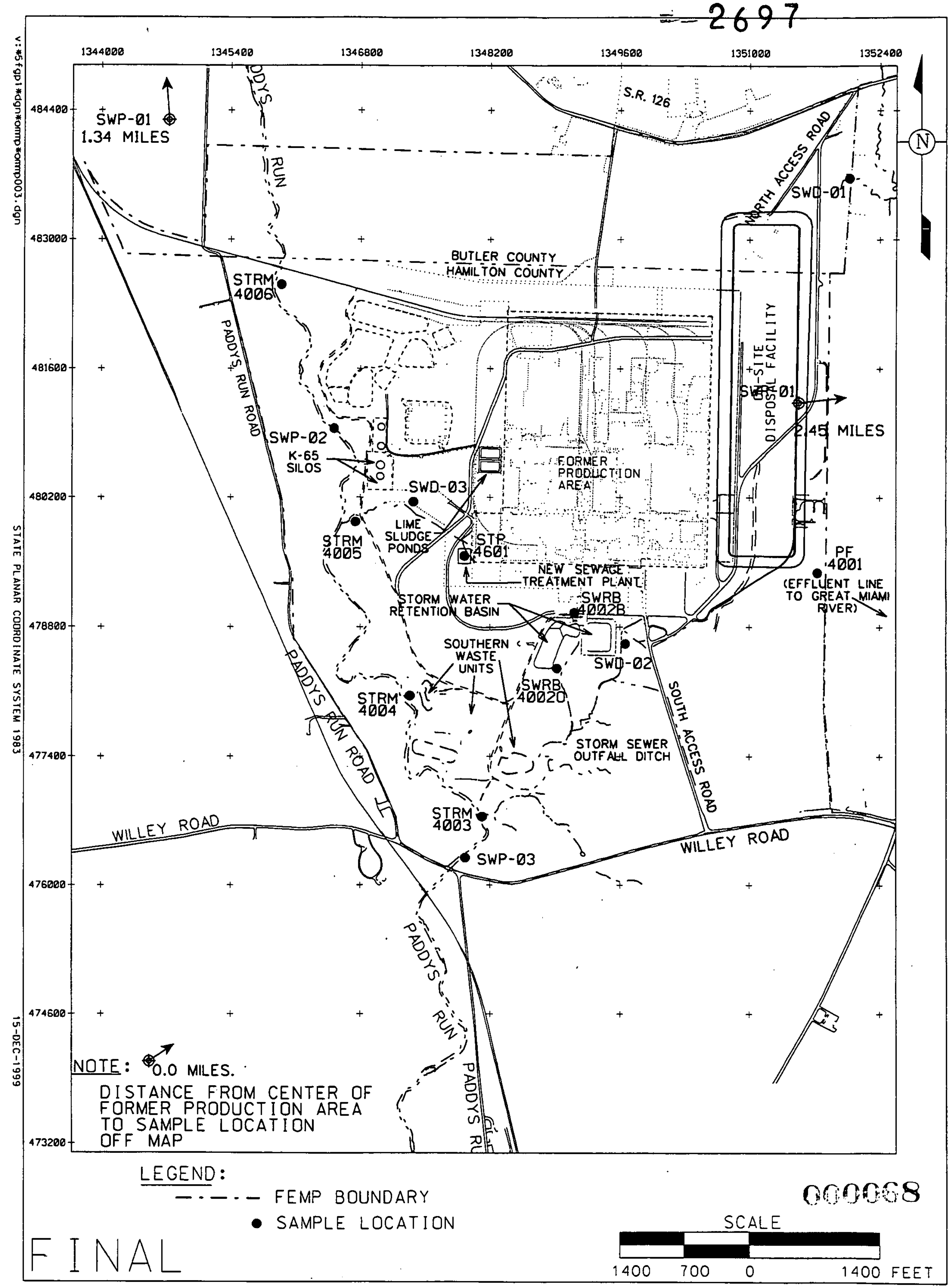
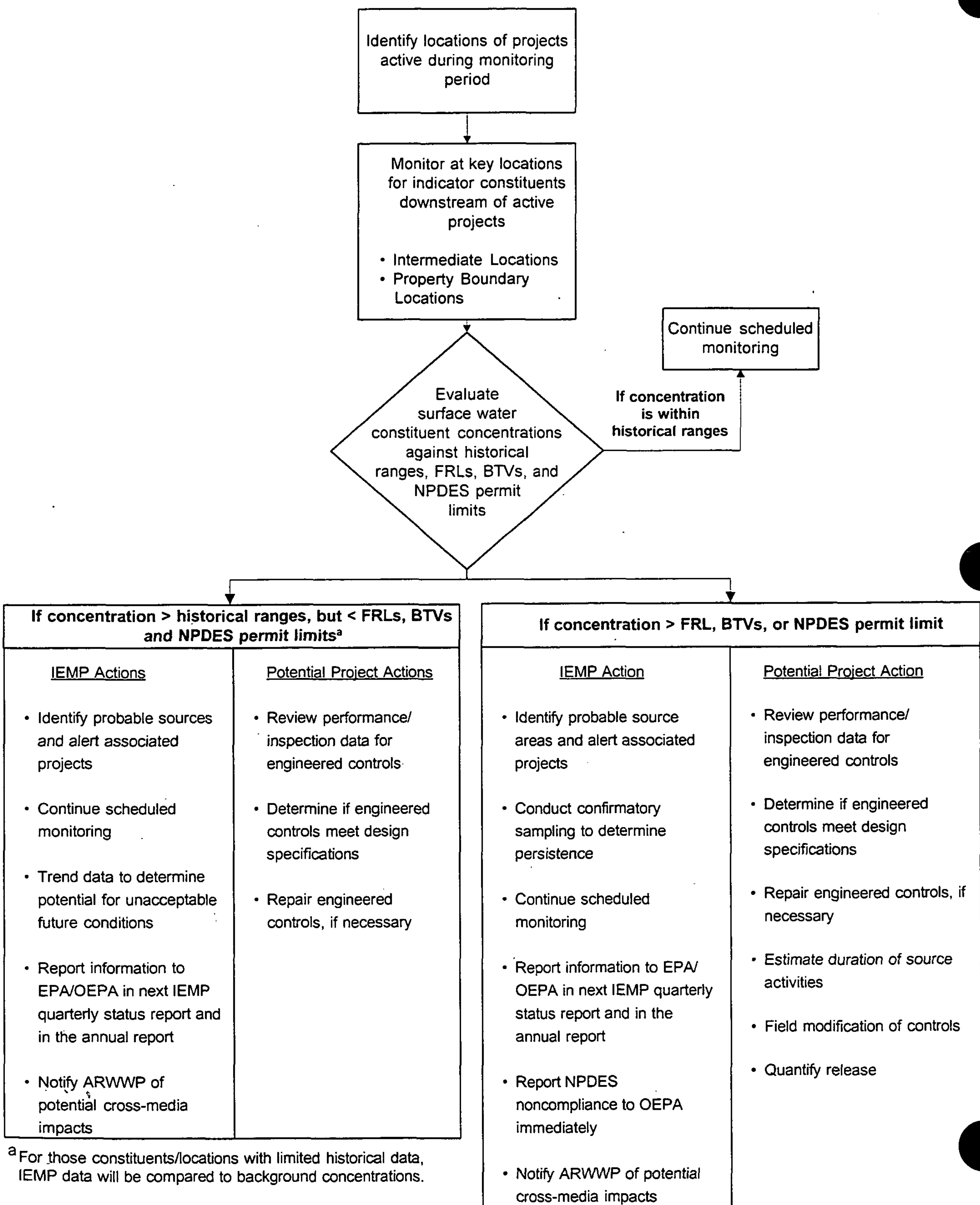


FIGURE 3-11. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

FIGURE 3-12
IEMP SURFACE WATER DATA EVALUATION AND ASSOCIATED ACTIONS



[a] For those constituents/locations with limited historical data, IEMP data will be compared to background concentrations.

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Section 4.0

4.0 PROJECTED FLOWS

Wastewater is classified as either groundwater, storm water, remediation wastewater, or sanitary wastewater. Sources of wastewater and their projected average annual generation rates, duration, and headworks discharge locations related to treatment requirements are presented in this section. Summary flow projections developed for the four types of wastewater are used in Section 5.0 to allocate and evaluate the treatment systems discussed in Section 3.0.

This section has been revised from the original issue of the OMMP (DOE 1997b) to address the latest understanding of flow projections. General revisions in the flow projections for the four types of wastewater are summarized as follows:

- Groundwater flows are base upon remediation of the Great Miami Aquifer being completed by the beginning of FY2006. Achieving this goal depends upon access to the locations where the wells are to be installed, success of groundwater re-injection technology, and validity of assumed modeling parameters. The groundwater flows presented have increased slightly from those presented in the initial version of the OMMP to reflect current operating conditions. They are considered conservative for this document's evaluation because they have not been adjusted to address the probability that the Waste Storage Area Extraction Module (see Section 3.1.2.3) may be delayed.

- Storm water flow projections continue to be based on the average annual rainfall of 40.9 inches. Minor changes to storm water flow projections have been made based on latest information obtained from the projects. Also, this revision discusses the impact of seasonal "wet" and "dry" periods of generation on operation of storm water collection and treatment facilities.

- Remediation wastewater flow projections have been revised for all major projects based on latest information obtained from the projects and are expanded to consider the impacts of "wet season" and "dry season" generation on the operation of collection and treatment facilities.

- Sanitary wastewater flow projections have not changed in this revision.

4.1 GROUNDWATER

Extracted groundwater will be the largest wastewater flow requiring treatment during the remediation of the FEMP. Unlike storm water and remediation wastewater, groundwater extraction rates can be controlled during the accelerated cleanup of the Great Miami Aquifer. Major concerns regarding achievement of the accelerated aquifer cleanup schedule are: 1) reliance upon assumed parameters used for computer model simulations, and; 2) assumptions regarding the viability of re-injection technology as an enhancement to the FEMP groundwater remedy. Data will be collected as the remedy progresses in order to verify the validity of these assumptions. Additional information regarding these assumptions is provided in the Baseline Remedial Strategy Report (BRSR). The success of the 10-year scenario is also highly dependent upon accessibility of areas where aquifer restoration infrastructure is required (i.e., in the Waste Storage, Plant 6, and in the Southern Waste Units).

4.1.1 Projected Groundwater Extraction/Re-Injection Rates

This section provides the current and projected groundwater extraction/re-injection rates planned over the remaining life of the groundwater remedy. The individual groundwater remediation modules comprising this adopted strategy are presented in Section 3.1. Figure 4-1 depicts the locations of all existing and planned extraction/re-injection wells, along with their associated numbers. Table 4-1 provides the current and BRSR projected extraction/re-injection rate schedule for each of the wells. With the exception of South Plume Module, the current module-specific flow totals are as presented in the BRSR. The flow rate of South Plume Extraction Well 4 has been increased from 400 gpm to 500 gpm to help assure capture of the northeast lobe of the South Plume.

The rates provided continue to anticipate that the restoration of the aquifer will be completed under the 10-year accelerated cleanup scenario. Throughout the duration of groundwater remediation the pumping/injection rates may be modified within system design and operational constraints, as necessary. These rate modifications will be made to maintain, to the degree possible, the aquifer restoration objectives outlined in the BRSR.

4.1.2 Projected Yearly Average Groundwater Extraction Flow Summary

Figure 4-2 presents a graphic summary of the projected average annual extraction rates that will result from the individual wells shown in Figure 4-1 and presented in Table 4-1. This flow will be available for treatment, or direct discharge into the Great Miami River, as discussed further in Section 5.0.

4.2 STORM WATER

This section addresses storm water runoff collected in the storm water retention basin from portions of the soil remediation areas identified in Figure 4-3. Contaminated storm water runoff requiring treatment is, or is projected to be, collected from the former production area (Areas 3, 4, and 5), waste pit area (Area 6), and from portions of remediation of areas beyond the boundaries of the production area (portions of Areas 1, 2, and 7). Flows from most of these areas are projected to be collected in the storm water retention basin. Storm water runoff from the waste pit area (Area 6), and perched water/commingled storm water from cleanup of the old STP (part of Area 1) and cleanup of the Fire Training Area, will not be discharged to the storm water retention basin, but will instead be sent to the BSL.

4.2.1 Storm Water Retention Basin (SWRB)

The collection of storm water runoff in the storm water retention basin and subsequent handling and discharge has evolved over time as discussed below.

4.2.1.1 Existing Conditions

The SWRB was constructed in 1986, as a storm water runoff retention basin having a capacity of 6.5 million gallons. The basin's capacity was expanded to 10.2 million gallons in 1989, to contain a 10-year, 24-hour storm event from a 165-acre collection area. Drainage to the SWRB came from the storm sewer system in existence at that time. Removal Action No. 16 (completed in 1993) added collection areas on the north, east, and west sides of the original drainage area to complete the 165-acre collection area shown in Figure 4-4.

Initially, after 24 hours of settling, the pumps installed at the SWRB transferred the water collected directly to the Great Miami River at a rate of approximately 300 gpm. In 1995, the pump-out rate was substantially increased with the addition of new pumps and since then, most of the collected water has received treatment at AWWT or IAWWT prior to discharge to the Great Miami River.

During much of 1997, operation of the SWRB was conducted in accordance with the OMMP which was approved by EPA and OEPA that same year. In general, the OMMP provided satisfactory guidance for the near-average rainfall of 40.12 inches that occurred in 1997. Overall, the collection and treatment facilities were managed and operated so that the Operable Unit 5 ROD requirements (i.e., <10 bypass days, <20 ppb monthly average uranium in effluent, <600 pounds per year uranium) for effluent discharged to the Great Miami River were met.

During 1998, the number of bypass days reached the 10-day limit in July, primarily as a result of significantly above-average rainfall (see Figure 4-5) that occurred in four consecutive months from April through July. In this period, rainfall amounts were nearly 80 percent greater than normal (28.2 inches versus the normal of 15.8 inches). This prompted a review of changes to the SWRB drainage area and related calculations since the basin was expanded 10 years ago.

Review of SWRB Drainage Area

As a result of reaching 10 bypass days from the storm event of July 20, 1998, an investigation was undertaken to evaluate changes which have occurred in runoff collection, operational practices, and assumptions related to the SWRB drainage area since it's construction. Figure 4-6 presents the current storm water collection area for the SWRB (plus BSL). The findings of the investigation are as follows:

- Runoff flows from the former Coal Pile, Decontamination Pad, miscellaneous abandoned secondary containment structures, and etc. have been redirected to the SWRB and away from the BSL, thus increasing the load on the SWRB.
- Runoff coefficients have been modified as a result of several remediation projects within the original 165-acre collection area, thereby resulting in higher-than-expected runoff volumes to the SWRB.
- The areal extent of several remediation efforts outside of the former production area have increased from original projections, thus resulting in higher-than-expected runoff volumes to the SWRB.
- Runoff from OSDF "clean" construction areas was being sent to the SWRB instead of to constructed settling basins then on to Paddys Run. This practice was immediately discontinued and therefore is not shown on Figure 4-6.
- The runoff coefficient used for paved and roofed areas were deemed to be estimated incorrectly, thus resulting in higher-than-expected runoff volumes to the SWRB.

Based on these findings, the SWRB was found to be unable to hold a 10-year, 24-hour storm volume as a retention basin (see Appendix A). The original design calculations reflected in the SWRB Permit to Install (PTI) application calculated a required volume of 10.2 million gallons (MG). Rerouting the non-uranium contaminated parking lot runoff away from the SWRB to Paddys Run in 1997 (see Figure 4-4) reduced the required volume by approximately 1.1 MG. Flow redirections, modifications of runoff coefficients, and newly controlled areas added 1.4 MG. Paved and roofed areas in the original design calculations should have used a runoff coefficient of 0.9 instead of 0.8, adding another 1.1 MG. The above changes have increased the 10-year, 24-hour design storm runoff volume to 11.6 MG, which exceeds the existing SWRB system capacity of 10.8 MG. This volume exceedance assumes delayed pumping from the Southern Waste Unit (see Section 4.2.1.2) until after the peak storm flow has passed.

FEMP Position on SWRB Expansion

The FEMP is reluctant to commit to any proposal that involves the construction of additional SWRB capacity, primarily because the life expectancy of the expansion is limited and secondarily because of costs. Instead, it is deemed that the 800,000 gallons of storm water projected to exceed the basin capacity has already been addressed through: 1) the 1995 installation of new pumps which significantly increased the discharge pumping rate; and 2) changes in operation to delete the 24 hours of settling prior to pumpout. These improvements effectively convert the SWRB from a retention basin to a detention basin; similar in function to the Waste Pit Area Storm Water Runoff Control (WPASRC) constructed at the FEMP in 1992 as Removal Action No. 1. This shift in operating logic compensates for the 800,000 gallon deficiency by allowing significant continued pumping/treatment during the storm event instead of waiting 24 hours for settling prior to initiating pumping. A discussion of the revised operating logic and the follow-on corrective actions are presented in Section 5.4.2.2

4.2.1.2 Future Conditions

The volume of storm water collected in the SWRB is not expected to increase from this time forward. Instead, it is projected to decrease as large areas, which are part of the current loading, are remediated and removed while only small areas are planned to be added. Area 1, Phase I and Area 2, Phase I remediation activities, currently in progress (Figure 4-3), have resulted in a portion of the increase in storm water runoff to the SWRB discussed above. Further increases are expected from SCEP during the course of remediation of the lime sludge pond and solid waste landfill. However, because of their current schedule, other areas will be removed before this work is started. Each of these flows and their anticipated durations are detailed below.

Southern Waste Unit Storm Water Runoff

Storm water runoff collection from excavation activities at the Southern Waste Unit (Area 2, Phase I) began in July 1998, with the construction of three basins for storm water management. Each of the three basins was sized to either meet or exceed the runoff volume from a 10-year, 24-hour storm event. Collected water is pumped to the SWRB for subsequent transfer to treatment.

Flow:	Anticipated annual average 9.5 mgy (15 gpm); pumped intermittently at a rate of approximately 600 gpm
Duration:	July 1998 through September 1999

Lime Sludge Pond Storm Water Runoff

Storm water runoff from the Lime Sludge Pond remediation is anticipated to be sent to the SWRB for subsequent treatment. Detailed design of this remediation effort is not complete at this time, but flows are anticipated to be insignificant because of the lime sludge pond's relatively small area.

Flow:	Anticipated annual average less than 2.6 mgy (5 gpm)
Duration:	October 2000 through December 2002

Solid Waste Landfill Storm Water Runoff

Storm water runoff from the Solid Waste Landfill remediation is anticipated to be sent to SWRB for subsequent treatment. Flows from this facility are anticipated to be insignificant because of its relatively small area.

Flow:	Anticipated annual average less than 2.6 mgy (5 gpm)
Duration:	January 2003 through December 2003

Former Production Area Storm Water Runoff

As discussed in Section 4.2.1, the SWRB currently accrues runoff from the former production area. Completion of soil remediation of the former production area is planned in segments (Figure 4-3). Soil remediation is planned to start in Area 3a and progress southward to Area 5. As each segment of the former production area is remediated, storm water runoff influents will diminish, and the associated storm water collection systems will be progressively decommissioned and removed. Note that the Area 1, Phase I stockpile area was added during remediation of Area 1, Phase I and is not part of the original 165-acre area. However, the drainage area was included as part of the basin evaluation presented in Appendix A. The quantities of storm water runoff include existing perched water infiltration. The perched water infiltration is estimated at 70 gpm for the whole of Areas 3, 4, and 5. This was estimated by reviewing past flow history of the Storm Sewer Lift Station (SSLS) (See Table 4-2). Prior to its shutdown, the SSLS intercepted the "dry weather" flow to the SWRB which is assumed to consist mainly of perched groundwater infiltration.

The estimated average yearly quantities of storm water runoff (including perched groundwater infiltration to the storm sewers) from each segment (see Figure 4-3) is detailed in Appendix A and summarized below:

SUMMARY OF ESTIMATED ANNUAL AVERAGE QUANTITIES OF STORM WATER RUNOFF FROM FORMER PRODUCTION AREA

	Projected Annual Flow[a]		
Area	Million Gallons	Average gpm	Ending Dates
Area 3a	28.9	55	12/2003
Area 3b	17.3	33	01/2005
Area 4a	14.5	28	01/2004
Area 4b	14.5	28	06/2006
Area 5	40.5	77	03/2006
A1PI stockpiles area	5.3	10	12/2003

[a]See Appendix A for calculation of flows

4.2.2 Projected Storm Water Annual Average Flow Summary

Figure 4-7 presents a graphic presentation of the projected annual average storm water flow discharged from the SWRB based on average annual rainfall calculations presented in Appendix A and discussed above. As explained later in Section 5.4.2.4, a modification to the AWWT Phase II treatment system is planned which will divert backwash waters to the SWRB. As shown on Figure 4-7, this additional estimated 70 gpm average inflow is expected to be diverted to the SWRB by January 2000. Note that after January 2000, the flow of water to treatment will decrease as remediated areas are cleaned up. Furthermore, after remediation on Areas 3a and 4a is completed in 2003 and 2004, the SWRB volume will exceed the 10-year - 24-hour retention volume. It should be noted that Figure 4-7 is not intended to show the short-term peak flows that will be encountered as a result of large storms or sequential storms, but is intended to show the annual average flows from the SWRB headworks to treatment.

This is done so that an analysis to determine adequacy of existing treatment capacity over the remaining remediation period can be performed.

4.2.3 Impacts on Treatment Operations

It is anticipated that contamination in storm water will be dependent upon the contamination levels of the soil area(s) being remediated. The operation of treatment facilities could be significantly affected by increased solids to the SWRB thereby increasing the colloidal loading to the treatment facilities. Clean out of the additional sediment collected in the SWRB will be addressed by the sludge removal systems described in Section 3.4.1.4. Increased process control testing will allow proper chemical dosage in primary clarification. As described in their remedial action documentation, measures will also be taken by the SCEP to minimize the solid loadings in runoff.

4.3 REMEDIATION WASTEWATER

Remediation wastewater/storm water includes existing or planned flows that are collected in the BSL (or sent directly to AWWT Phase II) by the projects. Many of these flows cannot be sent to the SWRB because they may contain VOCs, are not classified as storm water runoff, or are sent to the BSL because of relatively high uranium concentrations or merely for convenience. Each of these average flows, along with the responsible project, is described in the following subsections.

4.3.1 Aquifer Restoration and Wastewater Project (ARWWP)

One of ARWWPs responsibilities is handling Remediation Wastewater collected at the General Sump, AWWT Backwash and Plant Sumps, Waste Pit Area storm Water Runoff Control Facility (WPASRC), in addition to other project wastewaters collected in the BSL.

General Sump

As discussed in Section 3.4.4 , this facility has recently been shutdown for eventual D&D activities. The previous sources to the General Sump have been removed from service and flows rerouted. By mid 1998, more than half of the previous projected flow (original version of OMMP) of 50 gpm had been diverted to the SWRB through various site modifications. In late 1998, backwash from SPIT and IAWWT was rerouted to the SWRB through piping modifications. Additional modifications allow laboratory wastewater (≈1 gpm) to be trucked directly to AWWT Phase II. Plant 6 motor bay sump water (≈1 gpm) also continues to be trucked directly to AWWT Phase II.

AWWT Backwash and Plant Sumps

Backwash from AWWT and storm water collected in the AWWT plant sumps are estimated to be approximately 75 gpm on an annual average basis. Currently the backwash from all existing wastewater treatment systems (except SPIT and IAWWT as described above) is sent directly to AWWT Phase II, including the AWWT Expansion plant that became operational in 1998. Because of the need to handle wet weather flow volumes for all remediation project wastewater (see Section 4.3.8), this revised version of the OMMP addresses the diversion of backwash water to the SWRB to address a projected shortfall in treatment capacity for wastewater from the BSL. It is assumed that approximately 70 gpm of this estimated 75 gpm stream will be diverted to the SWRB, leaving approximately an annual average of 5 gpm from the Plant Sumps.

Waste Pit Area Storm Water Runoff Control (WPASRC) Facility

The WPASRC facility manages runoff from the area surrounding the Waste Pits area as shown in Figure 4-8. It was constructed in 1992 as an OU1 Removal Action and was designed to control runoff from a 25-year storm. The primary objective was to minimize discharges of contaminated storm water runoff directly to Paddys Run where they could become a source to increase groundwater contamination as a result of infiltration into the Great Miami Aquifer. The system collects contaminated storm water runoff from the perimeter of the waste pit area using drainage trenches, culverts, topographic features, and two (East and North) Inlet Runoff Control Structures (see Figure 4-8). Flow is directed to a concrete detention sump and is pumped to the BSL.

The concrete detention sump has dimensions of 5,600 square feet by 10 feet high, giving an effective hold capacity of 360,000 gallons. Four pumps, each capable of discharging approximately 700 gpm, transfer collected water through a force main to the BSL. The four pumps are actuated by automatic level controllers placed within the pump pit area at the east end of the concrete sump. The design of the detention facility requires three pumps to operate. The fourth pump serves as a backup in the event of a failure of one of the other three. A fuel-fired generator is mounted nearby to provide emergency electrical power to the pumps, if required.

The East Inlet Runoff Control Structure is located immediately west of the northwest corner of the BSL (Figure 4-8) and is designed to provide detention of peak storm water runoff flowing to the WPASRC concrete detention sump. The North Inlet Runoff Control Structure is similar in design and function to the East Structure. It is located in the northwest corner of the waste pits area. Storm water runoff is controlled by an orifice installed in each inlet runoff control structure that detains water in adjoining swales. Each structure has a manual bypass valve in parallel with the orifice to maintain flow if the orifice becomes obstructed.

Since the WPASRC has been in operation, the concrete detention sump has overflowed to the swale near Paddys Run on several occasions. There it can infiltrate into the Great Miami Aquifer or overflow to Paddys Run. A summary of the frequency and reasons for the overflows is presented in Table 4-3. Several of the overflow events are related to excessive precipitation (i.e., precipitation which exceeded the storage/pumpout capability present at the time of the event). Operational deficiencies may have contributed to these overflows.

Corrective actions were taken by ARWWP to address these operational deficiencies. The average annual flows from the WPASRC facility originated from the WPRAP and Silos project as discussed in Sections 4.3.2 and 4.3.5, respectively.

4.3.2 Waste Pit Remedial Action Project (WPRAP)

With the startup of project operations in 1999, the generation of significant quantities of wastewater/storm water associated with the following remedial activities is expected: 1) initial removal of waste pit water; 2) handling and processing of pit wastes (e.g., drying activities, decontamination activities, etc.); 3) excavation dewatering activities; 4) surface runoff from areas where water does not come in contact with waste materials; and 5) surface runoff from other areas. The project is collecting many of these waste streams in the Clearwell. A pretreatment system (i.e., the WPRAP Water Treatment System [WTS]) will remove excessive concentrations of contaminants prior to discharge to the BSL. Storm water runoff from areas where water does not come in contact with waste materials is expected to be directed to the Storm Water Management (SWM) Pond, and normally discharged from there to Paddys Run.

The remediation effort is divided into nineteen (19) Phases. Average wastewater volumes generated by WPRAP are projected to increase progressively from approximately 83 gpm during the first year (i.e., 1999) (Phases 1-3) to a peak of 147 gpm in 2003 for Phase 14, and then average 114 gpm for the final year in 2004. A summary of WPRAP's flows is presented in their remedial action planning documentation and is provided in Appendix B.

Clearwell Discharge

Runoff collected in the Clearwell (and Waste Pit 6) is currently pumped intermittently by ARWWP staff to the BSL. The existing Clearwell and Waste Pit 6 discharge will increase when combined with other WPRAP flows, beginning in 1999. At that time, operation of the Clearwell and Pit 6 will become the responsibility of WPRAP. Therefore, existing flow will become a part of the WPRAP flows presented in Appendix B.

Process Wastewater

This flow consists of waste facility effluent and contains dewatering, drying, and exhaust gas scrubber flows. Pretreatment of this stream is being provided by WPRAP prior to discharge to the BSL.

Waste Pit Dewatering Flows

During the excavation of the waste pits, significant dewatering flows are anticipated to be discharged to the existing Clearwell. This wastewater stream has the potential for high concentrations of heavy metals. Therefore, pretreatment of this flow by the WPRAP subcontractor is being provided.

Storm Water Management Pond

Runoff from "clean" areas surrounding specific waste pit remediation activities will be directed to the Storm Water Management (SWM) Pond which is designed to accommodate the 25-year, 24-hour storm event. This water is expected to normally be discharged to Paddys Run. However, based on uranium content and other indicator parameters, it may be sent to the BSL. It is assumed for this document that one-half of the flow collected will be sent to the BSL.

4.3.3 On-Site Disposal Facility (OSDF) Project

Wastewater from the OSDF Project is estimated to average 30 gpm annually. This flow is a combined flow of leachate and active cell runoff. Each is described briefly in the subsections that follow.

Leachate

Leachate from the OSDF results from the percolation of storm water through and out the bottom of the cells through installed underdrains. The flow is at its maximum when a cell is under construction and uncapped. The flow will steadily decrease after the cell is capped, until it stabilizes at a steady small flow. Construction of the first cell began in 1998, and the flow pattern will repeat for each subsequent cell that is constructed. The leachate collects in a pump sump and is transferred across the site to the BSL.

Flow:	Anticipated to annually average 5.3 mgy MG (10 gpm); pumped intermittently with active cell runoff at 200 gpm to BSL
Duration:	March 1998 and continuing for an undetermined period

Active Cell Runoff

During the period when a cell is being filled with contaminated soil and debris, storm water runoff from the active cell will be collected, combined with the leachate flow, and pumped to the BSL. It is envisioned that an average of 3 cells (total 21-acres) will be open for the purpose of calculating flows.

Flow:	Anticipated to annually average 10.6 MG (20 gpm); pumped intermittently with leachate @ 200 gpm to BSL
Duration:	March 1998 and continuing for an undetermined period at least through 2006.

Truck Washing

A vehicle truck washing station was installed inside the former production area for cleaning trucks coming out of the OSDF and entering the Haul Road. Vehicle wash water discharges to the existing storm sewer system and then to the SWRB at an estimated annual average of less than 10 gpm.

4.3.4 Soil Characterization and Excavation Project (SCEP)

Wastewater is/will be generated from the collection of storm water runoff in active SCEP remediation areas and from perched water in areas scheduled for deep excavation. Each flow is described in the subsections that follow.

Seepage Collection

Interception of seepage flow from the Inactive Flyash Pile and Southfield existed prior to start of remediation efforts in the Southern Waste Unit (SWU). However, with the start of construction activities in 1998, this flow was directed to newly constructed SWU retention basins and is combined with the basins' flow.

Truck Washing

A vehicle truck washing station was installed at the exit from the SWU for cleaning trucks entering the Haul Road. Vehicle wash water runs into the SWU retention basins at an annual average flow estimated at less than approximately 10 gpm. The flow is subsequently transferred to the SWRB. This practice is anticipated to be repeated for each subsequent SCEP area.

Soil Remediation of STP and FTA

Dewatering activities and incidental storm water runoff within the former Sewage Treatment Plant (STP) and Fire Training Area (FTA) during soil remediation will require treatment for VOC/RCRA-listed constituents. Therefore, these flows will be discharged to the BSL via the leachate collection system, or trucked to Phase II directly.

Flow:	Anticipated to annually average 5.3 mgy (10 gpm)
Duration:	January 2000 through March 2001

Dewatering Activities in VOC Contaminated Perched Groundwater Areas

Dewatering activities within the areas of soil remediation may be required to provide for slope stability in deep excavations (within perched groundwater zones). Flows from areas which indicate detectable levels of VOCs must be treated in AWWT Phase II. Areas with VOC levels that are less than detectable will be sent to the SWRB. This section only addresses flows anticipated to be sent to the BSL.

Flow:	Anticipated to annually average less than 26.3 mgy (50 gpm)
Duration:	Area 3, Area 4, and Area 5; March 2001 through completion

4.3.5 Silos Projects

Silos wastewater is expected from three sources. Each is described below.

Process Wastewater

Effluent from the Silos project is to be discharged directly to the existing High Nitrate Tank. Pretreatment of this wastewater may be required for radon and radium. A nominal allowance has been made for discharges from the eventual technology deployed for this remediation effort.

Flow: Anticipated to annually average 5.3 mgy (10 gpm)
Duration: Undetermined

K-65 Decant Sump Tank Effluent

The Decant Sump Tank was originally used as the collection point for the decanted liquid remaining from the slurrying operations at the K-65 silos. Although this sump is no longer operational, seepage accumulates within the tank over time and must be removed. This water has been and will continue to be pretreated in the Slurry Dewatering Facility prior to treatment in AWWT Phase II.

Flow: Batches. Anticipated to annually average 0.5 mgy (1 gpm)
Duration: Present and continuing for undetermined period

Area Runoff

Surface runoff will occur from the silos remediation area. This runoff is controlled by the WPASRC Facility as discussed in Section 4.3.1. The flow is anticipated to annually average 5 gpm.

4.3.6 Facilities Decontamination and Demolition (D&D) Project

The decontamination activities for each of the major facilities in the former production area will produce small batches of wash water that will require treatment. This minimal source of wastewater will be containerized and characterized prior to treatment.

Flow: Batches. Anticipated to annually average less than 0.5 mgy (1 gpm) annually
Duration: Present through 2005

4.3.7 Projected Remediation Wastewater Annual Average Flow Summary

Figure 4-9 presents a graphic summary of the projected remediation wastewater annual average flows that will result based on the individual flows discussed above as discharging to the BSL and further detailed in Appendix B. Many of these remediation wastewater inflows are mandated to receive treatment for VOC contaminants, or are not storm water flows, and are therefore restricted from discharge to the SWRB. Accordingly, they are planned to be treated through the AWWT Phase II treatment system. These sources are all competing for limited treatment capacity within this treatment system. Is should be noted that Figure 4-9 is not intended to show the short-term peak flows that will occur as a result of excessive stormflows. Rather, this figure is intended to show the annual average flows from the BSL/HNT headworks to the AWWT Phase II treatment system.

4.3.8 Impacts of Seasonal Flow Variations

As noted above in Section 4.3.1, WPASRC Facility, and shown by Table 4-3, a concern was raised over the capability of the BSL for handling the projected increase in generation of remediation wastewater. When four consecutive months of significantly above-average rainfall occurred during the first half of 1998 (see Figure 4-5), the monthly rainfall distribution appeared to be more critical to the BSL being able to adequately store water than the yearly average rainfall. An analysis of climatological data was undertaken to determine the impacts of seasonal flow variations on collection detention, and treatment capabilities.

Flow projections of storm water runoff and loads on collection and treatment facilities are based on the 50-year climatological data (see Table 4-4) for the Cincinnati area. The wettest year was 1990, when 57.58 inches fell, and the driest year was 1963 when 27.99 inches fell. An average annual rainfall of 40.9 inches is determined by summing the historical average monthly data (see Table 4-5). From March through July, the average monthly rainfall significantly exceeds the monthly average of 3.41 inches that is computed from 40.9 inch annual average. On average, nearly half (19.78 inches) of the total average annual rainfall can be expected to occur during this five-month period. By dividing the year into two 6-month seasonal periods of above-average "wet" and below-average "dry" (Table 4-6) gives averages of 3.84 inches per month in the "wet season" (March through August) and 2.97 inches per month in the "dry season" (September through February).

A statistical analysis of the 50-year Climatological Data produces the following profile:

Percentile	Inches/Year or Less	Factor vs. Average
90	49.6	1.21
75	44.1	1.08
50 (average rainfall)	40.9	1.00
25	37.5	0.92
10	33.7	0.82

The 25th and 75th percentile rainfall is within 8 percent of the average annual of 40.9 inches, and the 90th percentile rainfall is 21 percent greater than average. The 75th percentile is calculated to be 3.68 inches per month and the 90th percentile is calculated to be 4.13 inches per month. Thus, even in a normal average rainfall year, seasonal variations in average monthly rainfall can significantly affect headwork storage requirements when the average inflow can exceed the outflow over a long period of time (i.e., months) and the storage volume becomes a critical factor.

Based on the above results of the statistical analysis, an examination of the basis and rationale for establishing the treatment requirements for the existing BSL storage volume was required. The above factors were deemed adequate to perform adjustments to the average flows to evaluate these requirements (see Section 5.4.1.2). The analysis demonstrated that the BSL is not necessarily influenced by specific episodes of heavy rainfall, but rather long periods (months) of above average precipitation.

The SWRB, however, has a pump-out rate which greatly exceeds the average yearly inflow rate. Therefore, the need to adjust for seasonal flow variations is not necessary. Large storms or sequential storms govern its design. The above analysis does support the conclusion that: *storm water runoff from sequential storms during the "wet season" will be a governing factor in reducing the average treatment of groundwater through the treatment systems which normally handle a split of groundwater/storm water.* Meeting the 20 ppb average monthly uranium discharge during the "wet season" will therefore present more of a problem as potentially more groundwater will bypassed. This bypassed flow has a concentration of ≈30 ppb.

4.4 SANITARY WASTEWATER

The existing sanitary flow averages 21-26 mgy (40-50 gpm). This includes some infiltration of contaminated perched water, as discussed in Section 3.2.3. Existing flows are expected to decrease as the Operable Unit 3 remedial actions progress, buildings are shut down, and existing operations cease.

TABLE 4-1

EXTRACTION/RE-INJECTION RATE SCHEDULE

System ID	Location	Well ID	Fiscal Year Pumping Rates[a] (+) = Pumping (-) = Injecting 1999 - 2003 (mgy)	1999 - 2003 (gpm)	2004 - 2005 (mgy)	2004 - 2005 (gpm)
I	Waste Pits	1	0	0	53	100
I	Waste Pits	3	0	0	53	100
I	Waste Pits	4	0	0	53	100
I	Waste Pits	5	0	0	53	100
I	Waste Pits	6	0	0	53	100
I	Waste Pits	7	0	0	53	100
I	Waste Pits	55	0	0	53	100
I	Waste Pits	56	0	0	53	100
I	Waste Pits	57	0	0	53	100
I	Waste Pits	58	0	0	53	100
	System Totals	Pumped	0	0	526	1000
		Injected	0	0	0	0
III	Plant 6	2	0	0	131	250
III	Plant 6	23	0	0	131	250
	System Totals	Pumped	0	0	263	500
		Injected	0	0	0	0
II	Fence Line Injectors	8	-105	-200	0	0
II	Fence Line Injectors	9	-105	-200	0	0
II	Fence Line Injectors	10	-105	-200	0	0
II	Fence Line Injectors	11	-105	-200	0	0
II	Fence Line Injectors	12	-105	-200	0	0
	System Totals	Pumped	0	0	0	0
		Injected	-525	-1000	0	0
II	South Field Phase I	13	105	200	-105	-200
II	South Field Phase I	14	105	200	-105	-200
II	South Field Phase I	15	0	0	53	100
II	South Field Phase I	16	105	200	-105	-200
II	South Field Phase I	17	53	100	53	100
II	South Field Phase I	18	53	100	0	0
II	South Field Phase I	19	53	100	105	200
II	South Field Phase I	20	53	100	105	200
II	South Field Phase I	21	105	200	0	0
II	South Field Phase I	22	158	300	105	200
	System Totals	Pumped	789	1500	421	800
		Injected	0	0	-316	-600

TABLE 4-1
(Continued)

System ID	Location	Well ID	Fiscal Year Pumping Rates[a] (+) = Pumping (-) = Injecting 1999 - 2003 (mgy)	1999 - 2003 (gpm)	2004 - 2005 (mgy)	2004 - 2005 (gpm)
II	South Field Phase II	38	0	0	158	300
II	South Field Phase II	41	0	0	210	400
II	South Field Phase II	53	0	0	158	300
II	South Field Phase II	54	0	0	210	400
II	South Field Phase II	59	0	0	158	300
II	South Field Phase II	60	0	0	158	300
II	South Field Phase II	61	0	0	105	200
II	South Field Phase II	62	0	0	105	200
II	South Field Phase II	63	0	0	158	300
	System Totals	Pumped	0	0	1,420	2700
		Injected	0	0	0	0
II	North line of injectors	42	0	0	-105	-200
II	North line of injectors	43	0	0	-105	-200
II	North line of injectors	44	0	0	-105	-200
II	North line of injectors	49	0	0	-105	-200
II	North line of injectors	51	0	0	-105	-200
	System Totals	Pumped	0	0	0	0
		Injected	0	0	-525	-1000
IV	South Plume	RW-1	158	300	0	0
IV	South Plume	RW-2	158	300	0	0
IV	South Plume	RW-3	210	400	0	0
IV	South Plume	RW-4	210	500	0	0
IV	South Plume Optimization	RW-6	132	250	0	0
IV	South Plume Optimization	RW-7	132	250	0	0
	System Totals	Pumped	1002	2000	0	0
		Injected	0	0	0	0
	Total Pumping		1789	3500	2630	5000
	Total Injecting		-525	-1000	-841	-1600
	Net Aquifer Extraction		1264	2500	1789	3400

[a]Fiscal Year is from October 1 through September 30.

TABLE 4-2

ACTUAL STORM SEWER LIFT STATION (SSLS) FLOW DATA 1990-1992

Month	1990 SSLS (MG)	1990 Rain (inch)	1991 SSLS (MG)	1991 Rain (inch)	1992 SSLS (MG)	1992 Rain (inch)
JAN	4.409	3.27	4.503	2.37	4.433	3.87
FEB	4.832	4.80	2.700	3.44	2.795	0.69
MAR	2.409	2.44	3.322	4.34	5.602	1.88
APR	2.404	3.12	3.859	4.45	2.976	1.51
MAY	3.396	9.81	2.888	2.61	2.948	2.48
JUN	0.595	3.92	2.354	1.67	2.854	2.83
JUL	1.070	3.65	3.050	2.58	4.232	7.27
AUG	0.824	3.40	2.817	4.73	2.765	1.43
SEP	2.451	3.30	2.488	2.08	2.722	2.05
OCT	3.125	6.74	2.249	1.14	2.656	2.22
NOV	2.947	2.03	1.347	1.50	3.973	3.77
DEC	4.541	7.01	4.141	3.21	2.518	0.71
Total	33.003	53.49	35.718	34.12	40.474	30.71

Calculation of annual average dry weather flow from the SSLS:

Year	Inflow Volume(V) (MG)	Rainfall (R)	V/R
1990	33.003	53.49	0.617
1991	35.718	34.12	1.048
1992	40.474	30.71	1.318

Since V/R is not consistent, assume dry weather flow is an average:

$$V\ avg = \frac{33.003 + 35.718 + 40.474}{3}$$
$$= 109.195/3$$
$$= 36.40\ mgy$$
$$= 69.26\ gpm$$

Assume: Q infiltration = 70 gpm

000088

TABLE 4-3

WPASRC FACILITY - OVERFLOWS

Year	Date	Reason
1995	May 18	Pumps turned off - high level in BSL
1996	April 29, 30	Pumps turned off - high level in BSL
	May 4	Excessive precipitation
1997	February 4	Excessive precipitation
	August 17	Excessive precipitation occurred while AWWT Phase II down for maintenance
1998	April 16	Pumps turned off - high level in BSL
	June 12	Tripped circuit breaker
	June 23	Blown control fuse
	July 20	Excessive precipitation

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TABLE 4-4
50-YEAR CINCINNATI RAINFALL DATA (inches)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1948	2.63	3.70	5.10	4.36	2.26	3.74	3.55	1.96	1.69	1.81	6.09	4.07	40.96
1949	8.95	3.03	3.95	1.51	1.39	5.30	4.89	4.32	0.98	2.55	0.43	3.17	40.47
1950	9.43	5.58	2.09	3.82	3.12	5.03	4.39	1.93	8.25	1.86	5.37	2.35	53.22
1951	6.65	3.23	4.23	2.58	2.94	1.86	1.18	1.28	2.21	2.56	4.30	6.17	39.19
1952	3.99	3.33	5.17	3.10	3.56	2.92	2.43	1.68	3.06	1.82	2.35	4.18	37.59
1953	4.55	1.05	2.73	2.66	2.59	3.14	7.79	0.31	0.75	1.25	1.22	1.58	29.62
1954	2.54	1.84	2.41	2.55	1.33	3.39	3.79	6.10	2.12	4.13	1.33	2.86	34.39
1955	2.61	6.72	5.05	2.24	4.26	2.39	5.55	0.86	3.97	4.49	4.92	0.58	43.64
1956	2.50	5.92	4.19	4.09	7.04	4.98	3.90	2.91	2.29	1.54	1.91	2.56	43.83
1957	3.08	2.79	1.44	5.62	5.74	2.68	2.44	3.74	3.20	2.34	6.25	5.98	45.30
1958	2.34	0.61	1.73	3.49	5.33	5.19	7.54	2.52	3.67	1.46	2.67	0.68	37.23
1959	7.61	3.18	2.52	2.33	2.92	5.85	2.77	1.80	1.88	3.05	4.04	3.03	40.98
1960	2.48	3.49	1.14	1.32	3.22	6.16	3.15	5.21	1.07	4.00	2.33	1.73	35.30
1961	1.87	3.56	4.76	2.81	7.31	2.28	5.11	1.07	0.97	1.88	3.36	3.39	38.37
1962	3.98	5.58	4.25	1.26	3.64	4.40	8.36	2.14	2.67	2.87	2.37	1.36	42.88
1963	2.04	1.09	9.91	2.01	2.73	1.59	4.34	1.83	0.18	0.25	0.94	1.08	27.99
1964	2.88	1.98	12.18	6.73	1.13	4.32	2.56	2.25	1.65	0.59	2.69	4.92	43.88
1965	3.11	5.07	2.86	4.90	1.46	0.95	4.42	3.24	6.06	3.81	1.26	1.19	38.33
1966	3.84	3.73	1.22	5.38	2.42	2.52	4.06	4.31	3.13	0.57	4.18	3.31	38.67
1967	0.75	1.86	3.63	3.66	5.64	1.72	4.99	0.77	1.79	2.65	3.84	3.94	35.24
1968	1.79	0.64	4.24	3.47	9.48	2.43	7.50	2.26	2.16	1.35	3.21	4.01	42.54
1969	4.64	1.27	1.42	3.59	2.05	4.91	3.28	2.15	2.87	1.53	3.67	2.59	33.97
1970	1.27	1.68	4.71	7.19	1.88	5.73	3.47	2.96	3.87	2.44	2.29	3.32	40.81
1971	2.47	5.89	2.55	1.04	3.31	5.18	3.70	3.45	6.56	1.44	1.68	3.39	40.66
1972	1.96	2.20	3.68	5.89	6.02	2.41	1.50	2.64	5.96	2.55	6.26	4.23	45.30
1973	1.79	1.58	6.11	5.81	3.46	6.27	7.16	2.62	2.63	4.39	4.95	2.66	49.43
1974	3.65	1.63	4.39	5.08	5.53	4.38	3.82	5.75	4.44	1.07	4.19	2.83	46.76
1975	4.05	3.38	6.76	4.16	3.11	5.09	1.62	1.97	3.64	4.59	2.50	3.36	44.23
1976	3.00	2.37	2.14	1.21	1.80	5.94	2.33	4.36	1.95	3.85	0.83	0.51	30.29
1977	1.90	1.29	4.52	4.16	1.53	7.36	1.90	5.45	1.80	3.74	3.90	4.00	41.55
1978	4.52	0.25	1.99	2.28	5.30	6.63	6.86	4.41	0.43	5.03	2.67	6.46	46.83
1979	3.68	3.37	2.05	4.90	4.00	5.92	5.49	4.80	8.61	1.77	4.86	2.91	52.76
1980	2.26	1.04	4.50	1.96	4.59	4.13	5.51	4.19	1.83	3.28	2.58	1.26	37.13
1981	0.57	3.86	1.72	5.05	5.07	3.34	3.66	2.15	1.47	2.33	2.94	2.39	34.55
1982	7.17	1.17	4.67	2.18	4.60	3.61	2.44	7.71	1.27	0.99	5.08	4.25	45.14
1983	1.56	1.14	2.02	4.84	8.89	2.22	1.96	3.23	1.22	8.60	4.20	2.84	42.72
1984	0.75	2.40	3.61	4.88	4.82	2.11	2.57	3.30	3.50	3.85	6.00	4.21	42.00
1985	1.68	2.25	6.90	1.34	6.18	4.55	3.59	2.02	0.76	5.83	7.51	1.52	44.13
1986	1.01	2.85	3.07	1.57	3.59	1.46	3.33	3.78	3.53	3.08	3.79	2.58	33.64
1987	0.92	1.62	4.65	2.88	2.73	4.62	5.07	2.27	1.17	1.42	1.82	3.43	32.60
1988	2.75	4.94	3.42	3.92	1.99	1.19	6.85	2.44	3.05	1.86	4.78	2.78	39.97
1989	3.21	4.67	6.40	5.19	4.64	3.04	5.97	5.33	2.97	3.18	3.05	1.96	49.61
1990	2.59	5.82	2.75	3.22	9.41	5.01	3.68	5.67	4.13	5.09	2.31	7.90	57.58
1991	2.84	3.99	6.20	3.62	3.41	1.39	2.66	5.04	2.60	1.37	1.89	5.08	40.09
1992	2.99	0.93	4.19	2.71	2.84	3.65	7.00	3.17	3.23	1.11	4.31	1.36	37.49
1993	3.83	3.43	3.60	3.13	2.33	4.80	1.26	4.20	2.68	2.61	4.31	2.53	38.71
1994	3.22	1.68	2.22	6.46	2.06	4.08	5.64	5.14	0.55	1.49	2.87	2.88	38.29
1995	3.51	1.80	2.58	4.26	8.57	2.65	2.37	5.59	2.43	4.28	2.15	3.43	43.62
1996	4.36	1.98	5.58	8.20	9.20	5.83	2.62	0.76	5.41	1.74	3.40	4.33	53.41
1997	2.79	2.13	6.00	1.98	6.33	8.34	0.63	3.95	0.55	1.68	2.97	2.77	40.12
50-Yr Avg	3.21	2.82	3.98	3.66	4.17	3.97	4.00	3.26	2.72	2.66	3.29	3.12	40.86

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TABLE 4-5

AVERAGE MONTHLY RAINFALL (inches)
(Arranged Chronologically)

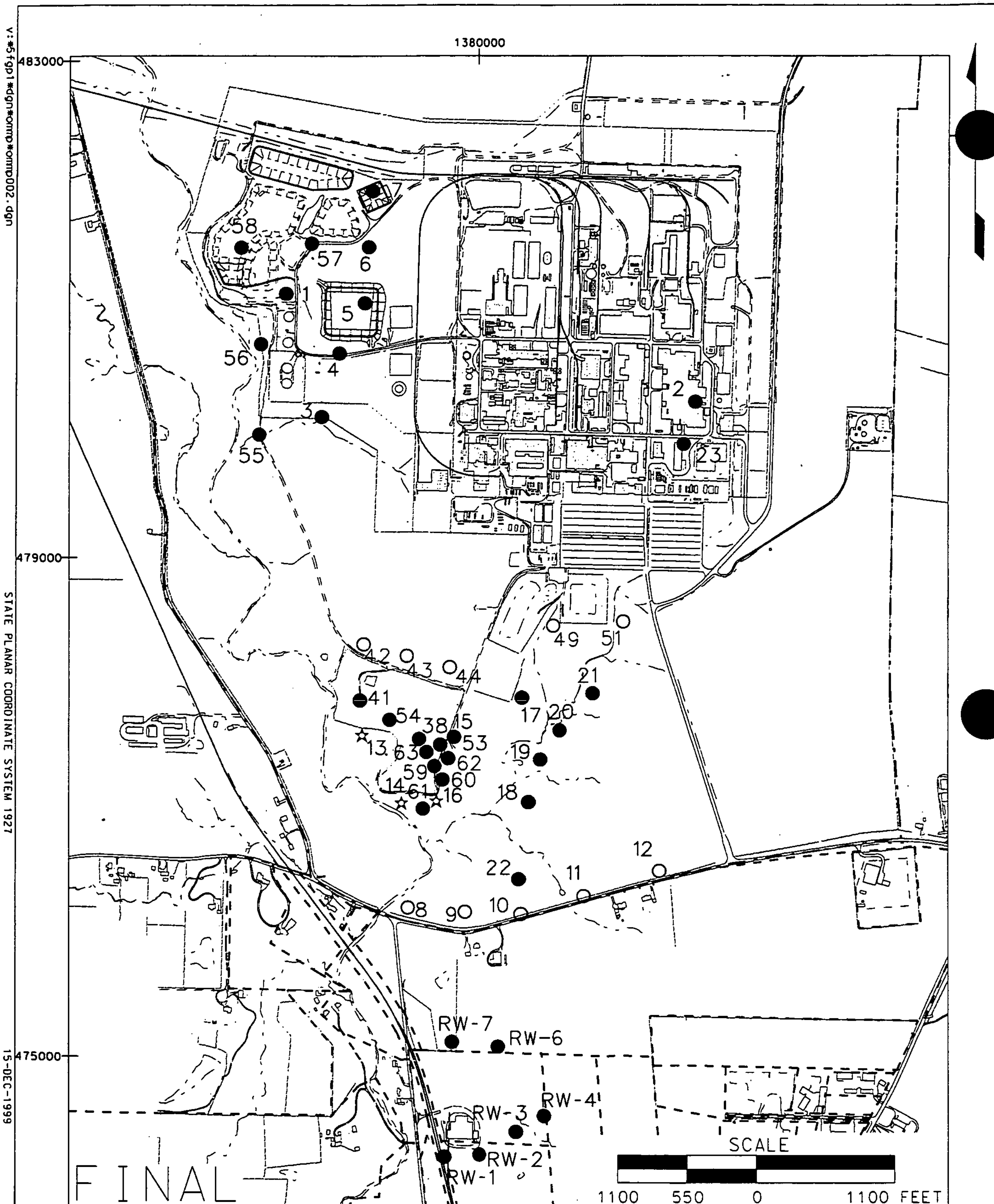
Month	Monthly Average	Monthly Data		Monthly Data	
		Low	Year	High	Year
Jan	3.21	0.57	1981	9.43	1950
Feb	2.82	0.25	1978	6.72	1955
Mar	3.98	1.14	1960	12.2	1964
Apr	3.66	1.04	1971	7.19	1970
May	4.17	1.13	1964	9.48	1968
Jun	3.97	0.95	1965	8.34	1997
Jul	4.00	0.63	1997	8.36	1962
Aug	3.26	0.31	1953	7.71	1982
Sep	2.72	0.43	1978	8.61	1979
Oct	2.66	0.25	1963	8.60	1983
Nov	3.29	0.43	1949	7.51	1985
Dec	3.12	0.51	1976	7.90	1990
Annual Average =	3.41	0.64		8.50	
Annual Total =	40.86				

TABLE 4-6

AVERAGE MONTHLY RAINFALL (inches)
(Arranged by Season)

	Ranked by Monthly Average[a]		
	Average	Low	High
"Wet Season" (March-August)			
May	4.17	1.13	9.48
Jul	4.00	0.63	8.36
Mar	3.98	1.14	12.20
Jun	3.97	0.95	8.34
Apr	3.66	1.04	7.19
Aug	3.26	0.31	7.71
6 month wet period average	3.84	0.87	8.88
"Dry Season" (September- February)			
Nov	3.29	0.43	7.51
Jan	3.21	0.57	9.43
Dec	3.12	0.51	7.90
Feb	2.82	0.25	6.72
Sep	2.72	0.43	8.61
Oct	2.66	0.25	8.60
6 month dry period average	2.97	0.41	8.13

[a]For convenience of providing a sequential "wet season" and "dry season," the nearly similar data for August and November was switched in order.



LEGEND:

FEMP BOUNDARY

HOMEOWNER PROPERTY BOUNDARIES

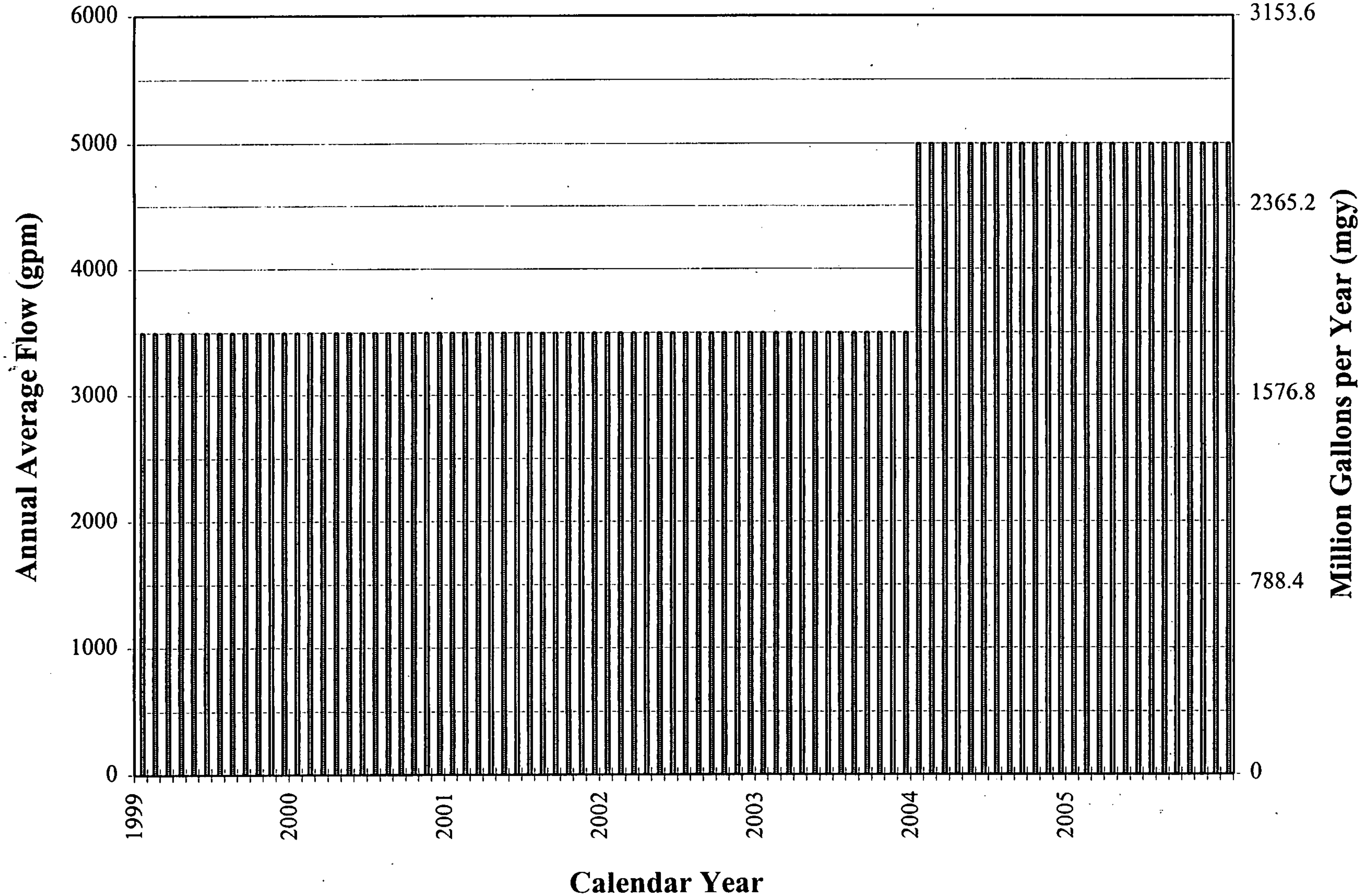
INJECTION WELL

EXTRACTION WELL

EXTRACTION/INJECTION WELL

FIGURE 4-1. WELL LOCATIONS FOR THE BASELINE GROUNDWATER REMEDIAL STRATEGY

Figure 4-2
Extracted Groundwater Flow Projection



FINAL

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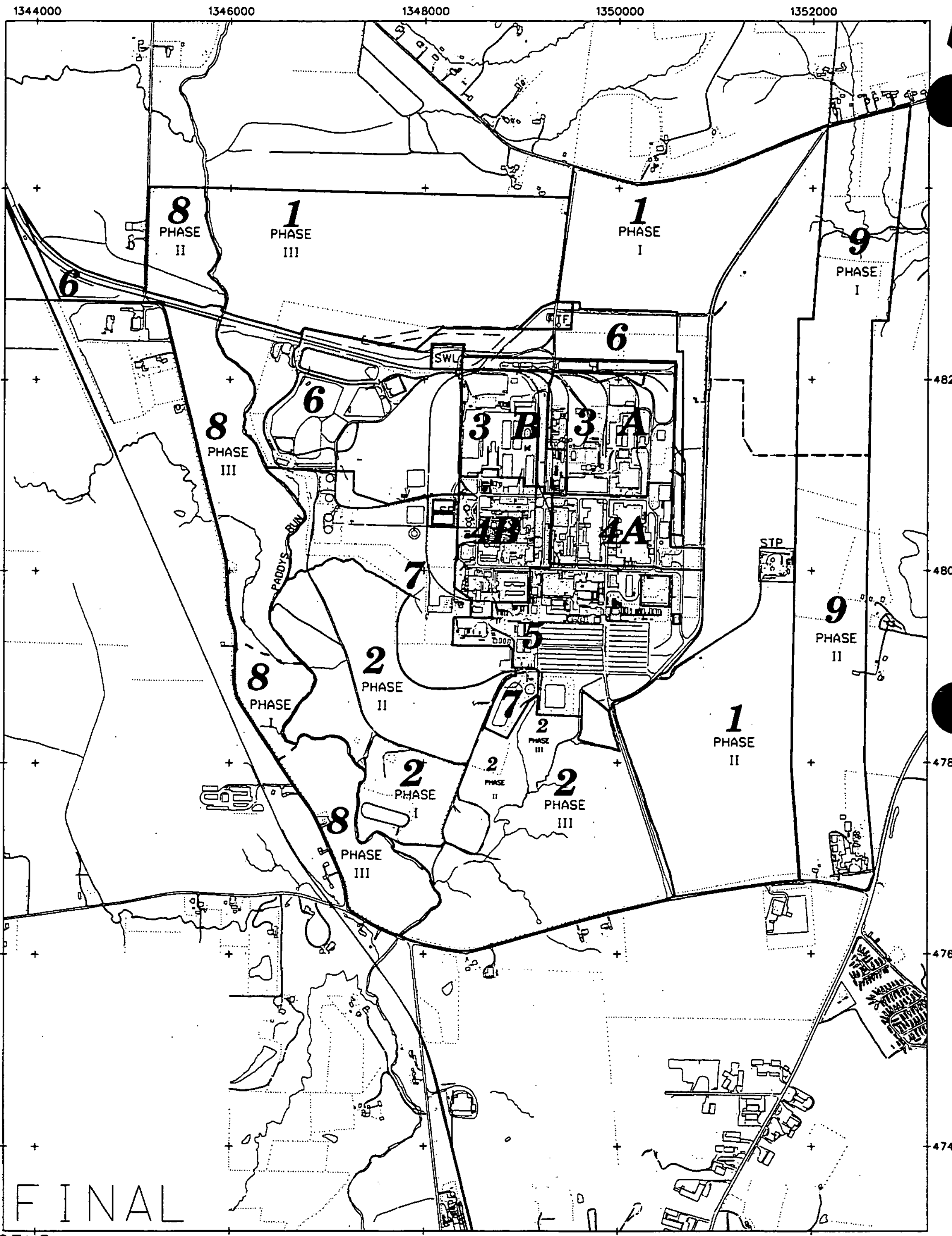

LEGEND:

- - - - FEMP BOUNDARY
——— REMEDIATION AREA BOUNDARIES
1 REMEDIATION AREA
- - - - - PHASE BOUNDARIES

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SCALE

1500 750 0 1500 FEET

v:\5fgp1\dgn\omm\omm005.dgn

STATE PLANAR COORDINATE SYSTEM 1983

15-DEC-1999

FIGURE 4-3. GENERALIZED SITEWIDE REMEDIATION AREAS

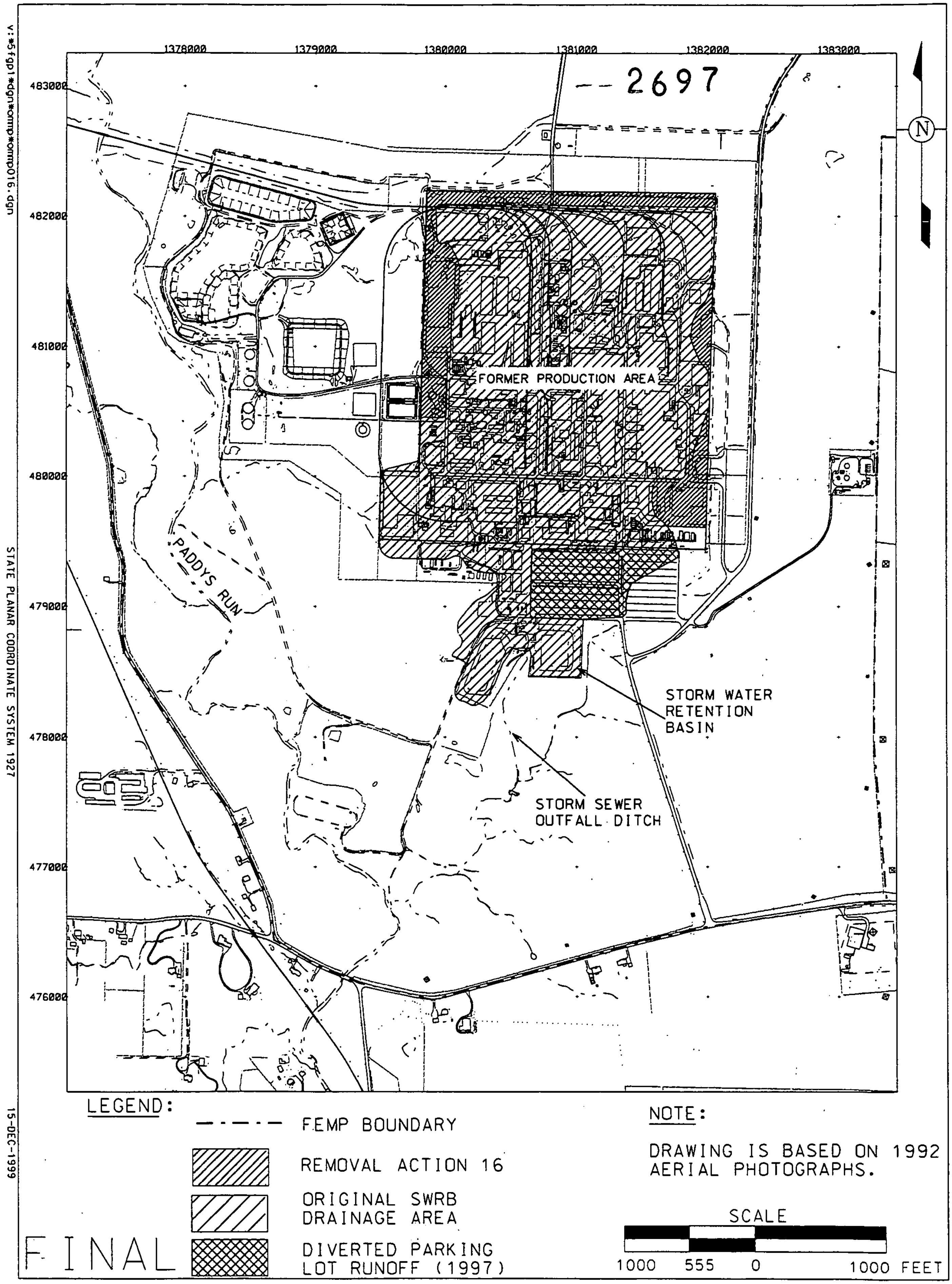
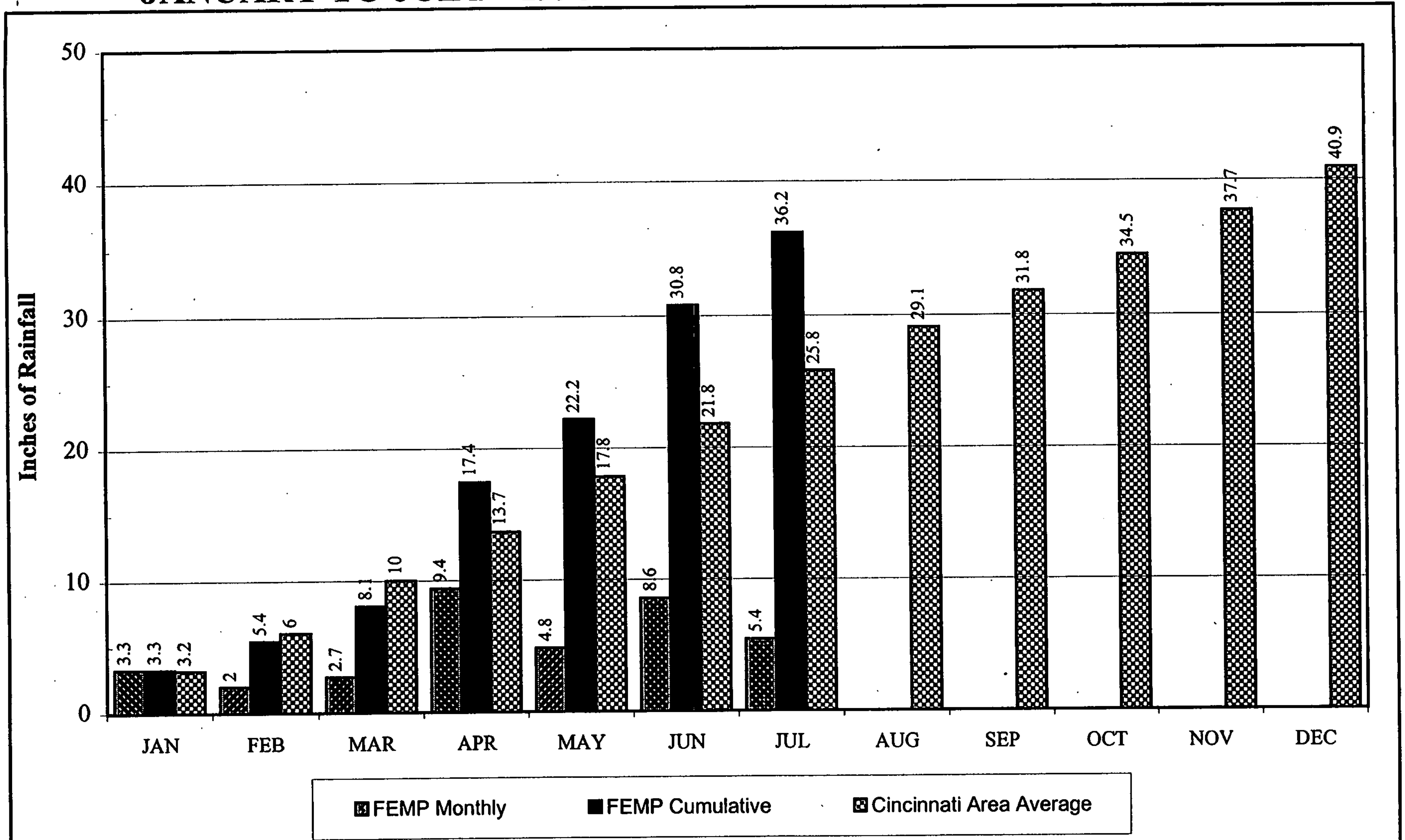


FIGURE 4-4. SWRB COLLECTION AREA (CIRCA 1993)

FIGURE 4-5

JANUARY TO JULY - 1998 FEMP PRECIPITATION vs. AVERAGE



Average Cincinnati rainfall April through July - 15.8 inches
1998 FEMP actual rainfall April through July - 28.2 inches

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FINAL

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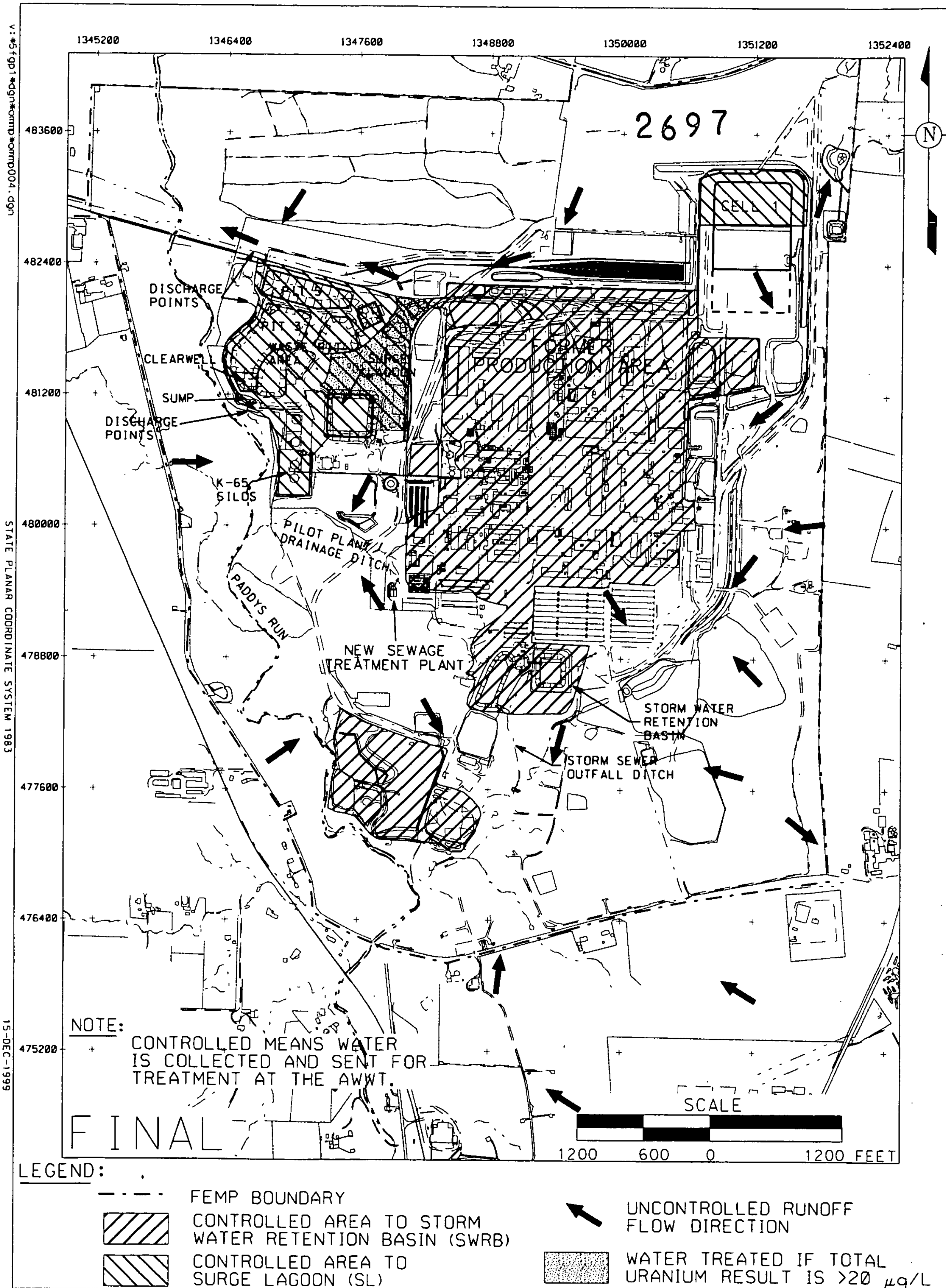

FIGURE 4-6. CONTROLLED RUNOFF AREAS AND UNCONTROLLED FLOW DIRECTIONS AS OF JANUARY 1, 1999

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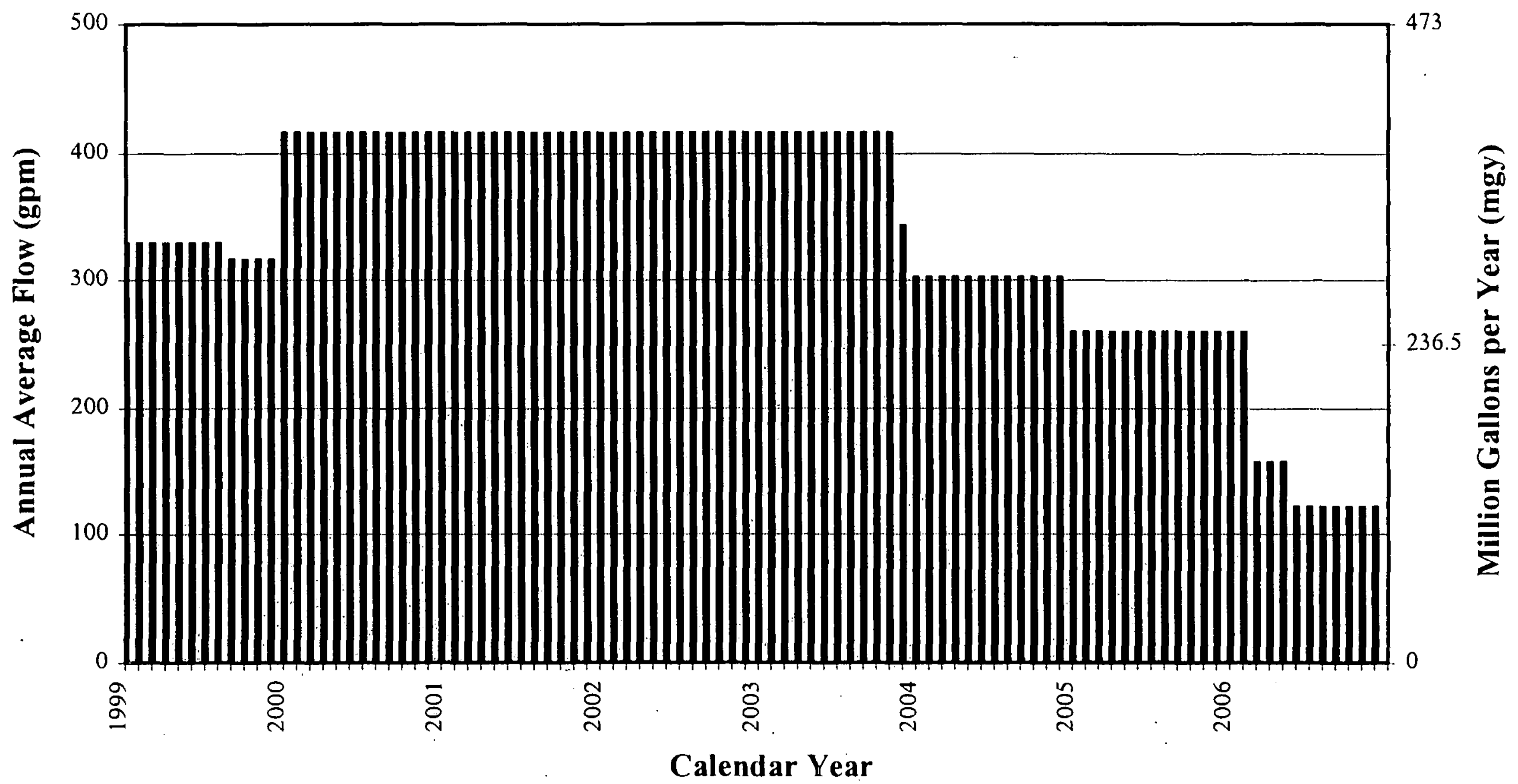
Figure 4-7
Storm Water Retention Basin Flow Projection



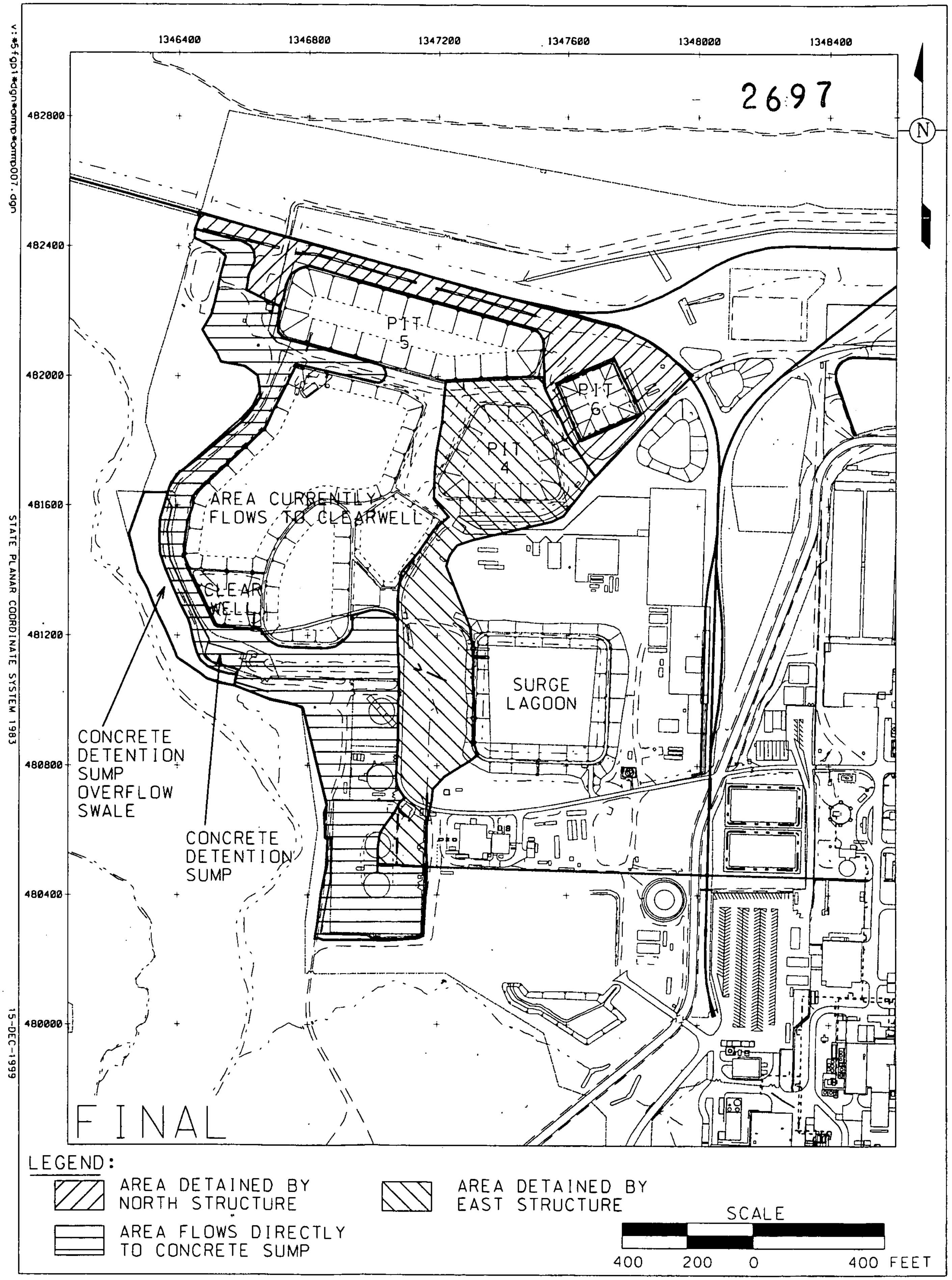
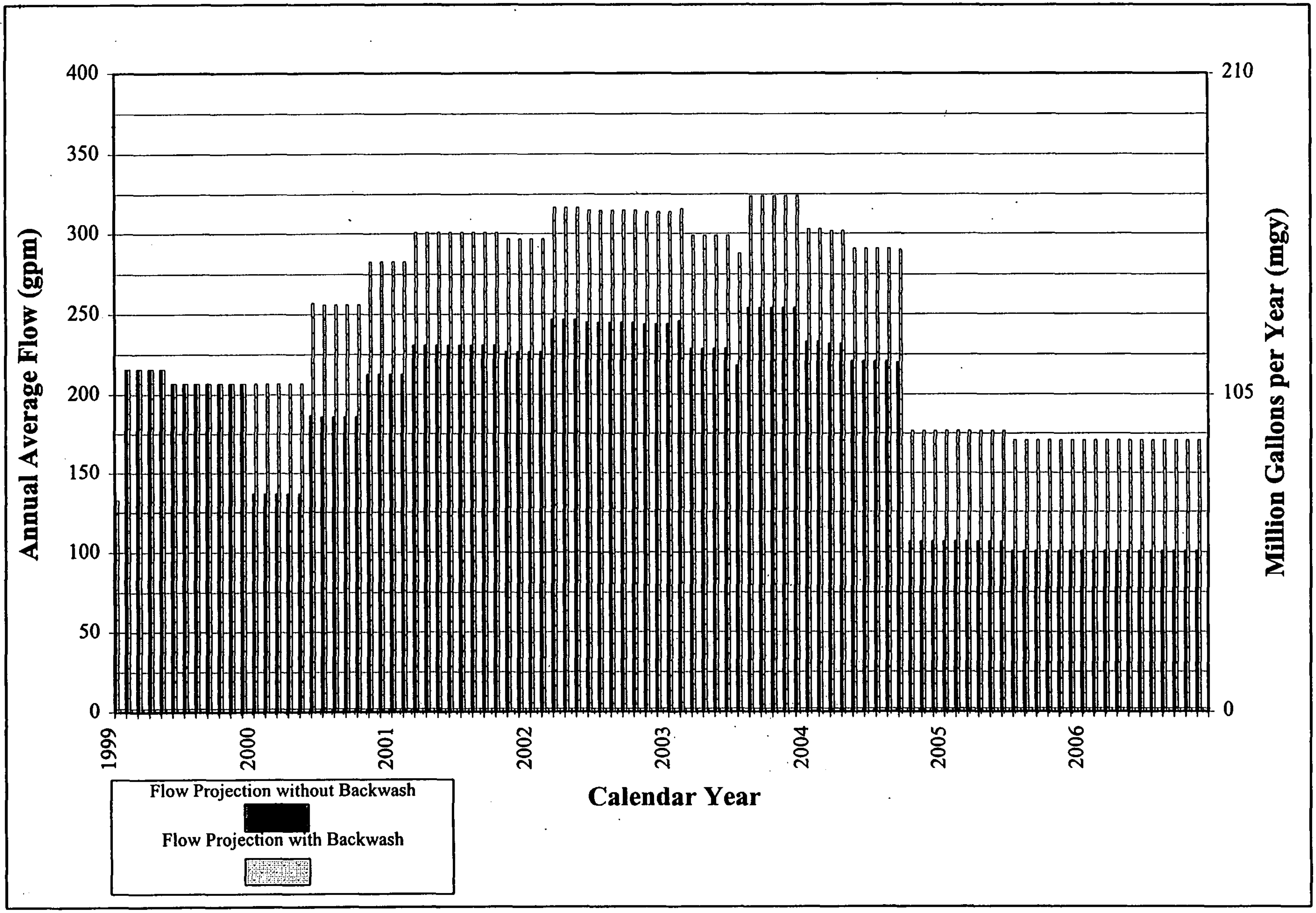


FIGURE 4-8. WASTE PIT AREA RUNOFF CONTROL

Figure 4-9
Remediation Wastewater Flow Projection - Average Rainfall



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Section 5.0

5.0 OPERATIONS PLAN

This section contains the operations philosophy, treatment priorities, hierarchy of decisions, management and flow of operations information, and management of treatment residuals necessary to successfully operate the groundwater extraction and wastewater systems in order to achieve regulatory requirements and commitments. Included are detailed flow charts and tables addressing: 1) day to day wastewater treatment operational decisions; 2) projections of annual average treatment capacity for groundwater; 3) the logic for determining which groundwater wells will receive treatment and which will be bypassed; 4) well field operational objectives; and 5) operational maintenance priorities. This section also contains a discussion of the relationship of this OMMP to other FEMP documents.

5.1 WASTEWATER TREATMENT OPERATIONS PHILOSOPHY

The primary goals of wastewater treatment operations and maintenance are to: 1) meet effluent discharge requirements; 2) minimize bypassing of untreated groundwater and storm water; and 3) maintain treatment headwork capacities. In keeping with the principles of ALARA (as low as reasonably achievable), this requires making the correct decisions in applying treatment to maximize the quantity of uranium removed from wastewater prior to its discharge to the Great Miami River. Maximizing uranium removal should result in compliance with the objectives as outlined in Section 2.0. Other regulatory discharge requirements, such as NPDES, must also be met. Influent streams to treatment and effluent streams from treatment are sampled for uranium concentration to provide information needed to help ensure that the objectives are met. The AWWT Phase II carbon bed influent and effluents stream will be sampled on a periodic basis to determine influent VOCs and the performance of VOC removal. Sampling is also performed to ensure all requirements of the NPDES permit and OU5 ROD are met.

5.2 TREATMENT PRIORITIES

As discussed in Section 3, wastewater treatment systems include the AWWT systems (Phases I, II, and Expansion), the IAWWT system, the SPIT system, and the STP. The effluents from these systems, along with bypassed (untreated) groundwater and storm water, combine at the Parshall Flume to form the FEMP site's regulated discharge to the Great Miami River.

As described in Section 3, the effective capacity of each uranium-removal treatment system is expected to be as listed below:

• AWWT Phase I	315 mgy	600 gpm
• AWWT Phase II	158 mgy	300 gpm
• AWWT Expansion	788 mgy	1500 gpm
• IAWWT	131 mgy	250 gpm
• SPIT	92 mgy	175 gpm

Figure 5-1 shows the treatment systems and simplified general wastewater flows in the overall FEMP centralized wastewater treatment system during remediation. The priority for non-sanitary water treatment through the wastewater treatment systems shown on Figure 5-1 is the water containing the greatest uranium concentration. At this time, the source of water containing the greatest amount of uranium is the remediation wastewater collected in the BSL/HNT. The water in the BSL/HNT contains about 1500 ppb uranium in a typical analysis. The BSL/HNT is also the collection point for all VOC-contaminated wastewater and process wastewater effluents. As a result, the AWWT Phase II treatment system (i.e., only system with VOC treatment) is utilized primarily for treating water from the BSL/HNT headworks. Phase II also currently treats eluate from the SDF. The treated eluate return (30,000 - 50,000 ppb) raises the combined uranium level to AWWT Phase II during its operation.

The source containing the second highest concentration of uranium is the storm water in the SWRB. The SWRB typically contains water with a uranium concentration of approximately 200 to 500 ppb. The AWWT Phase I system will be utilized primarily for treating storm water collected in the SWRB headworks.

Groundwater from the Great Miami Aquifer recovery systems contains the lowest concentration of uranium of all the wastewater streams. Groundwater sent to treatment typically contains a uranium concentration of approximately 70 to 80 ppb. Two treatment systems are dedicated to the exclusive treatment of groundwater to support aquifer remediation and the re-injection demonstration. These systems are the SPIT and AWWT expansion. These two dedicated systems, combined with intermittent treatment of groundwater in other systems combine to supply the required 2000 gpm of average annual groundwater treatment capacity specified in the BRSR. All groundwater flows exceeding the combined treatment system's capacity are discharged to the Great Miami River without treatment (Section 3.4.3). Bypassed groundwater typically contains a uranium concentration of approximately 30 ppb.

The IAWWT system serves as an alternating treatment system switching between groundwater and storm water. It will serve as a groundwater treatment system when the SWRB is at low levels. When the level of storm water in the SWRB is high, it will shift over to the treatment of storm water.

Water discharged from the STP also contains uranium. Uranium treatment for this discharge is not provided. However, as discussed in Section 3.5.4, the STP discharge contributes to the total uranium concentration at the Parshall Flume. At times this flow contributes significantly to the total site uranium discharge.

5.3 HIERARCHY OF TREATMENT DECISIONS

Figure 5-2 provides a logic flow chart listing the frequent decisions that must be made for the wastewater treatment systems. These decisions are typically made using guidance provided by ARWWP management and engineering support staff. The shift supervisor is responsible for operations and direction of maintenance activities at all of the groundwater extraction facilities, all uranium treatment systems and ancillary facilities, the STP, and the Parshall Flume. The purpose of Figure 5-2 is to provide a consistent logic for operation of all wastewater treatment facilities and a tool for the shift supervisors to ensure that they are operating the facilities in a manner most likely to achieve regulatory requirements.

Shift supervision is provided 24 hours per day, seven days per week, 365 days per year, by licensed wastewater operators with considerable experience in operating and supervising wastewater treatment plants. As the supervisor of all operations and maintenance activities that occur on a particular shift, the shift supervisors are responsible for ensuring that treatment and monitoring equipment is operated, maintained, and repaired as necessary so that maximum prioritized treatment throughput is achieved at all times. The operations activities are performed in accordance with the pertinent site standard operating procedures (SOPs) listed in Appendix C. Maintenance is performed in accordance with the operations and maintenance specifications provided by the manufacturer. The shift supervisors have been trained to follow the decision logic flow chart. All operators have also been trained on the chart so that they have an understanding of what decisions need to be made and when. Shift supervisors are expected to use their best judgment and experience to respond to situations where the flow chart cannot be applied. Additionally, process engineering support personnel are on-call and available by pager to aid in problem solving.

Not all decisions are listed on Figure 5-2; some are implied. For example, when the flow chart indicates that storm water should be pumped to IAWWT, it is implied that IAWWT is operational. The shift supervisor is responsible for knowing the operational status of each facility and sending water only to operational facilities. Events, such as equipment downtimes, that may occasionally occur and make it impossible to exactly follow the logic chart in Figure 5-2 are documented in the shift supervisor's logbook and communicated to the managers of ARWWP and ARWWP Operations.

5.4 WASTEWATER TREATMENT OPERATIONS DECISIONS

Below is a detailed presentation of the flow chart (Figure 5-2) introduced in Section 5.3. Each major type of water to be treated is discussed to provide a better understanding of the flow chart. As stated in Section 5.2, the priority for non-sanitary treatment is water containing the greatest uranium concentration. As further explained, that prioritization results in a treatment hierarchy of: 1) Remediation wastewater; 2) Storm water; and 3) Groundwater. This hierarchy is reflected in the discussion which follows and in the Operational Maintenance priorities discussed in Section 5.6.

5.4.1 Remediation Wastewater

During normal operations, water from the BSL is pumped to the AWWT Phase II treatment system. The level in the BSL is measured as inches freeboard or the distance between the liquid level and top of the BSL containment berms. When the volume of water stored in the BSL is minimal, quantities of groundwater may also be treated through the AWWT Phase II system. However, as discussed in Section 5.4.1.2, once the WPRAP and the former process area cleanup and dewatering projects are fully operational, it is expected that the AWWT Phase II system will rarely be available for groundwater treatment during the "wet season."

Control of the BSL level becomes more critical during the "wet season," when the level in the BSL may steadily rise for months as the average influent flow exceeds the average discharge rate to treatment. Furthermore, it is anticipated that during the "wet season," excessive storms or numerous sequential storms may raise the water in the BSL to a level where additional influent control actions may be necessary. Figure 5-2 illustrates the decisions that must be made to reduce inflow to the BSL when such an emergency occurs. Overflow of the BSL, besides discharging contaminated water to adjacent areas and Paddys Run, could cause erosion of the berms and possible structural failure, and is therefore unacceptable. Processes that send water to the BSL will be requested to terminate pumping in an order based on: 1) the relative importance of each influent to the overall FEMP site objectives; and 2) the ability of each process to hold its discharge water until the period of heavy precipitation is complete.

Based on this criteria, the following shutdown sequence results:

Sequence	Description
1st	HNT (Silos Project Wastewater)
2nd	WPRAP Storm Water Management Pond
3rd	SDFP Dewatering
4th	WPRAP Water Treatment System (WTS)
5th	Shutdown pumping of WPASRC Facility
6th	OSDF Leachate Transfer System

When project-specific remediation wastewater flows (including storm water) to the BSL are shut down due to high levels in the BSL, it is the individual project's responsibility to manage their water in accordance with their project-specific storm water/wastewater management plans. If all process flows (i.e., 1st through 4th on above sequence) to the BSL have been halted and the level in the BSL continues to increase, approximately 200 gpm of additional discharge flow from the BSL will be diverted to the AWWT Phase I treatment system. This action (partial treatment at Phase I) will only be used if this emergency condition exists, since wastewater treated through the AWWT Phase I system will not be treated for VOC contaminant removal. The partial diversion to Phase I will be continued until the emergency condition has passed.

It is possible that the WPASRC facility may be shut down and allowed to overflow to a swale to the west of the facility. Water which reaches the swale may infiltrate or overflow to Paddys Run and become a source of additional groundwater contamination. Water which remains in the swale can be pumped back into the WPASRC when the heavy rainfall is over and the level in the BSL has dropped low enough to allow additional inflow. The flow chart tells the supervisor to continue pumping this pond into the BSL until it becomes evident that continuing to pump will cause the BSL to exceed the freeboard level, which would place the facility into overflow potential. It is also possible that the leachate flow from the OSDF may be shut down, thereby causing the leachate to accumulate in the individual cells. All processes that pump water to the BSL will be resumed in reverse order as the level in the BSL drops. As shown on Figure 5-2, the accumulated leachate will be the first flow to the BSL to be reinstated once the BSL water level has declined to the prescribed level.

Evaluation of Phase II Treatment Capacity

An evaluation of the Phase II treatment system was made by plotting the 300 gpm effective treatment capacity on the Remediation Wastewater Flow plot developed in Section 4 (see Figure 5-3). This plot indicates that there will be essentially a two year period, where the capacity may be exceeded. Some adjustments in project schedules could potentially allow the system to function in its existing configuration. However, the question which results from the analysis of seasonal flow variations in Section 4.3.8 is, *"Will Phase II be capable of handling the "wet season" flows when accumulation of excess flow in the BSL may be required"?* Accumulation of excess flow will impact the number of times that the diversion of remediation wastewater described above in Section 5.4.1.1 will occur.

The design basis by which the BSL was evaluated is that the BSL should be capable of handling the calculated 90th percentile rainfall without implementing diversions. An analysis of the "wet season" can be made by using a plot similar to Figure 5-3 with flow projections adjusted to "wet season" and Phase II capacity adjusted for the net inflow which can be stored in the BSL.

The 90th percentile annual inflow rates are obtained by multiplying the rainfall induced flows by 1.21 (See Section 4.3.8) and adding them to the remaining non-rainfall impacted inflows. This is done in Appendix B and plotted on Figure 5-4. The differential average inflow rate can be calculated by dividing the storage volume available in the BSL by the time that water may be accumulated (this assumes the BSL to be empty at the beginning of the "wet season"):

- Volume available for storage in BSL:

9.18 MG	=	Volume at 2' freeboard
-2.55 MG	=	Volume at low level
6.63 MG	=	ΔV

- Since the "wet season" exists for 6 months (184 days), the above volume can be assumed to provide a differential average inflow (Δq) of:

$$\Delta q = \frac{\Delta V}{\Delta t} = \left(\frac{6.63 \times 10^{6}\ \text{gal}}{184\ \text{day}}\right)\left(\frac{1\ \text{day}}{1440\ \text{min.}}\right) = 25\text{gpm}$$

Adding this calculated differential average inflow rate to the average Phase II treatment rate presents the average inflow rate allowable to the BSL for the 184 day "wet season":

Allowable Inflow for 6 month "wet season" = 300 gpm + 25 gpm = 325 gpm

Adding this to the plot of adjusted flows (Figure 5-4) results in a graphical indication of 90^{th} percentile inflow to treatment/storage capability.

The plot indicates that the potential deficiency in treatment capacity that was a concern in Figure 5-3 now becomes a greater concern. Therefore, this deficiency must be addressed.

In late 1998, a presentation of the concepts described in Section 5.4.1.1 was given to the EPA's. The purpose of this presentation was to request permission to ease the loadings on AWWT Phase II by shifting backwash flows from AWWT Phase II to AWWT Phase I. The EPA's agreed in concept, however they deferred formal approval to the approval of this document. Submission of this revised document formally presents a request to remove these flows. As shown by Figure 5-4, removal of the backwash water, from the Phase II treatment system should allow the existing system to adequately handle the 90^{th} percentile inflow throughout the entire remediation effort. In the future, if additional problems arise, then additional changes may be made.

5.4.2 Storm Water

Storm water runoff from the former production area will continue to be collected in the SWRB and processed primarily through the AWWT Phase I treatment system. The primary goal governing operation of the SWRB is to prevent an overflow to Paddys Run. Water which overflows the SWRB readily becomes a source of further groundwater contamination.

5.4.2.1 Storm Water Under Original OMMP

Under the original OMMP, treatment of storm water through the AWWT Phase I system continued until the level in both chambers of the SWRB dropped to approximately one to four feet and then the AWWT Phase I system was switched to treating contaminated groundwater. The switchback from groundwater to storm water was required to be made when the level in one chamber of the SWRB was up to the influent gate and the level in the other chamber rose to 3 to 5 feet (≈ 7.7 MG). The switch from groundwater to storm water could be made sooner, when heavy rainfall was predicted.

During heavy precipitation, when the level in the SWRB increased to 7 to 8 feet with more precipitation expected, the shift supervisor directed that the IAWWT system begins treating storm water. If the level continued to increase, the shift supervisor determined if the AWWT Phase II system had the capacity to treat any storm water. AWWT Phase II was only used to treat storm water in the event the BSL level was low before the precipitation began.

If the level in the SWRB rose to between 8½ to 10½ feet, storm water from the SWRB was bypassed around treatment to the Parshall Flume and the Great Miami River. The exact level at which bypassing began depended on the availability of additional treatment through the AWWT Phase II system and on the weather forecast. Bypassing continued until the level in the SWRB dropped below eight feet and the precipitation event was over.

5.4.2.2 SWRB Operational Logic Re-Evaluation

Re-evaluation of the SWRB operational logic found in the original approved OMMP was performed as discussed in Section 4.2.1.2. Potential problems with that logic were as follows:

- AWWT Phase I was configured to treat either storm water or groundwater. "Batch" treatment of storm water through Phase I at its high (700 gpm) capacity necessitates that a significant volume of water be accumulated in the SWRB prior to shifting to storm water treatment. Accumulated volume for treatment is a judgment factor and can result in an unnecessary bypass event if it is not removed prior to a large storm event.

- Transfer of the SWU retention basins to the SWRB with their 600 gpm design rate essentially neutralizes the ability to lower the level of water in the SWRB when only Phase I is operating (700 gpm). Therefore, transfer of SWU water to the SWRB under these conditions keeps it unnecessarily vulnerable to a bypass from a subsequent storm event.

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- The SWRB has a trapizoidal cross-section, therefore, the storage capacity for a given foot of vertical rise is greater as the height increases. Setting the start of bypass at a low elevation can cause a relatively large loss in potentially unused storage volume and result in unnecessary bypass events.

Corrective Action

Several actions were identified to improve storm water handling based on the above re-evaluation of the OMMP treatment "logic." These actions, coupled with increased pump-out capacity added in 1995 and a basic operational change which eliminates the 24 hours of settling prior to pumpout (see Section 4.2.1.1), will serve to optimize available capacity of the SWRB. These actions are as follows:

- Implement a low flow treatment configuration to maintain maximum volume (minimum level) in the SWRB during "dry weather" conditions; including provisions for observed and projected increases in dry weather flows. Dry weather inflow to the SWRB had averaged approximately 70 gpm, based on historical data at the Storm Sewer Lift Station (see Table 4-2). Water generated from vehicle wheel washing (estimated 20 gpm), dust control measures (estimated 10 gpm), and diversion of various treatment system backwashes from Phase II to the SWRB (estimated 100 gpm) increases the projected "dry" weather inflow to the SWRB to approximately 200 gpm.

- During major storm events, cease the transfer of runoff collected in the Southern Waste Unit (SWU) basins once the volume in the SWRB reaches half full. Do not begin the transfer until the event is over and the SWRB volume drops below half. Also, continue operation of the IAWWT to assist in shortening the time required to address this added flow. This action is reasonable as the SWU basins are sized to accommodate runoff from a 25-year, 24-hour storm.

- Raise the level at which bypassing of SWRB to the Great Miami River begins, and also raise the level at which this bypass is terminated. This will delay bypassing longer and minimize the volume of untreated water released to the Great Miami River. Raising the level of beginning and cessation of bypasses will increase the probability of an overflow. This is judged to be acceptable during the time-frame of concern that ends in late 2003/early 2004 with the remediation of the initial SCEP soils area (Area 3a and 4a, see Figure 4-3). During that interval, any overflow volume from the SWRB, with its potential subsequent infiltration into the Great Miami Aquifer, will be addressed by the South Field Extraction system (SFES); which is projected to remain in operation through 2003. After 2003, the design basis of the SWRB will exceed the 10-year, 24-hour storm event because of the significant reduction in contributing acreage. Therefore, when the SFES is ready for shutdown, the bypass level can be readjusted to reduce the probability of overflow and not compromise the ten days of bypassing.

These proposals were presented to and verbally endorsed by EPA and OEPA in late 1998. Modification of the OMMP was decided as the means of attaining formal approval of the corrective actions. When an additional bypass of the SWRB occurred in December 1998, an evaluation was performed which indicated that the bypass could have been significantly reduced or possibly even avoided if the above changes had been in effect. Therefore, the above measures were put into effect in January 1999, with the verbal concurrence from EPA and OEPA.

5.4.2.3 Storm Water Under Revised OMMP

Under this revised OMMP, modifications have been made to Figure 5-2 to implement the corrective actions discussed above. These modifications should reduce the potential of exceeding the ten precipitation bypass days.

"Dry Weather" Flow

Modification of equipment at the SWRB is planned to eliminate the current practice of switching between storm water and groundwater. The modifications will provide for a continuous transfer of a nominal 200 gpm of storm water ("dry weather" flow) to AWWT Phase I when the SWRB is at its low level. This will be accomplished by installing an orifice under what will become a permanently closed half gate to the east chamber of the SWRB. The orifice will restrict flow to the east chamber and cause a ponding of the influent in the old Emergency Spill Basin (ESB); which forms a part of the west chamber for the SWRB (See Figure 5-5). Surges of backwash water, etc. will thereby obtain some settling of total suspended solids (TSS) prior to entering the east chamber. Water which enters the east chamber will obtain additional settling of TSS as it commingles with the minimum volume of water in the chamber and flows slowly toward the east chamber floating weir outlet. The minimum volume of standing water results from the floating weir coming to rest on the bottom of the basin. As the floating weir intake is near the surface of the water, a reasonably settled discharge stream should result (i.e., the east chamber will operate as a typical wastewater treatment plant clarifier). Groundwater will make up the remaining portion of the flow to Phase I automatically as a result of the low level in the SWRB pumpout structure caused by the orifice flow restriction.

Large Storm Events

When a large storm event occurs, the flow of storm water to Phase I will automatically increase as the volume in the SWRB increases. The sequence of actions/responses which will occur at the SWRB during a major storm event are as follows:

The level in the ESB will rise quickly because of its relatively small size and the orifice restricting flow to the east chamber. (Case I, Figure 5-5). Once an ESB level of approximately 4 feet is reached, (≈ 0.2 MG of accumulated volume), excess influent to the SWRB will overflow the west end (divide) of the ESB. At this level, the orifice will allow storm water into the east chamber at a rate of approximately 400 gpm. This influent rate to the east chamber will hold essentially steady until the west chamber fills to the level of this divide (≈ 2.8 MG of accumulated volume, Case II, Figure 5-6). As the water level in the west chamber continues to rise to the level of the top of the half gate to the east basin (≈ 4.5 MG of accumulated volume Case II, Figure 5-6), the inflow through the east chamber orifice and into the outlet weir to the SWRB pump station similarly rises to approximately 700 gpm, or the full capacity of the AWWT Phase I treatment system. Correspondingly, the groundwater component of the mixed flow to Phase I reduces to 0 gpm. At this point, the effluent to Phase I will be shifted to what should be a relatively settled west basin. At the same time, IAWWT is also switched over from groundwater to storm water. (Note - this is at a point much sooner, in terms of contained volume, than the ≈ 7.1 MG of accumulated volume that was previously used.)

The partially submerged half gate to the west chamber (left open approximately 1.5 feet) will serve to direct approximately 1000 gpm of inflow (AWWT Phase I plus IAWWT) to the west basin under the surface of the contained water, while the remaining inflow overflows the half gate into the east chamber (Case III, Figure 5-7). Again, as described above for initial east chamber operation, primary settling of TSS in the inflow to the west chamber should occur as it commingles with the standing level of water, and flows through the ESB toward the floating outlet weir.

The east chamber then fills to the level of the top of the east half gate (≈ 8.3 MG of accumulated volume. Case IV, Figure 5-8). At that point, flow from the southern waste units (SWUs) is stopped to save the remaining volume exclusively for runoff from the former production area. When the basin surface rises to the start of bypassing level of 10 foot (≈ 10.1 MG of accumulated volume Case V, Figure 5-9), the east chamber outlet valve will be reopened to divide the approximately 2000 gpm (sum of AWWT Phase I, IAWWT, and bypass) effluent flow between the two chambers. (Note that the bypassing level has been raised a nominal one foot from the original version of Figure 5-2 as discussed in Section 5.4.2.2. Similarly, as also discussed in Section 5.4.2.2, the level of shutoff of bypassing has been raised one foot to nine feet.) Overflow occures at approximately 10.8 MG (Case VI, Figure 5- 10).

Other Rainfall Events

Figure 5-2 also directs other actions when smaller storm events occur and the above levels are not reached. It also addresses other events such as a sequential storm causing a rise in basin level after partial drawdown, etc.

Additionally, note the following changes: 1) flow from the SWUs will not be restarted until the level in the SWRB drops below the top of the east chamber half gate level (Case VII, Figure 5-11); and 2) storm water flow to IAWWT will continue until the west chamber of the SWRB is empty and ready to receive another storm (Case VIII, Figure 5-12). This modification commits the IAWWT to performing storm water treatment for a significantly longer period of time than previously implemented.

5.4.2.4 Planned Modifications to Phase I

The two flow modifications are planned to be implemented at AWWT Phase I to enhance overall treatment operations. These are discussed below.

Groundwater Bypass of Clarifiers

Past practice of interchanging of groundwater and storm water feed to Phase I has created operation upsets in the AWWT clarifiers. This has resulted in increased solids overflow to the multimedia filters, which then results in greater backwash and reduced system efficiency. This operational upset is attributed to the water chemistry and temperature differential between groundwater and storm water. Revisions planned to provide blending of the two streams by mixing groundwater and storm water in the SWRB pumpout sump as discussed above should help alleviate this problem.

A modification to the piping at the AWWT is planned to further address this problem. Groundwater will be routed to the AWWT Phase I clarifier overflow tank, thus bypassing the clarifier. The new pipe will be equipped with a flow element, meter and control valve with appropriate DCS interlocks and monitoring to control flow. At any time the SWRB discharge drops below the Phase I operating level (i.e., normally 600-700 gpm), this configuration will automatically allow groundwater inflow to maintain maximum system flowrate downstream of the clarifiers.

AWWT Filter Backwash Reroute

Backwash streams from AWWT Phase I, II, and Expansion are routed back to the first tank (T155) in the AWWT Phase II system. These flows have resulted in operational upsets to the AWWT Phase II system and, have therefore, not let it achieve its highest efficiency. The intermittent slugs of heavy solids flow to the system result in clarification upsets which force the overall system to be operated at a lower flowrate than designed. Based on the latest estimates of "wet season" flow rates as described in Section 5.4.1.2, the Phase II capacity was projected to fall short of that required.

A system modification is planned to correct this problem. The combined backwash header will be intercepted and rerouted to a storm sewer manhole adjacent to the AWWT and allowed to flow via gravity to the SWRB; the headworks of the Phase I system. The SWRB will act as both a detention basin and settling area for the backwash. The solids should settle out in the basin to be collected later by the Sludge Removal System. This "dry weather" low flow addition to the SWRB, combined with recently completed similar rerouting of SPIT and IAWWT backwash, will contribute to keeping the SWRB low flow discharge at a nominal 200 gpm.

5.4.3 Groundwater

Groundwater treatment capability is required to provide re-injection water, to meet limits for uranium in water discharged to the Great Miami River, and to average 2000 gpm yearly per the Baseline Remedial Action Strategy Report. Because of system design and the need to keep system discharges of highest quality to provide for the re-injection water, the AWWT Expansion Facility and the SPIT facility are dedicated to treating groundwater. Groundwater is treated at the IAWWT unless additional storm water treatment capacity is needed to minimize the potential for and duration of storm water bypass (see Section 5.4.2.3). Under no conditions will the IAWWT, AWWT Phase I, or AWWT Phase II discharges be used for re-injection. The AWWT Phase I system will continue to primarily be used to treat groundwater when the level in the SWRB is low. The AWWT Phase II system may be used to treat groundwater if the level in the BSL is very low and the weather forecast does not predict rainfall for the upcoming period.

5.4.3.1 Groundwater Treatment Prioritization vs Bypassing

Using the flow information previously presented in Section 4.0, and the expected effective treatment capacity presented in Section 5.2, it is possible to project the additional average annual groundwater flows that can be treated in the IAWWT and AWWT Phases I and II. The unshaded portions of Figures 5-13 and 5-14 depict the capacities in IAWWT/AWWT Phase I and AWWT Phase II, respectively, that are projected to be available for groundwater treatment. Figure 5-15 presents a graphic summary of the anticipated average annual groundwater treatment capacity from all treatment systems plotted against the projected groundwater flow rate from Figure 4-2. The difference between the projected groundwater flow and the treatment capacity is the planned flow that will be bypassed. Note that the treatment projections meet or exceed the required 2000 gpm of groundwater treatment capacity as specified in the BRSR.

Treatment of groundwater well discharges are prioritized in order of uranium concentration, with the highest uranium concentration wells routed to treatment until all available treatment capacity is utilized. Remaining well discharges are bypassed around treatment to the Parshall Flume. As shown schematically in Figure 5-16, treatment/bypass decisions for the Southfield extraction wells are made on a well-by-well basis. The existing four South Plume off-property, leading-edge wells combined with the two wells of the South Plume Optimization Project are routed as a group either for treatment, full bypass, or partial bypass since piping does not exist for well-by-well treatment/bypass decision. Note that bypassing of a percentage of groundwater from the off-property South Plume wells occurs automatically at the South Field Valve House based on pressure in the treatment header. Therefore, when temporary changes in treatment throughput occur, such as vessel backwashing, the quantity of flow to treatment fluctuates.

5.4.3.2 Re-Injection of Treated Groundwater

The water for the re-injection demonstration is being obtained from the discharge of the AWWT Expansion System as shown on Figure 5-16. In the future, if the Re-Injection Demonstration Project is successful, effluent from the SPIT system will be piped to allow routing to the 50,000 gallon surge tank (see Section 3.1.1.4). The quantity of flow which is transferred to the surge tank is controlled automatically by level control at the surge tank.

The re-injection demonstration system functions such that each injection well has its own flow control system that allows the flow of injectate to be varied individually. The nominal flow of 1000 gpm to the Re-Injection Demonstration Wells is supplied by a single pump (with backup spare provided). Additionally, controls are provided to allow less than a total of 1000 gpm to be injected, if required.

These controls allow the pump's fixed speed discharge to be split between injection and recycle to the injection supply tank. Therefore, the discharge from the pumps remains relatively constant while the flow to the injection wells can be varied.

Similarly, in the future, when the re-injection flow is to be increased above 1000 gpm, two pumps will operate and a third pump will be added for standby purposes as discussed in Section 3.1.2.1. The two operating pumps will be controlled in the same manner as described above to provide a varying demand.

In addition, instrumentation on the individual injection wells is provided such that the water levels within each injection well are monitored. Clogging within the injection wells is indicated by a rise in water level while flow into the well remains constant. The injection wells are also instrumented such that flow to the well is automatically stopped if excessively high levels are reached.

5.4.4 Ion Exchange Vessel Rotation/Regeneration

The Baseline Remedial Strategy Report contains a sequence of aquifer well extraction flows (Table 4-1 herein) based on the projected treatment capability of the various facilities. Meeting the overall 20 ppb monthly average total uranium discharge level to the Great Miami River was based on the following assumed average uranium discharge concentration from the treatment facilities:

- AWWT Phase II - below 20 ppb
- AWWT Phase I - below 10 ppb
- AWWT Expansion facility, SPIT, and IAWWT - below 5 ppb.

In order to effectively balance operating costs while meeting regulatory commitments, the performance based 20 ppb discharge limit at the Parshall Flume is used to determine when changes must be made in the ion exchange (IX) operation. As the 20 ppb limit is reached, the IX vessels in the treatment train that are causing the Parshall Flume uranium concentration to exceed 20 ppb are rotated from standby to lag (if a standby unit is available), lag to lead, and lead to standby, followed by regeneration, to maintain compliance. (Note - AWWT Expansion does not have standby vessels.) Some difficulty has been experienced in having the standby vessels regenerated and ready when problems with the 20 ppb discharge have arisen. An evaluation of the resin regeneration system is being undertaken to determine the cause of and provide potential corrective actions for this problem. Also note that the above uranium discharge projections may be inadequate, because of higher than projected uranium concentrations in STP effluent and groundwater bypass, plus the need to increase flow of storm water through IAWWT. Operating experience from September 1998 to February 1999, combined with additional changes discussed throughout this revised document, have increased the uncertainty in FEMP's ability to meet the 20 ppb monthly average uranium limit in the site's combined effluent discharge to the Great Miami River.

5.4.5 Sanitary Sewage

Sanitary sewage, including the laundry sump (scheduled to be shut down in late 1999), is treated through the STP. Its purpose is to treat sanitary sewage to meet NPDES requirements. The STP discharges directly to the Parshall Flume. The concern for the level of uranium in the discharge from the STP is for meeting the composite 20 ppb uranium discharge limit at the Parshall Flume. During late 1998, and early 1999, daily levels as high as 800 ppb have been observed. Potential corrective measures to address this situation discussed in Section 3.5.4, are currently being evaluated.

5.5 WELL FIELD OPERATIONAL OBJECTIVES

Several objectives must be considered when well field operational decisions are made. These objectives are listed in Table 5-1 along with the anticipated actions required to achieve each objective. At times the objectives conflict, therefore operational decisions are generally made by group consensus at ARWWP meetings. Participants in these meetings include ARWWP Operations, Hydrogeology, and Engineering Section managers, the ARWWP Project Manager and the DOE Operable Unit 5 representative. These meetings are held on an as-needed basis. Decisions from these meetings that affect wellfield operations are normally communicated to the EPA and Ohio EPA on the weekly conference calls. Operational changes are also reported in the IEMP quarterly reports. Changes in groundwater restoration well pumping/re-injection set points are transmitted to shift supervisors by the ARWWP Operations Manager.

5.6 OPERATIONAL MAINTENANCE PRIORITIES

Maintaining the treatment facilities on line includes ensuring that all equipment is operating properly, that adequate personnel are assigned to operate the treatment systems safely, and that the combined treatment and bypassing systems are removing uranium to below 20 ppb as measured at the Parshall Flume. Below is a list of operational maintenance priorities in their order of importance:

- Keeping the AWWT Slurry Dewatering Facility available to process clarifier slurries and provide treatment of resin regeneration waste streams.
- Keep the AWWT Phase II treatment system on line at maximum capability. This will also allow the BSL to be maintained at a low level so that a heavy precipitation event will not quickly create the potential for bypassing or overflow.
- Keep AWWT Phase I on line to prevent the SWRB from overflowing and to minimize the amount of untreated storm water that must be bypassed around treatment.
- Keep the sewage treatment plant on line and operating correctly. This will prevent NPDES permit violations by STP discharge.
- Keep the ion exchange resin regeneration system on line and available to regenerate resin for reuse.
- Keep the Parshall Flume discharge point and sampling system on line. If the discharge monitoring system were to become nonoperational, discharge monitoring of effluent to the river from the FEMP would have to be collected manually. The sampling system must be operational so that accurate reports of uranium and NPDES contaminant levels can be made.

The next two priorities after these will vary based on weather conditions and the level in the SWRB:

- In periods of heavy precipitation or high level in the SWRB, the priority is to keep IAWWT on line. IAWWT, which normally provides additional treatment capacity for groundwater, also provides supplemental and backup capacity for storm water.
- If the SWRB level is not high and large quantities of precipitation are not expected, the priority will be to keep the South Plume Extraction Wells on line to maintain capture of the South Plume of uranium contamination in the aquifer. These wells are located at the leading edge of the plume and prevent the plume from spreading further south in the aquifer.
- Keep the AWWT expansion facility, the south field extraction wells, and the re-injection demonstration wells on line. The re-injection wells receive discharge from the AWWT Expansion facility and re-inject that water into the aquifer to speed the cleanup process.
- Keep SPIT on line. SPIT provides additional groundwater treatment.
- Keep the South Field Extraction and future systems operating.

More specific details of managing equipment operation and maintenance are contained in Section 6.

5.7 OPERATIONS CONTROLLING DOCUMENTS

Operations at the wastewater treatment facilities are controlled directly by standing orders and standard operating procedures (SOPs, see Appendix C). Standing orders translate the DOE Orders and conduct of operations principles, guidelines, and procedures into performance requirements for personnel involved in operating the wastewater treatment facilities. The standing orders were written to ensure that all operations are conducted in full conformance with DOE conduct of operations requirements.

A more extensive discussion of SOPs and Standing Orders is contained in Section 6.1.2. Standing Orders and SOPs implement the requirements of this plan. The OMMP is not intended to replace Standing Orders or SOPs.

5.8 MANAGEMENT AND FLOW OF OPERATIONS INFORMATION

Samples are taken from each of the treatment systems at locations indicated on Figure 5-2. The results of the sample analysis are reviewed daily by the shift supervisors, the process engineer, and the operations manager to review system performance and determine if any of the treatment system ion exchange vessels need to be removed from service for resin replacement or regeneration.

The ARWWP operations manager issues daily and monthly operations reports that summarize flow rates and flow totals as well as uranium concentrations from each wastewater treatment system. The operations manager communicates process information from the operations personnel to ARWWP personnel involved in modeling and monitoring the performance of the aquifer cleanup (ARWWP Hydrogeology Section). Information on required well pumping/injection rates is communicated from the ARWWP hydrogeology section to operations personnel via the operations manager's monthly performance goals and operating orders, as specified in the Standing Orders.

5.9 MANAGEMENT OF TREATMENT RESIDUALS

The AWWT Slurry Dewatering Facility (SDF) began routine operations in September 1996. It has been used primarily to dewater AWWT clarifier settled solids, to dewater sewage treatment plant waste activated sludge, and to precipitate and dewater sludges from AWWT ion exchange regeneration solutions. The SDF will be used in the future to dewater sludges dredged from the SWRB and BSL.

The filter cake produced by the SDF filter press is unloaded in metal boxes of about 50 cubic foot capacity. Representative samples from each box have been analyzed for total uranium, to characterize the waste and to help assess the possibility of eventual disposal at the FEMP's OSDF. The average SDF filter cake uranium concentration (from AWWT clarifier bottom dewatering) has been approximately 1200 milligrams per kilograms (mg/kg), with a range of 600 mg/kg to 9000 mg/kg. This compares to the Waste Acceptance Criterion of 1030 mg/kg total uranium for the OSDF.

Variations in the incoming wastewater and in-treatment operations result in variations in the filter cake uranium concentration. Many individual boxes have tested below 1030 mg/kg total uranium and could be considered acceptable for disposal on site. Personnel who make decisions regarding the ultimate practices for disposal of SDF filter cakes will need to consider various factors. Some factors would be:

- The costs of continued sampling and analysis for each box
- The cost of shipping and handling for off-site disposal compared to on-site disposal
- The possibility of improved economies of scale in off-site disposal by collaboration with the WPRAP
- Changes in the AWWT incoming wastewater or treatment
- Differences in the sources of other incoming waste sludges and slurries
- Stakeholder concerns and preferences.

A Waste Acceptance Criteria (WAC) plan [DOE1998f] was developed to clearly define the requirements and conditions for material disposition into the OSDF. However, at this time, the section addressing SDF sludges was placed on hold. No materials will be placed in the OSDF unless they can meet the WAC plan. Specific decisions regarding the disposal of sludges and treatment residuals will be made after a modification to the OSDF WAC plan is approved to include SDF.

These factors may also differ in the future. Decisions regarding SDF filter cake disposal will need to be made to best fit the situation. Current thinking is to empty and ship the contents of those boxes not meeting the on-site WAC to WPRAP for subsequent disposal at Envirocare. Future conditions may dictate other actions.

TABLE 5-1

WELL FIELD OPERATIONAL OBJECTIVES

Objectives	Actions Required
Operate individual wells within constraints imposed by system design and equipment. Key constraints include: • Pumping equipment is limited to a range of flows that will dictate the flexibility of extraction rates for individual wells. • Hydraulic capacity of the piping limits extraction rates • Control range of flow control valves and variable frequency drives for pump motors bound the range of extraction rates for individual wells • Capacity of existing electrical service to each well • Average entrance velocity of water moving into the screen should not exceed 0.1 ft/sec.	• Operate well pumps and motors per manufacturer recommendations. • Operate extraction and injection systems within design constraints
Perform necessary equipment/well maintenance in accordance with established schedules	• Per OMMP, Appendix D
Maintain compliance with the discharge limits of 20 μg/L monthly average uranium concentration and 600 pounds per year for the combined site water discharged to the Great Miami River	• Monitor discharge concentrations • Evaluate well set points and treatment routing weekly • Use flow weighted average concentration calculations to predict how changes to set points and routing will effect discharge concentrations. • Maintain well set points • Compare predictions with actual measurements to evaluate if/how predictions can be improved.

TABLE 5-1
(Continued)

Objectives	Actions Required
Minimize impact to the Paddys Run Road/Site Plume	• Pumping from Recovery Well 3924 (RW 1) should not exceed 300 gpm. • Pumping from Recovery Well 3925 (RW 2) should not exceed 300 gpm (if Well 3924 is pumping) and 400 gpm (if Well 3924 is not pumping). • Pumping from Recovery Well 3926 (RW 3) should not exceed 500 gpm if either Wells 3924 or 3925 go down. • If the actual capture zone differs significantly from that defined via previous modeling it may be determined that the above-noted pumping rates require modification in order to maintain this objective. Required modifications will be made based on additional modeling projections and verified based on field data.
Maintain capture of the ≥ 20 μ/L uranium plume along the southern Administrative Boundary	• The following pumping rates for each South Plume Well provides for the capture (within system constraints) of the uranium plume along the administrative boundary: Recovery Well 3924 at 300 gpm Recovery Well 3925 at 300 gpm Recovery Well 3926 at 400 gpm Recovery Well 3927 at 500 gpm • Adjust the pumping rates of the remaining operable wells in the South Plume module to maintain capture along the administrative boundary when: 1) any single South Plume Module well outage for one week or more occurs; or 2) when multiple well outages for 3 days or more occur • If the actual capture zone differs significantly from that defined via previous modeling it may be determined that the above-noted pumping rates require modification in order to maintain this objective. Required modifications will be made based on additional modeling projections and verified based on field data.
Maintain hydraulic capture of the remaining portions of the ≥ 20 μg/L uranium plume (within areas of active modules)	• Establish initial pumping/re-injection rates based on model predictions of required pumping rates to maintain a desired catchment area. (Completed in BRSR [DOE 1997a]) • Determine the actual catchment area created when the wells are operating at the modeled rates based on groundwater elevation contour maps derived from field measurements.

TABLE 5-1
(Continued)

Objectives	Actions Required
	• Adjust pumping rates within system design and operational constraints, if warranted, when the actual catchment area is not consistent with the modeled catchment area. This will be done in an effort to establish a catchment area consistent with the desired catchment area, as modeled.
Minimize duration of clean-up time for off-property portion of the ≥ 20 μg/L uranium plume	• Give priority to keeping South Plume and South Plume Optimization Wells online when other wells have to be shut-down
	• Maximize pumping rates within the following constraints/considerations: system design and equipment, hydraulic capacity of the aquifer, regulatory limits, interaction with other modules and remedy performance.
Minimize duration of clean-up time for on-property portions of the uranium plume	• Maximize pumping rates within the following constraints/considerations: system design and equipment, hydraulic capacity of the aquifer, regulatory limits, interaction with other modules
Minimize migration of on-property portion of the plume to off-property areas	• Maintain re-injection rates at 200 gpm in each of the property boundary re-injection wells, or;
	• Balance pumping from the South Field Extraction and South Plume Modules such that the stagnation zone is at or south of Willey Road, or;
	• When the combined flow into the property boundary re-injection wells is less than 800 gpm but greater than or equal to 600 gpm, shut down South Plume Optimization wells (Wells 6 & 7), or;
	• When the combined flow into the property boundary re-injection wells is less than 600 gpm, shut down South Plume Optimization wells (Wells 6 & 7) and increase pumping from South Field Well 22.
Minimize drawdown in off-property areas	• Do not exceed set points defined in Table 4-1 unless modified by ARWWP Hydrogeology Section.
Determine viability of re-injection as an enhancement to the groundwater remedy	• Keep individual re-injection wells operating at 200 gallons per minute as defined in the Re-Injection Demonstration Test Plan for the duration of the Re-injection Demonstration

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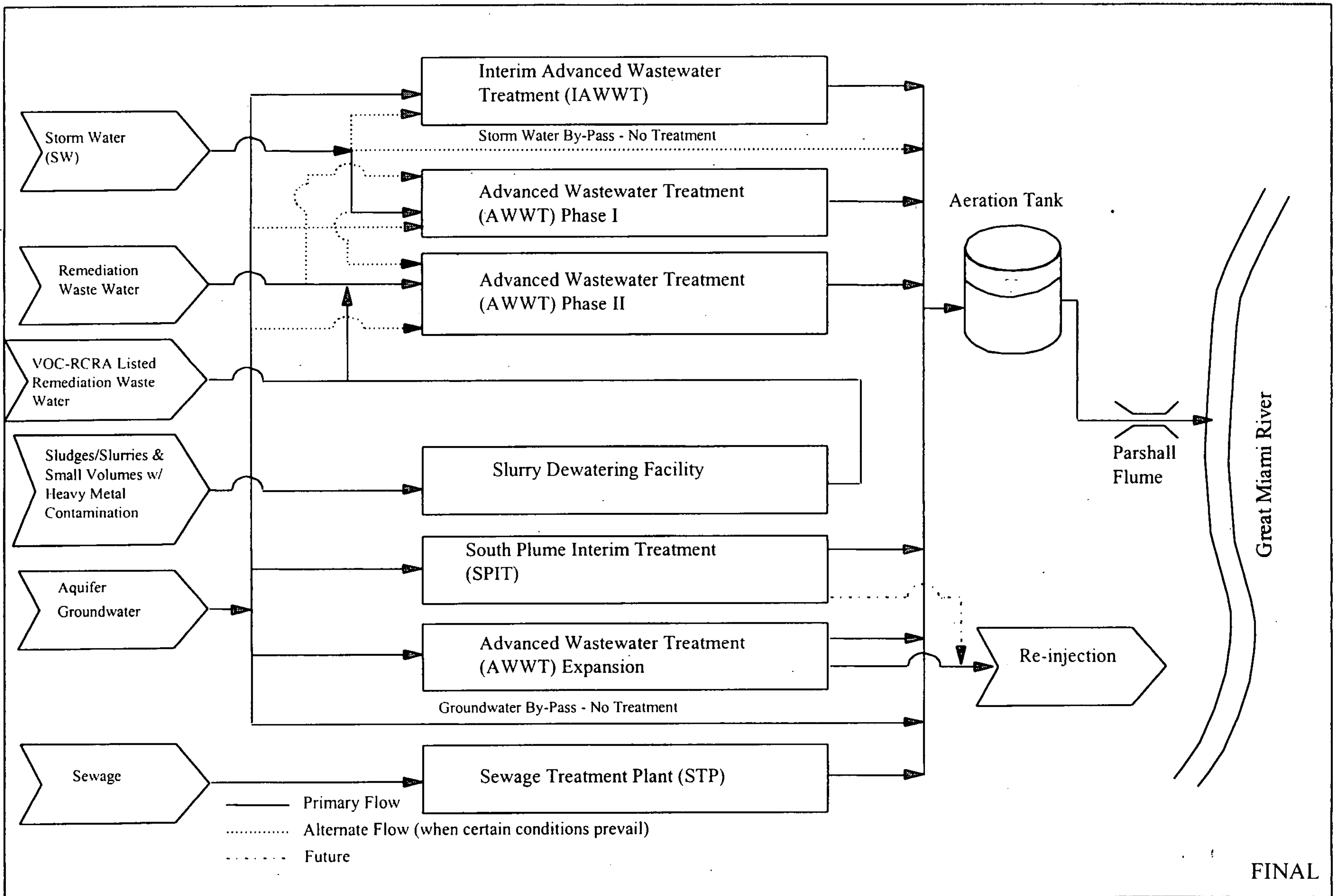

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FIGURE 5-1. TREATMENT SYSTEMS FLOW DIAGRAM

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FER\OMMP\99\FIGURES\FIG5-1.PRZ

Figure 5-2 Wastewater Operations Decision Flow Chart

This figure is provided as a 28" x 42" full size drawing inserted in a plastic holder at the rear of this document

Figure 5-3
Remediation Wastewater Flow Projection - Average Rainfall

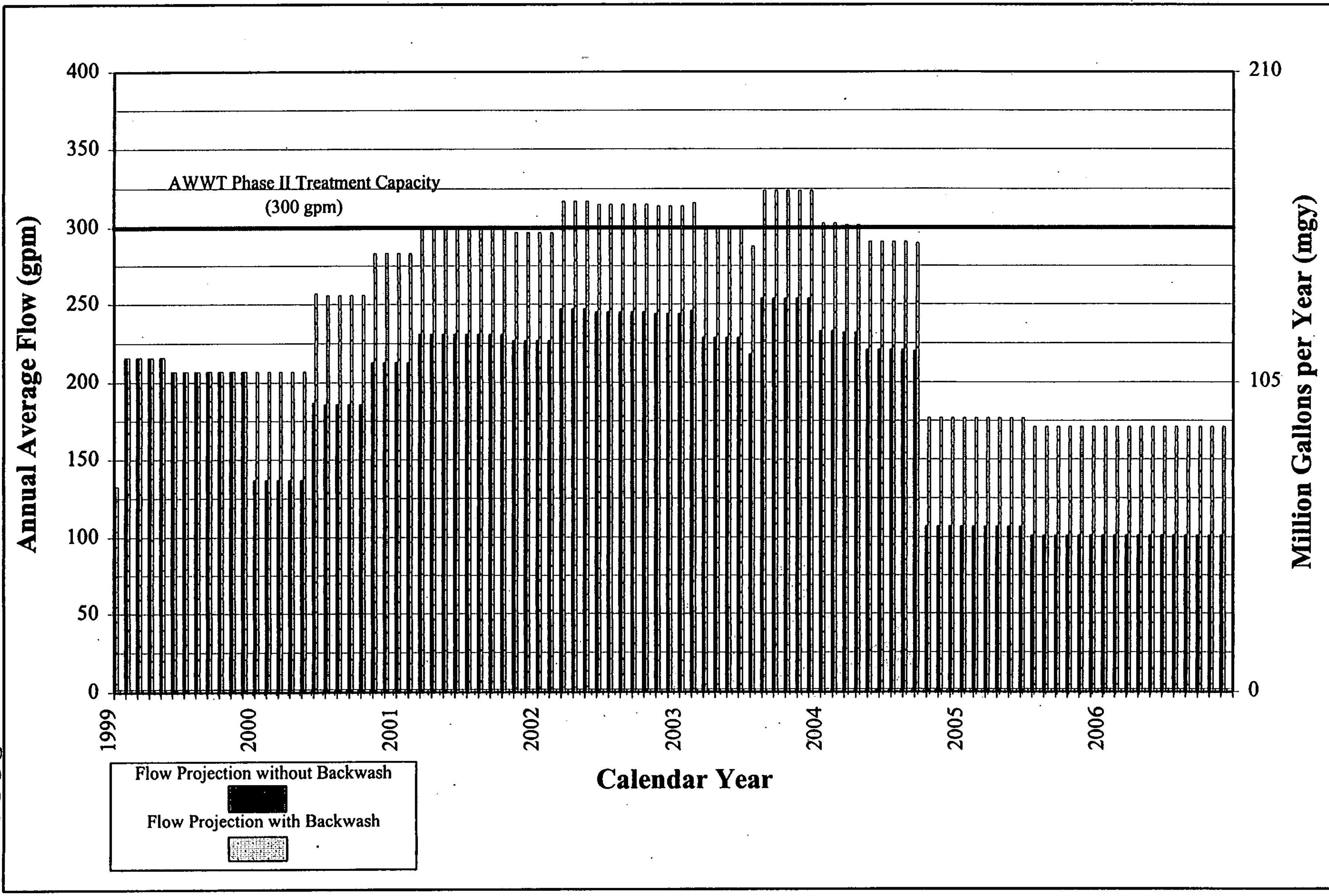

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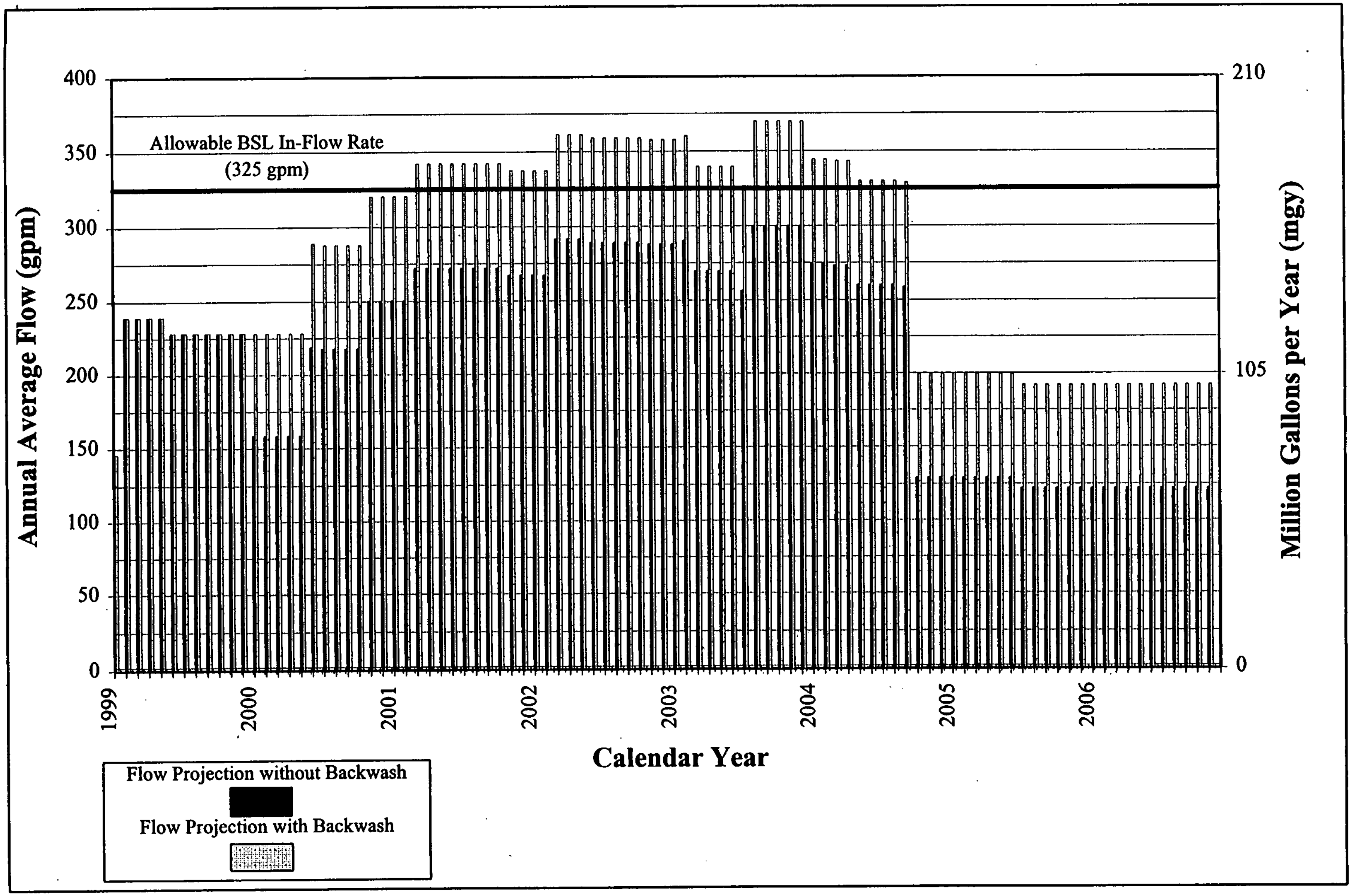
Figure 5-4
Remediation Waste Water Flow Projection - 90th Percentile Rainfall



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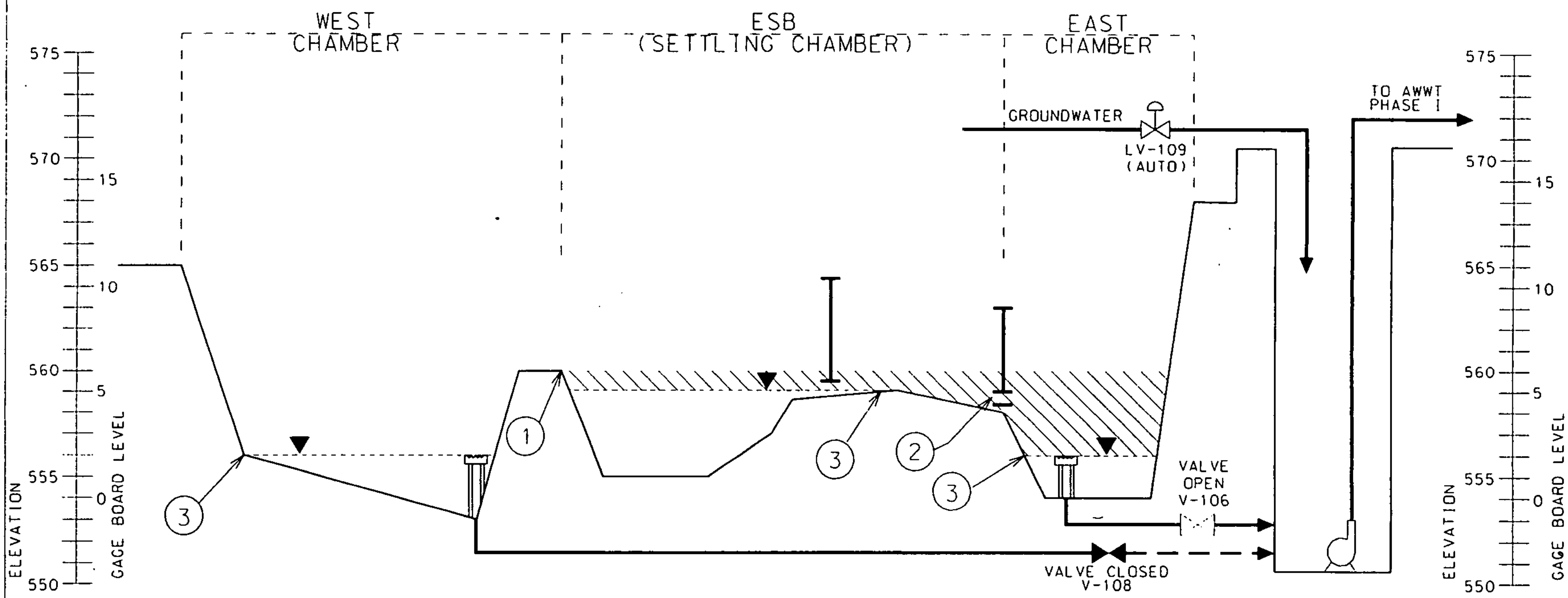
CASE I



NOTE:
CASE I: LOW LEVEL.

LEGEND:

① ORIFICE FLOW AT ELEVATION 560′ = APPROXIMATELY 400gpm

② ORIFICE (UNDER EXISTING HALF GATE)

③ MINIMUM LEVEL

MINIMUM WATER LEVEL FOR CASE I.

WATER LEVEL RANGE FOR CASE I.

VALVE OPEN

VALVE CLOSED

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STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 5-5. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE I)

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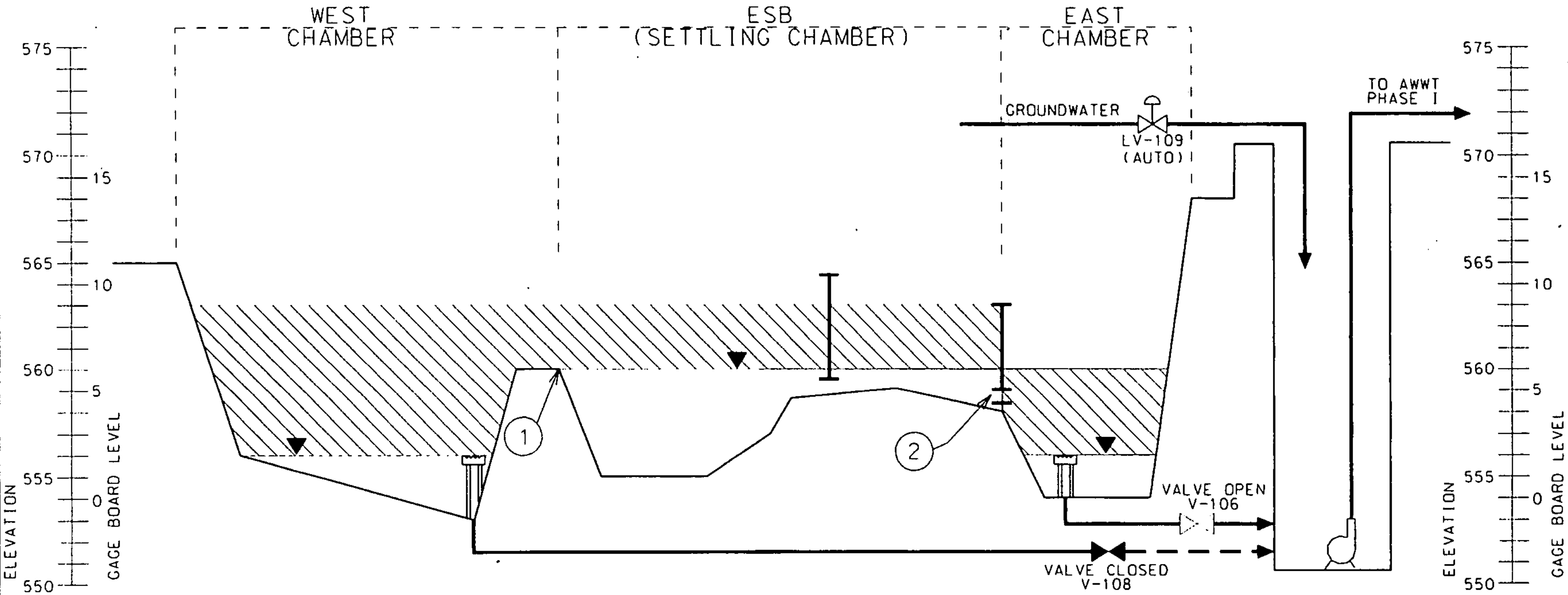
CASE II



NOTE:
V-106 OPEN; V-108 CLOSED UNTIL 8 HOURS AFTER PRECIPITATION STOPS.
AFTER 8 HOURS V-106 CLOSED AND V-108 OPEN.

LEGEND:

(1) ORIFICE FLOW AT ELEVATION 560' = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

MINIMUM WATER LEVEL FOR CASE II.

WATER LEVEL RANGE FOR CASE II.

VALVE OPEN

VALVE CLOSED

FINAL

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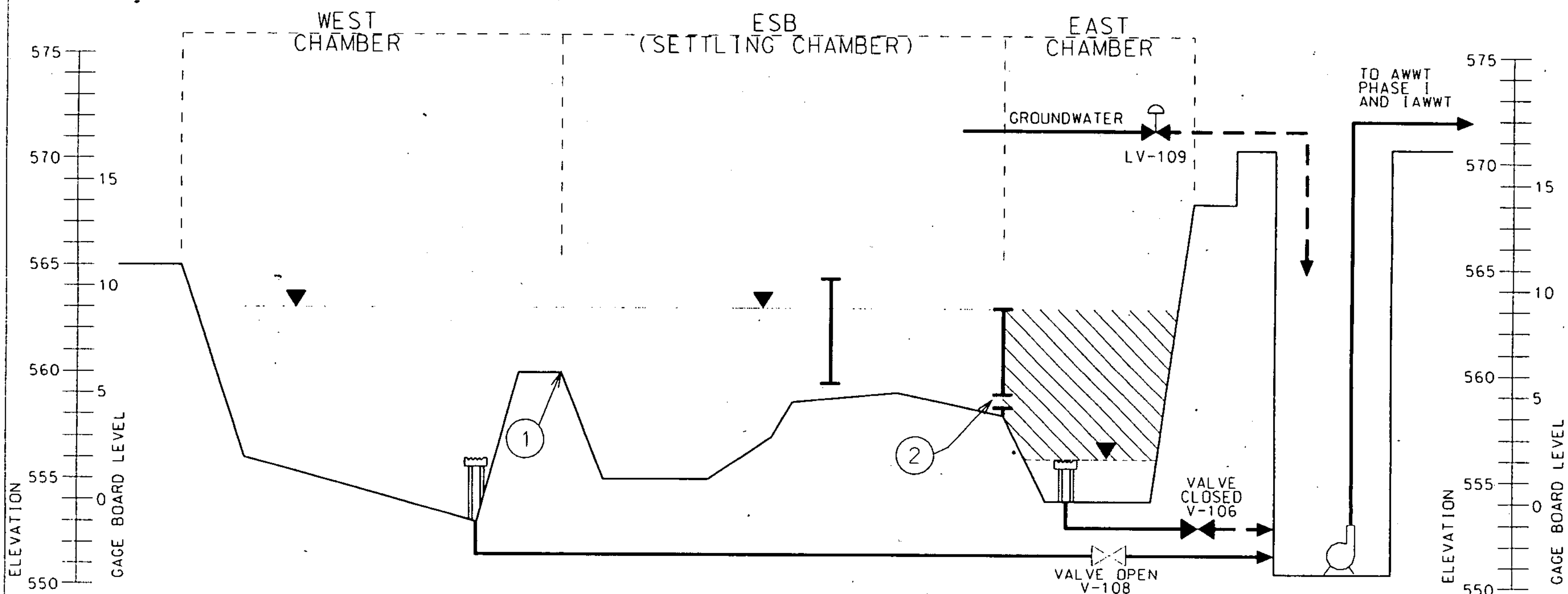
STATE PLAN[illegible] COORDINATE SYSTEM 1983

FIGURE 5-6. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE II)

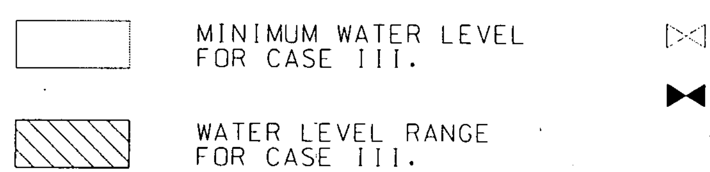
15-DEC-1999

CASE III



NOTE:
CASE III: WHEN OVERFLOW OF EAST HALF GATE OCCURS, START IAWWT TREATMENT ON STORM WATER

LEGEND:



(1) ORIFICE FLOW AT ELEVATION 560′ = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

MINIMUM WATER LEVEL FOR CASE III.

WATER LEVEL RANGE FOR CASE III.

VALVE OPEN

VALVE CLOSED

FINAL

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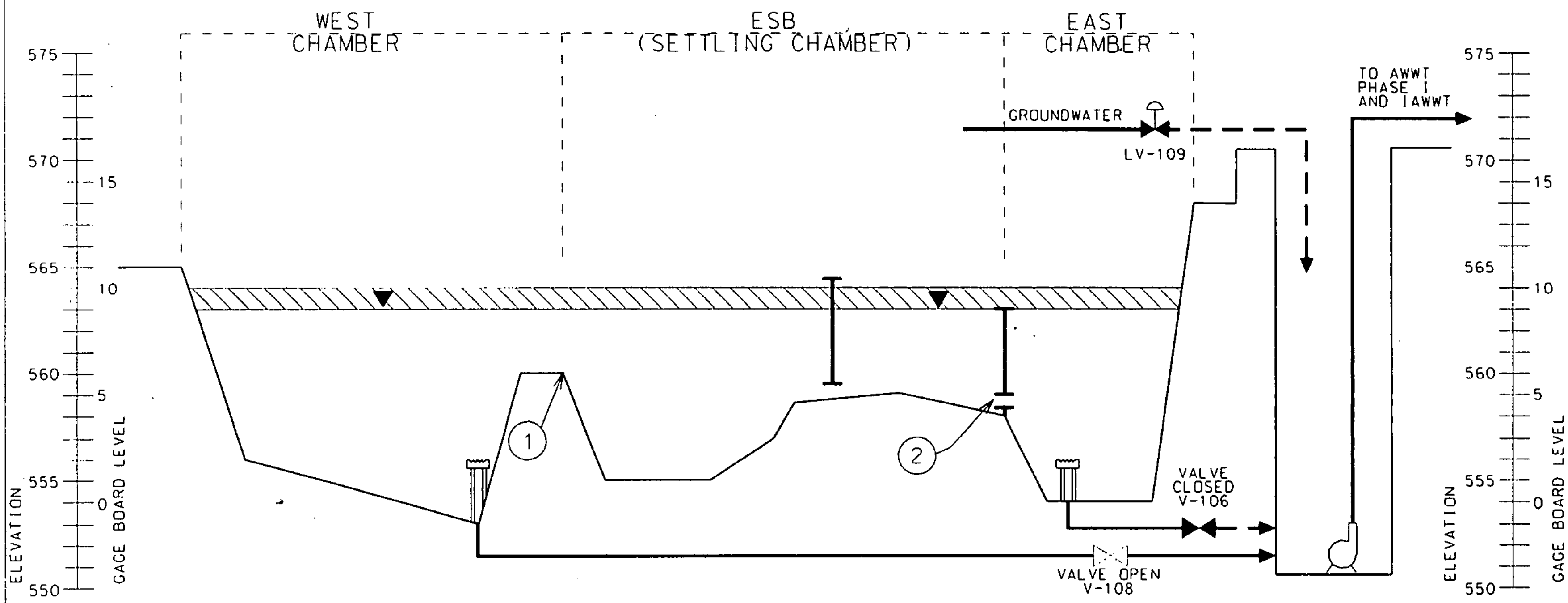
STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 5-7. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE III)

15-DEC-1999

CASE IV



NOTE:
CASE IV: ALL BASINS EQUALIZED.
SHUT DOWN SWURB PUMPS.

LEGEND:

(1) ORIFICE FLOW AT ELEVATION 560' = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

[ ] MINIMUM WATER LEVEL FOR CASE IV.

[hatched] WATER LEVEL RANGE FOR CASE IV.

VALVE OPEN

VALVE CLOSED

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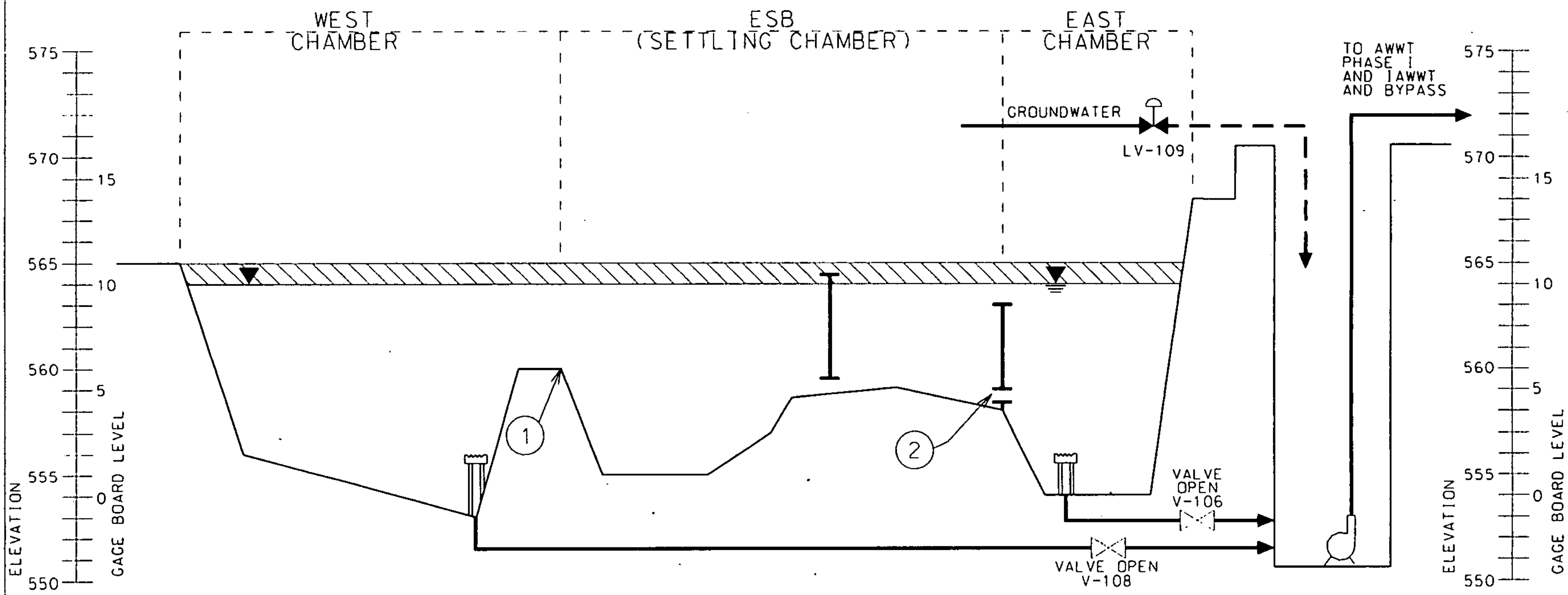
FIGURE 5-8. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE IV)

CASE V



NOTE:
CASE V: ALL BASINS REACH 10' LEVEL (564').
OPEN V-106 AND BEGIN BYPASS!
MAINTAIN BYPASS UNTIL LEVEL IS LESS THAN 9' (563').

LEGEND:

(1) ORIFICE FLOW AT ELEVATION 560' = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

MINIMUM WATER LEVEL FOR CASE V.

WATER LEVEL RANGE FOR CASE V.

VALVE OPEN

VALVE CLOSED

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STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 5-9. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE V)

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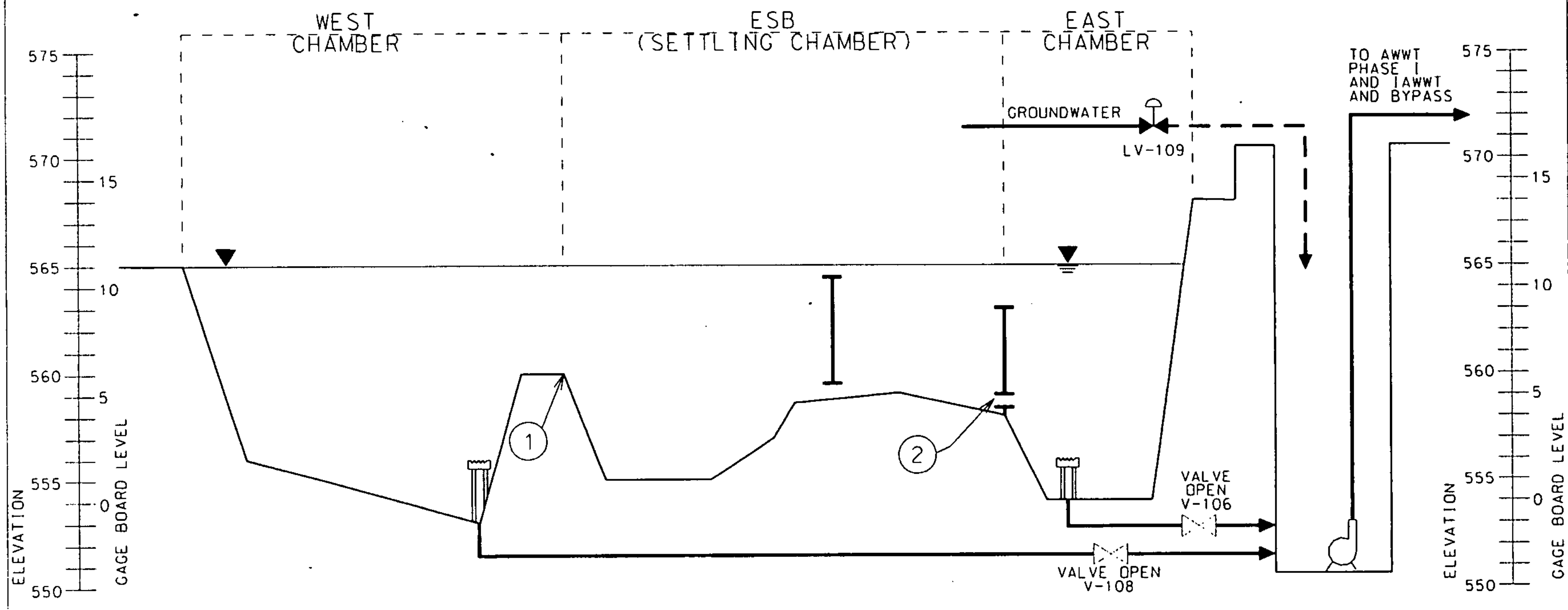
CASE VI



NOTE:
CASE VI: OVERFLOW.

LEGEND:

(1) ORIFICE FLOW AT ELEVATION 560′ = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

WATER LEVEL FOR CASE VI. (OVERFLOW = 565′)

VALVE OPEN

VALVE CLOSED

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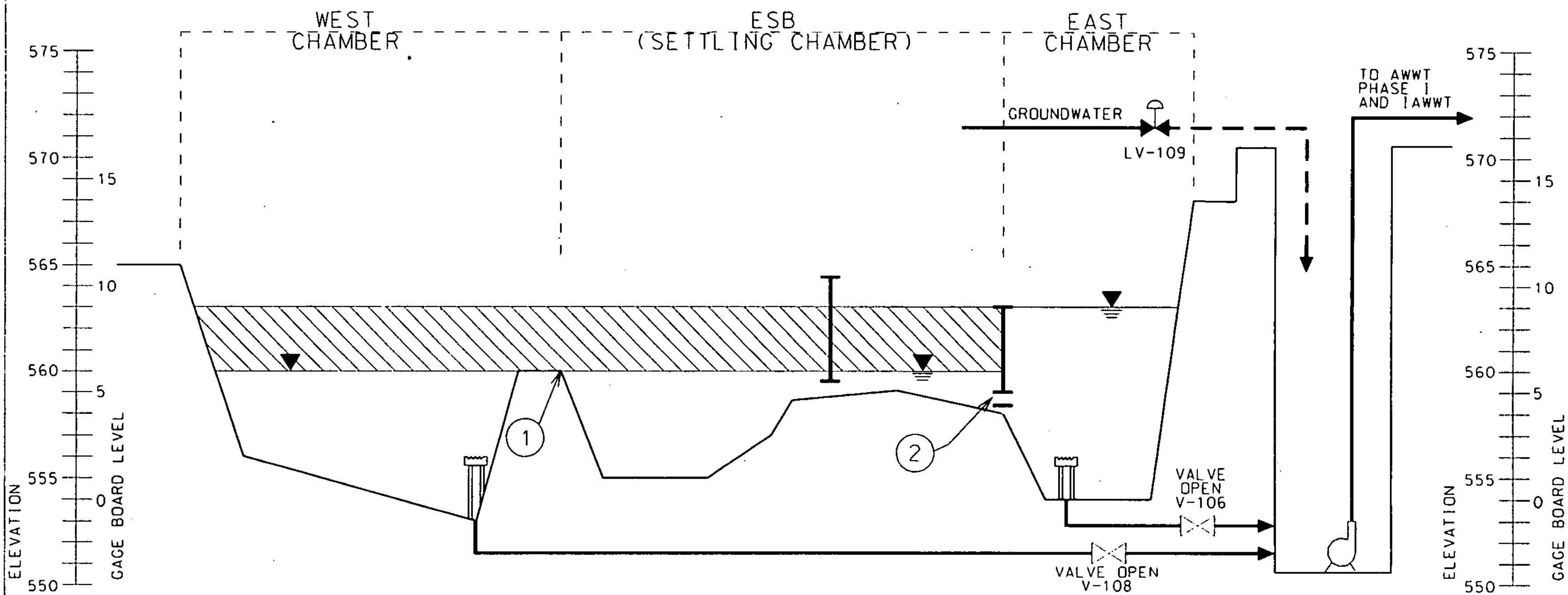
STATE PLANE COORDINATE SYSTEM 1983

FIGURE 5-10. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE VI)

15-DEC-1999

CASE VII



NOTE:
CASE VII; STOP BYPASS AT LESS THAN 9'.
TURN SWURB PUMPS TO AUTO WHEN EAST
CHAMBER IS LESS THAN 6', (560').

LEGEND:

(1) ORIFICE FLOW AT ELEVATION 560' = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

MINIMUM WATER LEVEL FOR CASE VII.

WATER LEVEL RANGE FOR CASE VII.

VALVE OPEN

VALVE CLOSED

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STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 5-11. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE VII)

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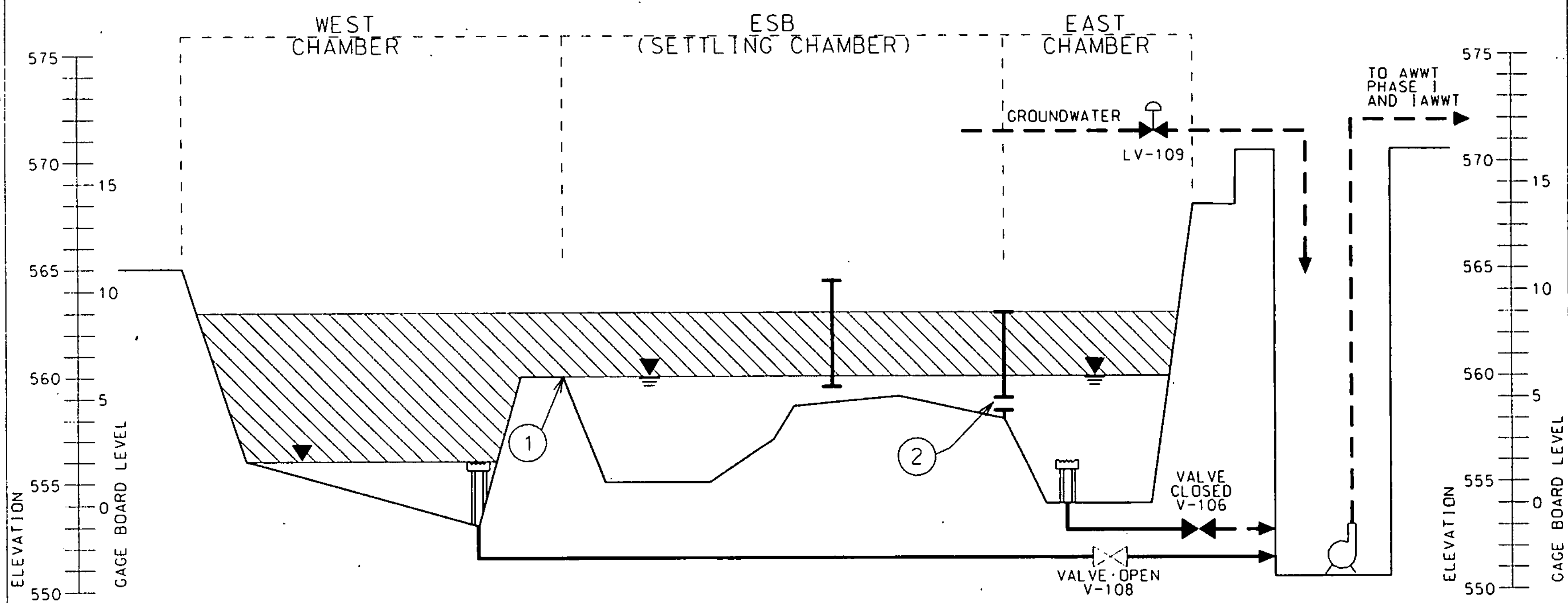
CASE VIII



NOTE:
CASE VIII; CLOSE V-106 WHEN WEST BASIN FALLS BELOW TOP OF HALF GATE AND DRAW WEST CHAMBER DOWN FIRST.

LEGEND:

(1) ORIFICE FLOW AT ELEVATION 560' = APPROXIMATELY 400gpm

(2) ORIFICE (UNDER EXISTING HALF GATE)

MINIMUM WATER LEVEL FOR CASE VIII.

WATER LEVEL RANGE FOR CASE VIII.

VALVE OPEN

VALVE CLOSED

FINAL

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STATE PLANAR COORDINATE SYSTEM 1983

FIGURE 5-12. STORM WATER RETENTION BASIN CROSS SECTION SCHEMATIC (CASE VIII)

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Figure 5-13
SWRB Flow Projection with Groundwater Treatment Projection

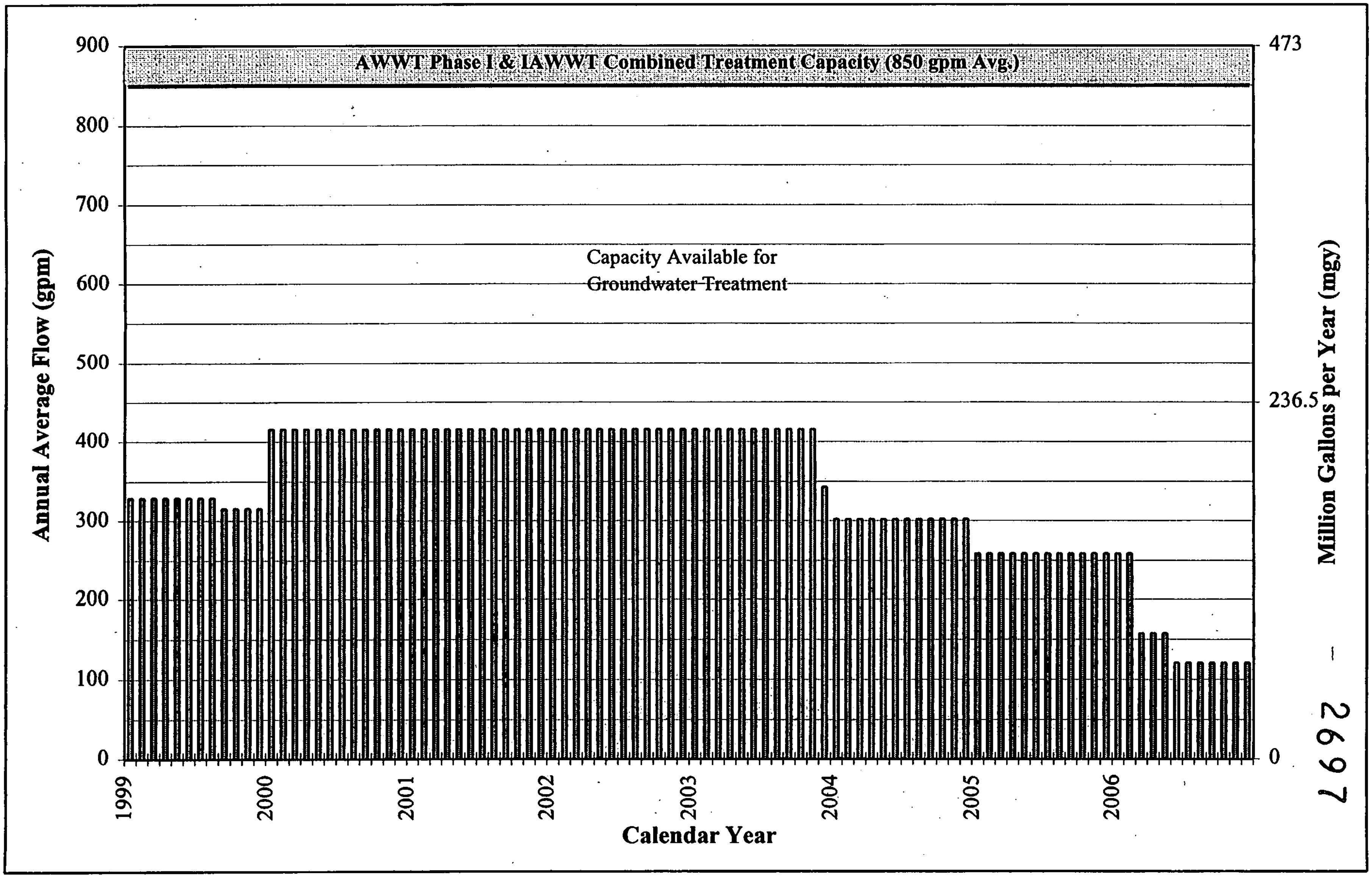

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Figure 5-14
Remediation Wastewater Flow Projection with Groundwater Treatment Projection

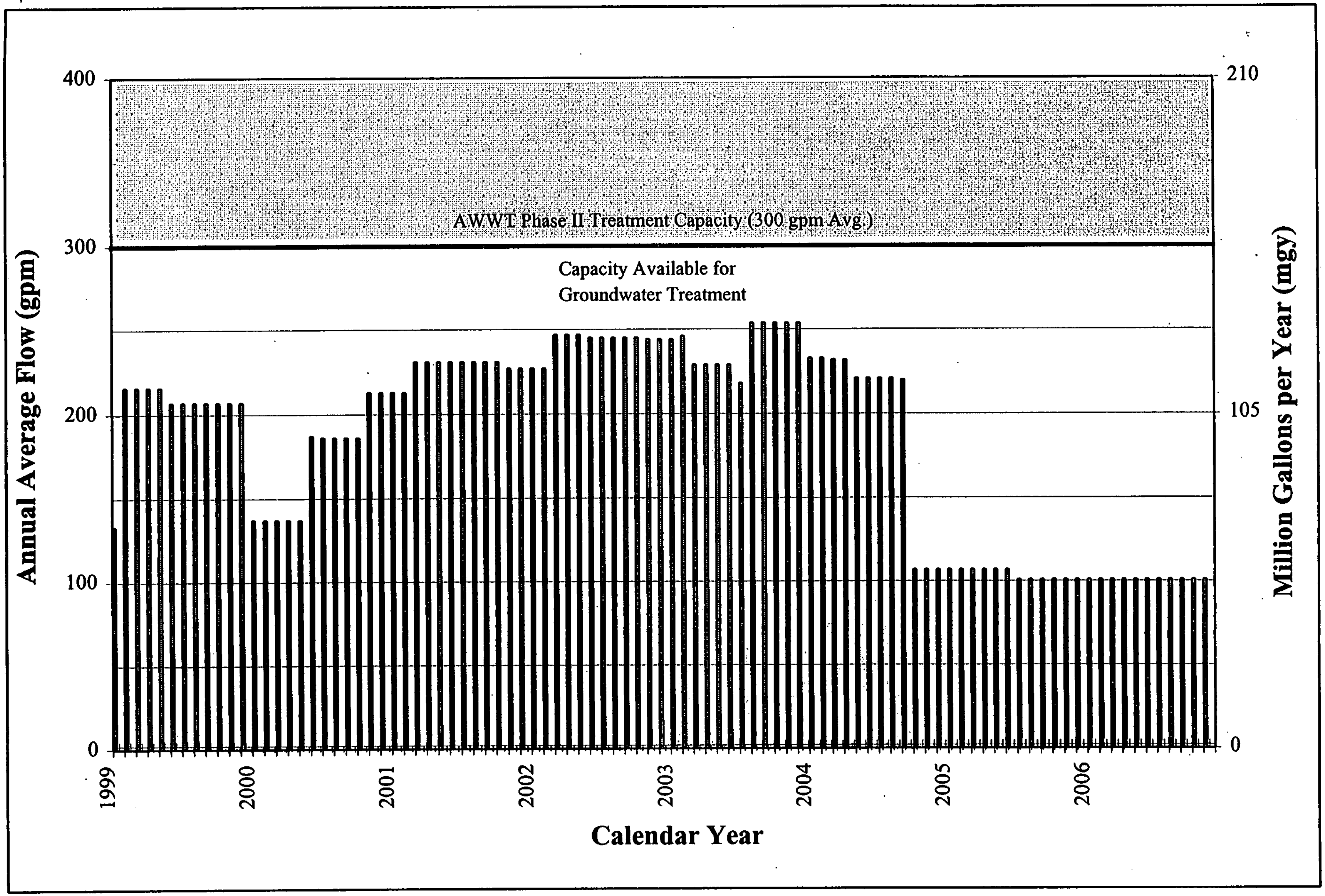

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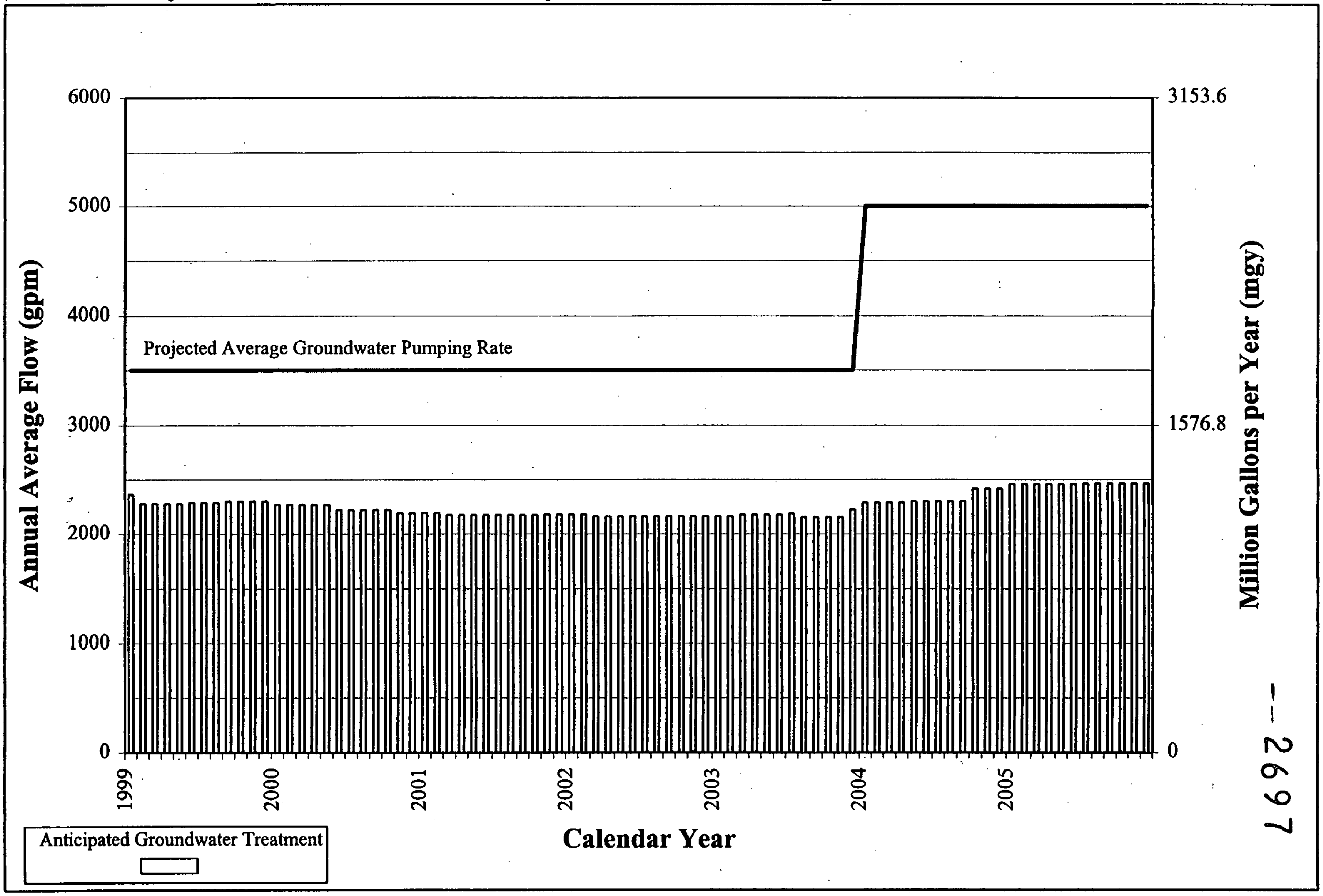
Figure 5-15

Summary Groundwater Flow Projection with Anticipated Groundwater Treatment



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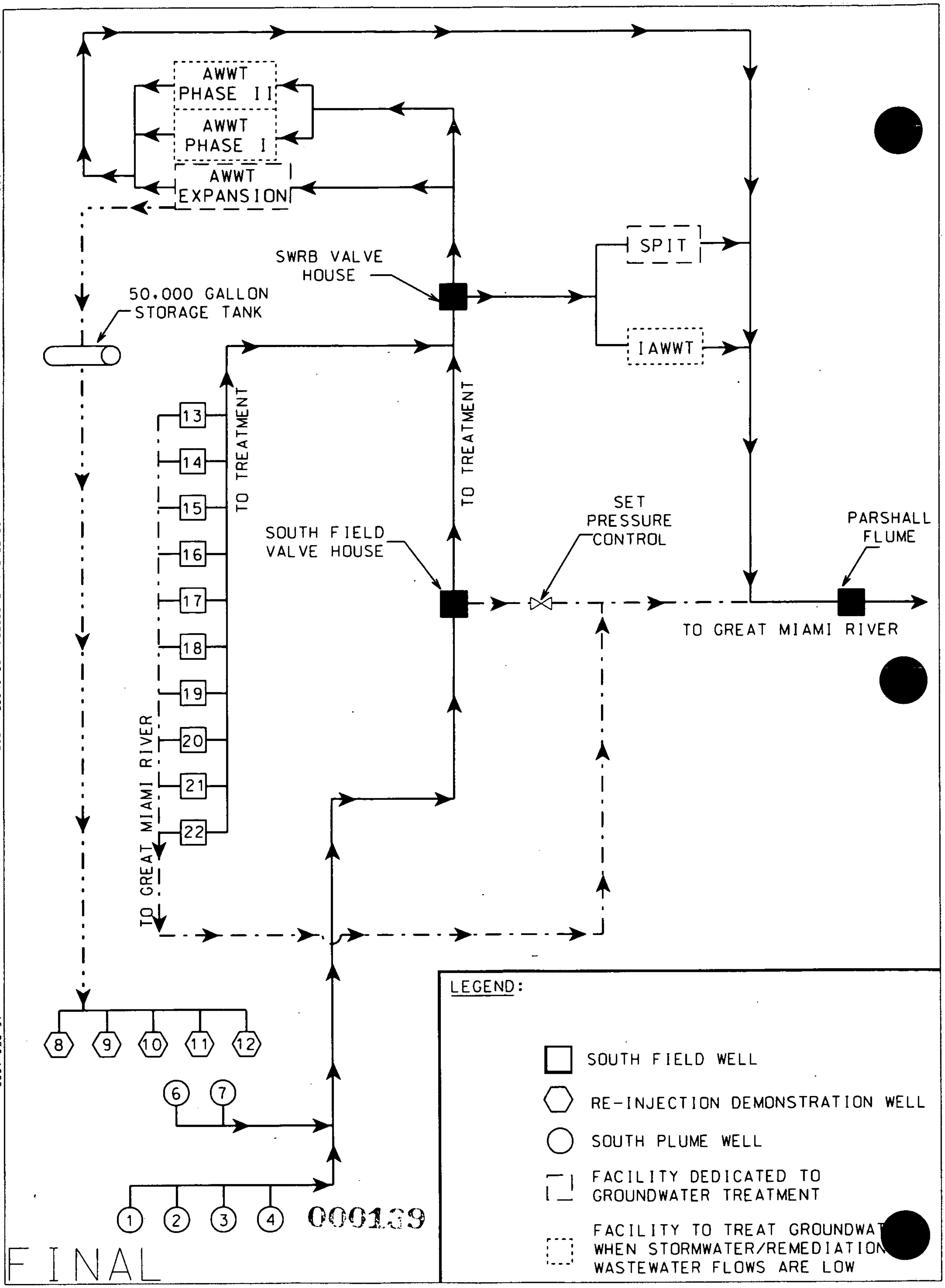

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FIGURE 5-16. CURRENT FEMP GROUNDWATER REMEDIATION/TREATMENT SCHEMATIC

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Section 6.0

6.0 OPERATIONS AND MAINTENANCE METHODS

This section describes the general methods, guidelines, and practices used in managing equipment operation and maintenance. Managing equipment operation and maintenance in the context of this document includes not only routine control panel monitoring and repair work, but also the preventive, predictive, and proactive actions used to maximize equipment operating efficiency and capacities. This section presents some of the management systems that will help to assure that the Operable Unit 5 ROD (DOE 1996b) requirements are met, describes the key parameters used to monitor the performance of the groundwater and wastewater facilities, and describes the principal features and maintenance needs of the overall operation.

The treatment and restoration well system performance parameters and maintenance requirements have unique differences. The treatment systems are designed and built with many redundant features and equipment to reduce potential downtime (for example, installed spare pumps and ion exchange units). Those features are not economically practical for the well systems. The equipment in the treatment systems has more easily discernible indicators of equipment condition and are more easily accessed for monitoring by operator walk-through than the underground well system. The methods used to measure the equipment condition and the specific measurable goals for the two systems also are different.

6.1 MANAGEMENT SYSTEMS

6.1.1 Maintenance and Support

The ARWWP is responsible for routine repairs, preventive maintenance, and minor modifications and improvements needed to maintain the operational capability of FEMP wastewater treatment facilities. Full-time maintenance supervision and skilled, qualified craftsmen (pipe fitters, welders, millwrights, electricians, instrumentation technicians, and asset preservation specialists) are headquartered in a combination shop/storage/office facility inside of Building 51. The operations and maintenance groups work together closely on a day-to-day basis, promoting a sense of ownership and cooperation between the operators and maintainers of this system.

The ARWWP technical staff directly supports facility operation and maintenance, and includes chemical and civil engineers, geologists and hydrogeologists, quality assurance, health, safety, and environmental compliance personnel. The technical staff works together to resolve issues and improve operations.

They also provide troubleshooting and technical assistance to the day-to-day operations and maintenance groups.

Key responsibilities of the central maintenance group include developing preventive maintenance schedules, developing spare parts inventories, developing maintenance work instructions, and administering the sitewide Computerized Maintenance Management System (CMMS). Specific engineering discipline skills may be utilized from the sitewide facilities engineering group for specific maintenance needs (for example, structural analysis, electrical power distribution design, and instrumentation system configuration). All work involving a modification is reviewed by knowledgeable, technical staff members to ensure that it is appropriate. All maintenance work is formally planned and scheduled, except for emergency repairs, which are handled in a safe, expeditious manner. Major system maintenance turnarounds are planned in detail to help minimize the duration of system outages.

The CMMS is used as a powerful maintenance management tool. Each specific piece of equipment (for example, every tank, pump, motor, flow meter, control valve, etc.) is assigned a unique, specific, identification number. All maintenance work performed by the skilled crafts (repairs, preventive maintenance, and minor modifications) is initiated by a work order request, written to the specific equipment number. Work order information is maintained in a database in the CMMS. Work orders may be initiated for a specific, one-time task or on an automated scheduled basis for routine repetitive work. For example, the CMMS is used to regularly schedule and document all instrumentation calibrations. Calibration/preventative maintenance schedules, maintenance work instructions and procedures, spare parts information (including inventory), and repair history information are documented in the CMMS database. The information inputs into the CMMS are provided by maintenance, operations, and engineering personnel. The data collected in the CMMS provides for the creation of equipment histories, which assists in the analysis of maintenance trends and costs.

The facilities consist of standard gravel-packed water wells and conventional water and wastewater treatment unit processes that are typical for the industry. It may be expected to have good reliability and has well-documented maintenance guidelines. Routine maintenance practices, as documented by the original equipment manufacturer's maintenance manuals, have been used to provide the basis for FEMP maintenance procedures and practices. A spare parts inventory (developed from original equipment manufacturer's recommendations) is maintained to expedite the completion of equipment repairs.

6.1.2 Operations

Operating personnel play an important role in maximizing equipment operating efficiency and capacity. One significant duty of the facility operators is to identify and report existing and potential future equipment problems. Operators perform routine scheduled checks, inspections, and walk-throughs of the facilities and systems. Potential problems and maintenance needs are reported to supervision and maintenance work orders are initiated. Operators and Shift Supervisors maintain shift logbooks that document activities and specific actions taken during each shift. Information in the logbooks is used as the basis for transfer of duty from one shift to the next. The logbooks are kept as a historical record of operational activities. Management and technical staff periodically review the logbooks and roundsheets as additional assurance that the systems are being effectively operated.

6.1.2.1 Process Control

Facilities are staffed by operators and shift supervisors around the clock (24-hours per day, seven days per week, 365 days per year). The operators at AWWT and the SDF monitor the process using a distributed control system (DCS) located in control rooms. The DCS receives input from process meters (e.g., tank level and process flow meters) and from devices that indicate equipment status (e.g., valve position limit switches and motor run relays). The DCS outputs control signals to regulate the process (e.g., control valve positioning and motor start/stop control). The DCS uses desktop-style computer equipment (monitors, keyboards, and pointing devices) to provide a graphic operator-machine interface for the process monitoring and control. The DCS operator interface includes various process graphics screens depicting portions of the treatment system in piping and instrumentation diagram format and providing real time process measurements and information. The DCS system has graphic process trending capabilities, process alert and alarm management, and an historical database of all operator inputs and process alert/alarms. The DCS also provides an interface with new and existing well systems to provide enhanced real time monitoring and remote controls. The operators at AWWT and SDF also access process and equipment information by making "walking rounds" of all equipment in the process.

The other facilities have more traditional control panels or local control boards at the equipment. Operators at all the other facilities perform walking rounds to ensure correct operation of all equipment.

Information collected during the walking rounds is documented on rounds sheets which are reviewed each shift by the Shift Supervisor. If any unusual conditions are observed during the walking round, the operator immediately notifies the Shift Supervisor and appropriate corrective actions are taken.

6.1.2.2 Standard Operating Procedures

Each operation is performed in accordance with approved SOPs that are developed by the technical staff with the assistance of operations personnel. The SOPs are living documents that are reviewed periodically and revised as necessary for the safe and consistent operation of treatment processes. A list of current SOPs used is contained in Appendix C.

SOPs provide step-by-step instructions for performing wastewater treatment operations activities. They also contain health and safety precautions that must be followed while performing the steps contained in the procedure. SOPs are written from the perspective of the operator who will be performing the steps.

SOPs also contain instructions as to when management must be notified of non-routine operating conditions or events and to whom in ARWWP management these conditions must be reported. Reporting of these conditions or events to management beyond ARWWP and to outside agencies is discussed in Section 7.0 of this OMMP.

6.1.2.3 Conduct of Operations

The DOE Conduct of Operations standards (DOE Order 5480.19) are implemented for operations and maintenance through Standing Orders. The Standing Orders spell out the specific methods used by the project for the implementation of all eighteen chapters of DOE 5480.19. The chapter titles (which are indicative of the important operational protocol) are Operations Organization and Administration, Shift Routines and Operating Practices, Control Area Activities, Communications, Control of On-Shift Training, Investigation of Abnormal Events, Notifications, Control of Equipment and System Status, Lockouts and Tagouts, Independent Verification, Logkeeping, Operations Turnover, Operations Aspects of Facility Chemistry and Unique Processes, Required Reading, Timely Orders to Operators, Operations Procedures, Operator Aid Postings and Equipment and Piping Labeling. Implementation of the Standing Orders helps to assure clarity, consistency, and a common purpose in the day-to-day activities.

6.1.2.4 Training

A training and qualification program exists to ensure that all operating personnel involved in treating wastewater are qualified and competent for their positions. The goal of the training and qualification program is to prepare personnel for the operations team and to continually improve the team's knowledge and capabilities. The program consists of two major elements. An initial training program leads to operator qualification in wastewater treatment facilities. A continuing training program provides a means to update team members on changes to regulations, equipment, and procedures as well as information and exercises to improve understanding and performance. Along with the in-house training programs, the operators and supervisors of the wastewater systems affirm their competence through the requirement that they possess a Class I (or higher) Wastewater Operator's license.

6.1.2.5 Self-Assessments

Verification that personnel are operating according to the SOPs is accomplished through self-assessments and audits. Self-assessments are performed on a regular basis to ensure that the SOPs accurately reflect current operating conditions and to ensure that operations personnel are following the SOPs. Independent audits are performed to ensure that all activities in the wastewater treatment facilities are performed in accordance with internal and external requirements. The results of the self-assessments and audits are used to revise and update procedures and to improve performance of activities involved in wastewater treatment.

6.1.2.6 Oversight

In general, a much greater level of control and oversight exists in government work than that found in the private sector. In-depth safety review and analysis, job-specific health-and-safety plans and procedures, execution of internally generated permits, and careful reliance on personal protective equipment are used to help reduce employee exposures to risks, to levels as low as reasonably achievable. This level of control requires formal, written documentation, analysis, and justification, lengthier authorization and approval chains, and a greater need to create and to ensure strict adherence to fixed rules and procedures.

6.2 RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE

This section describes the key performance monitoring and maintenance guidelines for the groundwater restoration well systems. To complete the aquifer restoration within the accelerated schedule, a high level of on-stream time at the modeled pumping rates is needed for each individual well. Some well downtime is expected and can be accommodated. However, lengthy outages can adversely impact the planned goals. An upgraded well maintenance program was recently developed to address this issue. More frequent component preventive maintenance checks along with periodic formal performance testing and well chlorination were identified and included as major program elements to improve well operating efficiency. The following sections provide a description of the highlights of the planned well maintenance program that is detailed in Appendix D.

6.2.1 Operational Monitoring and Performance Testing

The main system performance indicators for the wells will be gathered and summarized using formal performance tests to monitor the recovery well specific capacity and the pump/motor assembly performance. The test results will be used to determine the need for well redevelopment or pump/motor rebuilding. The information will help to minimize unscheduled, unplanned emergency maintenance and will help to shorten the duration of well outages. System operating parameters that will be routinely monitored include: 1) water level - static and pumping; 2) flow; 3) discharge pressure; and 4) motor amperage draw.

Water level, both static and pumping, will be measured periodically to detect significant changes. The drawdown from static water level to the pumping water level, compared to historical drawdown for an individual well, is an indication of the degree of fouling of the well screen and the surrounding formation. The vertical placement of the recovery well pump/motor assemblies is fixed, based upon an anticipated worst-case drawdown that is below the seasonal low-static water levels. While each pump setting has some added submergence to be conservative, pumping levels need to be routinely monitored in order to ensure that adequate pump/motor submergence is maintained and to prevent severe component damage. Each recovery well has an installed pressure transducer that can be linked to an automated data logger. These pressure transducers are located approximately one foot above the pump bowl assembly, well above the required minimum submergence for the pump intake. As long as the pumping water level is maintained above the transducer, adequate pump intake submergence is assured. If the pumping water level above the pressure transducer approaches zero head (i.e., begins to approach the still acceptable level of one foot above the bowl assembly), well/screen maintenance actions will be taken.

Performance testing of the wells is anticipated to require an outage of approximately four-hours each. Until an adequate historical database is developed, the testing is planned to be conducted for each well on a quarterly basis. It is planned to measure static water level, then pump flow, discharge pressure, pumping water level, and motor amperage for at least five different flow rates for each performance test of a well.

The results of the performance measurements will be used to determine the condition of the pump/motor and of the well. The flow and discharge head will be plotted and compared to the manufacturer's pump curve and to previously developed head/flow curves. The amperage draw of the well's pump motor at various flows will also be compared to previous readings and pump/motor manufacturer published information. The static water level and pumping levels will be used to calculate drawdown and specific capacity (flow rate divided by drawdown) within the recovery well at various flows. As fouling and encrustation of the well progresses, drawdown within the well will increase for a given flow rate (the specific capacity will decrease). The need for well screen maintenance activities will be triggered by excessive drawdown. Maintenance work will be planned, scheduled, and performed to avoid costly damage to equipment such as the recovery well pump/motor assembly and to avoid lengthy unplanned outages.

6.2.2 Routine Well/Screen Maintenance

Well/screen routine maintenance is required to maximize system overall on-stream time and to minimize recovery well drawdown and the need for major rehabilitation. The recovery wells will be superchlorinated by the addition of sodium hypochlorite (an industrial strength bleach with 12.5 percent available chlorine). This is a common practice in the well water supply industry. The chlorination will serve to deter bacteria growth and buildup on the screen and in the local formation and will serve to increase long term well production. The procedure will be performed on each well on a scheduled basis or when pumping drawdown exceeds eight feet. It is anticipated to require an outage of 72-hours for each recovery well. Routine well superchlorination is currently being performed on a semi-annual basis. It is anticipated that periodic, major rehabilitation efforts will be required every few years, when the drawdown within the well becomes excessive and the superchlorination procedure is not adequately effective.

The basic procedure includes well shutdown, removal of the well cover, feed of a calculated quantity of sodium hypochlorite, well surging by pump stop and start, and a hold time to allow the sodium hypochlorite to react and dissipate. The hypochlorite quantity will be calculated to yield about 2000 to 3000 milligrams per liter (mg/L) available chlorine in the volume of water within the well screen assembly (between the static water level and bottom of the well screen). The reaction/dissipation time will be 24- to 72-hours during which the free chlorine residual is expected to fall to acceptable limits. It is anticipated that the water initially pumped from a superchlorinated well will contain turbidity and scale. The water quality of this discharge will be documented and controlled through the internal procedure for discharge of miscellaneous wastewater sources to treatment systems (EP-0005). Sampling and analysis of this water will be performed in order to document its chlorine content If after superchlorination, the drawdown remains excessive, more extensive rehabilitation efforts will be required.

6.3 TREATMENT FACILITIES PERFORMANCE MONITORING AND MAINTENANCE

This section describes the key performance monitoring parameters and maintenance needs for the wastewater treatment systems and their ancillary facilities. Meeting the FEMP effluent discharge uranium limit of 20 ppb on a monthly average basis, within the accelerated schedule, is an ambitious undertaking. The experience that has been gained in operating the various FEMP systems provides an increased confidence level that the limit may routinely be met. Round-the-clock vigilance and wise decision-making will be needed to ensure compliance.

6.3.1 Treatment Facilities Performance Monitoring

All of the FEMP's wastewater treatment systems use strong base-anion exchange as the final unit process for uranium removal. The strong base-anion exchange resins have a very strong affinity for the uranyl carbonates in the FEMP's wastewater. The technology is reliable; however, treatment to the effluent levels required at the FEMP (i.e., < 20 ppb) is not widely practiced in wastewater systems. An expected performance of the various FEMP treatment systems has been used in this plan to demonstrate the ability to meet the ROD effluent requirements. The performance expectations are, for the most part, based on historical FEMP operating experience, utilizing new resin, as opposed to vendor performance guarantees or widely published data.

The commissioning of the AWWT Phases I and II in January 1995 provided treatment for the wastewaters most highly contaminated with uranium. The AWWT Expansion System began operation in April 1998 and is dedicated to treating groundwater. Each FEMP treatment system has routinely reduced uranium concentrations by more than 90 percent and has reduced the total mass of uranium discharged to the Great Miami River. The total uranium discharged to the Great Miami River for the past six calendar years is as follows:

Year	Uranium Lbs. Discharged
1993	1044
1994	773
1995	393
1996	275
1997	126
1998	216

The amount of uranium discharged to the Great Miami River increased slightly in 1998 due to the operation of the new groundwater extraction wells and resulting bypass of some untreated groundwater.

Measurable parameters for the FEMP treatment systems are the total volume of water treated, the influent and effluent uranium concentrations and mass, and the total mass of uranium removed by treatment. The FEMP total effluent flow rate is metered. Flow weighted composite samples of the effluent are analyzed daily for total uranium. Those two parameters are used to measure compliance with the Operable Unit 5 ROD requirements for uranium discharge in the FEMP's effluent. Additionally, each individual wastewater treatment train has flow measurement and control. The individual treatment systems are also routinely sampled at strategic process locations, including the inlet and outlet of each ion exchange vessel. The sample results and treatment flow rates are reported, tracked, and used to determine the need for troubleshooting, process adjustments, and corrective actions. A daily summary sheet of all aquifer restoration and wastewater process data, including individual well and treatment system total flows and treatment train uranium inlet and outlet concentrations, is published and distributed to the project's management and technical staff. All of the routine uranium analytical work is conducted in a laboratory located within the AWWT, Building 51A.

Although operation and improvement efforts continue, the long-term ability to meet the 20 ppb monthly average limit remains unproven. The ion-exchange unit performance has been slightly erratic and somewhat unpredictable, most likely due to varying degrees of resin bed fouling. The available indicator of fouling (ion-exchange unit pressure drop) does not directly mathematically correlate with uranium removal capability. A management system involving timely sampling, analysis, and response has been implemented as a primary means of ensuring compliance.

6.3.2 Treatment Facilities Maintenance Practices

The treatment systems have been constructed with adequate installed spare equipment (e.g., spare pumps, multimedia filters, and ion exchangers) and with some alternate piping and valving configurations to minimize unscheduled outages. This redundancy helps to allow a treatment system to remain on line, even when a major component requires maintenance work. There are installed spare pumps to move the wastewater through each of the treatment systems. If an individual pump needs to be shut down (due to a failure or to investigate unusual conditions), the installed spare pump may be started and the treatment system kept on line. The AWWT Phase I and II ion-exchange trains include three vessels (two are operated in series while the third is an installed spare). If an individual ion-exchange unit needs to go off line (for maintenance, resin replacement, backwash, regeneration, inspection, etc.), the spare unit may be brought on line. The multimedia filter systems also include an additional filter allowing for off-line activities (similar to those of the ion-exchange vessels) enabling the treatment systems to stay on line at no loss in processing rate. The filtration systems (multi-media and activated carbon) are operated with multiple units in parallel flow. Even when a spare unit is unavailable, a filter shutdown leads to a reduction in throughput (not a complete system shutdown). The treatment systems also have piping bypasses around flow meters and control valves allowing for continued system operations, using manual means, during maintenance activities.

The AWWT Expansion System was been designed with only two ion exchange units per train. Normally, both units in a train operate in series. For short duration shutdowns of a single vessel (for example, backwashing, resin regeneration, minor maintenance, etc.) flow will be routed through one ion exchange unit only. Longer duration outages of a single vessel may necessitate specific well shutdowns, depending on the overall system performance and on the performance of the affected train. The two vessel per train configuration was selected during the project's design to provide a higher total system capacity and better equipment utilization within the remaining serviceable space in Building 51.

As described above, much of the routine preventive maintenance and repair work in the treatment systems can be accomplished without a unit shutdown, because of the installed spare equipment and bypass piping and valving. There are some planned maintenance activities that will result in treatment system outages. Current plans include an annual one-to-two-week shut down of the AWWT facilities to accommodate thorough tank inspections, cleanouts, and repairs. Those maintenance shutdowns will be scheduled (as much as can be made practical) during periods of expected low rainfall, and low storm water retention basin (SWRB) and BSL storage levels. That strategy will minimize the possibility that storm or remediation wastewaters could be discharged untreated. The Operable Unit 5 ROD provides for relief allowances from the effluent discharge limit of a monthly average of 20 ppb uranium concentration during periods of treatment plant scheduled maintenance. Decisions regarding well operations during treatment plant scheduled maintenance will be made on a case-by-case basis. For planned maintenance shutdowns, advance EPA approval will be obtained for relief allowances that may be requested.

Some breakdowns will lead to system shutdowns. Loss of utilities or a failure in the AWWT DCS would result in a system shutdown. (Note that the DCS is equipped with an uninterruptable power supply [UPS] that provides battery backup to the DCS in the event of a power failure.) All treatment systems will fail safely on loss of a utility or a major component and are not very complicated to restart. Spare parts inventories follow the original equipment manufacturer's recommendations and a corps of experienced, skilled craftsmen are available for emergency repairs in the treatment systems.

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Section 7.0

7.0 ORGANIZATIONAL ROLES, RESPONSIBILITIES, AND COMMUNICATIONS

This section presents the organizational roles and responsibilities with respect to implementation of this OMMP. Also presented are information needs and communications protocol for coordination with other FEMP project organizations outside the ARWWP and interaction with the EPA and OEPA.

7.1 ORGANIZATION ROLES AND RESPONSIBILITIES

7.1.1 DOE FEMP

The DOE Operable Unit 5 Team Leader is responsible for providing direction and oversight of all activities within the ARWWP.

7.1.2 Operating Contractor

Fluor Daniel Fernald (FDF), previously called Fernald Environmental Restoration Management Corporation (FERMCO), is the operating contractor for the FEMP. The ARWWP is one of several projects within the Soil & Water Projects Division. This division includes all projects covering the Operable Unit 1, 2, and 5 scopes of work. Hence, overall management authority and responsibility resides with the Soil & Water Projects Division Vice President, who reports directly to the Office of the President.

The ARWWP Manager, who reports directly to the SWP Vice President, has oversight authority and responsibility for the ARWWP. The following functional groups report directly to the ARWWP Manager:

- Engineering/Construction
- Operations
- Safety and Health
- Controls and Administration
- Hydrogeology.

The ARWWP Engineering/Construction Team is responsible for all engineering design and construction activities within the project which includes:

- Engineering functional requirements, design basis and detailed design drawings and documents
- Title III engineering support during construction
- Start-up Plans, System Operability Test procedures and supervise tests
- Standard Start-up Review Plans and coordinate resolution of issues
- Technical support to Operations
- Coordination of project-specific activities associated with procurement and management of construction contractors.

The ARWWP Operations Team is responsible for all operations and maintenance activities within the project which includes:

- Operations of groundwater extraction and injection well systems
- Operation of all site wastewater treatment systems and their ancillary facilities
- Estimate, plan, and execute corrective and preventative maintenance
- Training and qualification of operators and supervisors
- Develop, review and revise Standard Operating Procedures
- Sampling and analysis of process streams for compliance with operational parameters and established regulatory limits.

The ARWWP Safety and Health Team is responsible for all Safety and Health activities within the project which includes:

- Development and revision of Safety and Health Project matrixes for operations and construction
- Radiological monitoring of activities
- Industrial health monitoring of activities
- Oversight of construction and operations safety programs
- Safety design reviews and technical input.

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The ARWWP Controls and Administration Team is responsible for:

- Project cost and schedule baseline development and maintenance
- Monthly performance and variance reporting to DOE
- Estimate at completion funding analysis and reporting
- Change proposal and cost savings coordination
- Project Quality Assurance oversight.

The ARWWP Hydrogeology Team is responsible for all aquifer restoration planning and environmental monitoring/reporting activities within the project which includes:

- Developing and maintaining the aquifer restoration strategy
- Developing and implementing remedy performance groundwater monitoring, data evaluation, and reporting
- Technical input to management on recovery well operation and maintenance
- Fulfilling site NPDES reporting requirements
- Technical input to design and construction of site groundwater extraction/injection systems
- Analysis of state and federal regulations to identify project-specific regulatory requirements
- Preparation of required CERCLA documentation (e.g., RA Work Plan, Start-up Monitoring PSPs, IEMP groundwater section, and various other required reports).

7.2 INTEGRATION WITH OTHER PROJECT ORGANIZATIONS

Wastewater Acceptance Guidelines have been developed by ARWWP to assist the FEMP remediation projects in identifying wastewater issues and concerns. ARWWP has and will continue to: 1) work with the projects to obtain best estimates of water quality and quantity data during the design review process; 2) apply the guidelines to these estimates to identify areas of concern; and 3) interface with the projects to develop an awareness of the functions and capabilities of existing and planned site-wide water treatment facilities and handling operations. As noted above this integration occurs during design reviews. These reviews include as necessary, comment resolution meetings and alignment sessions.

7.3 REGULATORY AGENCY INTERACTION

Interaction with EPA and Ohio EPA regarding the OMMP occurs initially, during the review and comment resolution process. Future versions of the OMMP will also be submitted for review and will go through a review and comment resolution process similar to this submittal. As noted in Sections 1.0 and 3.0, Revision 1 of the IEMP (DOE 1998a) provides for the collection and reporting of groundwater remedy performance (IEMP Section 3.0) and treated effluent (IEMP Section 4.0) information that supports operational decisions regarding groundwater restoration and water treatment.

The current plan is that wellfield and treatment operational summaries are included as part of the IEMP quarterly and annual reports. These summaries allow for agency input as aquifer restoration and water treatment progress. In addition the NPDES and Federal Facilities Compliance Agreement reporting will continue as outlined in Section 4.0 of the IEMP. The Operable Unit 5 ROD required notifications of storm water bypasses of the SWRB will continue at the stipulated times. ARWWP participation in meetings and conference calls will continue as necessary.

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Appendix A

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APPENDIX A

CALCULATIONS SUPPORTING STORMWATER FLOW PROJECTIONS

APPENDIX A

This appendix was prepared in order to develop projections of the annual average discharge from the SWRB during remediation of the FEMP. These projections are summarized in Figure 4-7. Information used to prepare this appendix was obtained from:

1. Figure 4-3, "Generalized Sitewide Remediation Areas" (Section 4.0) and the current schedule for remediation of the areas.

2. Figure 4-6,. "Controlled Runoff Areas and Uncontrolled Flow Directions as of January 1, 1999" (Section 4.0)

3. Actual Storm Sewer Lift Station Flow Data 1990-1992 (Table 4-2)

4. Average Monthly and Annual Runoff Volume Calculation Spreadsheet (Attachment A.3)

CALCULATION OF STORMWATER FLOW PROJECTION

Background

Flows to the SWRB come from several sources. Attachment A.1 of this appendix summarizes the projected average flows to the SWRB through calendar year 2006. In projecting future flows to the SWRB, the following sources of water were used:

1) Stormwater Runoff - direct runoff from the former production area and administrative areas flows by gravity via the site storm sewer to the SWRB. A spread sheet calculation based on the average monthly rainfall is used to determine an average annual flow of stormwater to the SWRB. This spreadsheet uses the most recent estimates of site runoff coefficients and estimates an average annual stormwater runoff flow of 221 gpm. See Attachment A.2.

2) Dry Weather Flows - Perched groundwater that infiltrates the storm sewer system flows by gravity to the SWRB. An estimate of the average annual flow to the SWRB from this source was made using historical data presented in Table 4-2. The total flow from three years of dry weather pumping operations through the Storm Sewer Lift Station (SSLS) was used to estimate the an average continuous flow of 70 gpm to the SWRB.

3) Backwash Flows - In the future, all backwash flows from the IAWWT, SPIT, AWWT Phase I & II, and the AWWT Expansion will be routed to AWWT Phase I via the SWRB. The combined flow of backwashes to be routed to the SWRB is estimated at 100 gpm.

4) Wheel Wash/Dust Control Flows - Miscellaneous wheel wash activities on site contribute flow to the SWRB. This flow combined with various dust control activities is estimated to produce a continuous 20 gpm flow that contributes to the SWRB.

5) Miscellaneous Minor flows - Several soil remediation activities contribute flow to the SWRB at various times throughout the site remediation. These include the Southern Waste Units (SWU) at 18 gpm, Lime Sludge Pond flow at 5 gpm, and the Solid Waste Landfill flow at 5 gpm.

As the remediation of the former production area progresses and areas are certified clean, the contributing stormwater and dry weather flow allocations will be deducted from the flow to the SWRB. The summary plot of the data presented in Attachment A.2 is presented in Figure 4-7.

Miscellaneous Calculations used for Attachments A.1 and A.3:

1) Calculate Annual Average flow from the Southern Waste Units (Assume that the flow from this unit will cease in September of 1999).

Basin #1 contributing area = 10.2 acres (Total = 15.2 acres, but 5 acres is ponded)
Basin #2 contributing area = 6.0 acres
Basin #3 contributing area = 4.8 acres
Total Area SWU = 21.0 acres

Assume Runoff coef. = 0.4

Annual Total Flow (gal/yr) =
21 Ac. x 0.4 x 43,560 ft^2/Ac. x 7.48 gal/ft^3 x 40.8 in/yr ÷ 12 in/ft = 9,305,671 gal/yr.

Average Annual Flow Rate (gpm) =
9,305,671 gal/yr ÷ 365 day/yr. ÷ 1440 min/day = 17.7 gpm ...use 18 gpm

2) Calculate Q (gpm) for each of the remediation areas that make up the SWRB drainage area:

Area	Date Certified	% of Total Area	Stormwater	Dry Weather
3a	12/03	25	55 gpm	17.5 gpm
3b	01/05	15	33 gpm	10.5 gpm
4a	01/04	12.5	28 gpm	8.75 gpm
4b	06/06	12.5	28 gpm	8.75 gpm
5	03/06	35	77 gpm	24.5 gpm
	Totals	100%	221 gpm	70 gpm

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ATTACHMENT A.1

ATTACHMENT A.1

The accumulated 10-year frequency runoff volume was calculated using the rainfall-intensity-duration curve for Cincinnati, Ohio, prepared by the U.S. Weather Bureau. The individual points were calculated in the following manner:

1. The rainfall intensity in inches per hour was read from the curve of the corresponding storm duration using a return period of 10 years.
2. The value read is multiplied by the corresponding duration to give the total inches of rainfall which has occurred since the beginning of the storm (assumes worst case of storm peak occurs at the beginning of the storm).
3. Inches of rainfall is multiplied by:
   a. Area of drainage basin (163 acres)
   b. Drainage basin composite runoff factor (0.56)
   c. Proper conversion factors to give answer in million gallons.

EXAMPLE:

Duration = 1 hour

From chart - intensity is 1.8 inches per hour

Volume of Runoff =

1.8 in/hr x 1 hr x ft/12 in x 163 acres x 43560 ft/acre x 0.56 x 7.48 gal/cu ft = 4.46 million gallons

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ATTACHMENT A.2

FEMP SWRB FLOW PROJECTIONS

FEMP STORM WATER RETENTION BASIN FLOW PROJECTIONS

SWRB Flow with Time

	Month	Storm Flow (gpm)	Dry Wealhe Flow (gpm)	Treatment Backwash (gpm)	Wheel Was Flow (gpm)	SWU Flow (gpm)	LSP Flow (gpm)	Landfill Flow (gpm)	Area 3a Storm flow Removed (gpm)	Area 3a Dry flow Removed (gpm)	Area 3b Storm flow Removed (gpm)	Area 3b Dry flow Removed (gpm)	Area 4a Storm flow Removed (gpm)	Area 4a Dry flow Removed (gpm)	Area 4b Storm flow Removed (gpm)	Area 4b Dry flow Removed (gpm)	Area 5 Storm flow Removed (gpm)	Area 5 Dry flow Removed (gpm)	Month	Summary Flow
1999 January	1	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	1	329
February	2	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	2	329
March	3	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	3	329
April	4	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	4	329
May	5	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	5	329
June	6	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	6	329
July	7	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	7	329
August	8	221	70	0	20	18	0	0	0	0	0	0	0	0	0	0	0	0	8	329
September	9	221	70	0	20	0	5	0	0	0	0	0	0	0	0	0	0	0	9	316
October	10	221	70	0	20	0	5	0	0	0	0	0	0	0	0	0	0	0	10	316
November	11	221	70	0	20	0	5	0	0	0	0	0	0	0	0	0	0	0	11	316
December	12	221	70	0	20	0	5	0	0	0	0	0	0	0	0	0	0	0	12	316
2000 January	13	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	13	416
February	14	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	14	416
March	15	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	15	416
April	16	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	16	416
May	17	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	17	416
June	18	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	18	416
July	19	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	19	416
August	20	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	20	416
September	21	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	21	416
October	22	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	22	416
November	23	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	23	416
December	24	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	24	416
2001 January	25	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	25	416
February	26	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	26	416
March	27	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	27	416
April	28	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	28	416
May	29	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	29	416
June	30	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	30	416
July	31	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	31	416
August	32	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	32	416
September	33	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	33	416
October	34	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	34	416
November	35	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	35	416
December	36	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	36	416
2002 January	37	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	37	416
February	38	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	38	416
March	39	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	39	416
April	40	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	40	416
May	41	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	41	416
June	42	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	42	416
July	43	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	43	416
August	44	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	44	416
September	45	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	45	416
October	46	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	46	416
November	47	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	47	416
December	48	221	70	100	20	0	5	0	0	0	0	0	0	0	0	0	0	0	48	416

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FEMP STORM WATER RETENTION BASIN FLOW PROJECTIONS
(Continued)

SWRB Flow with Time

	Month	Storm Flow (gpm)	Dry Weathe Flow (gpm)	Treatment Backwash (gpm)	Wheel Was Flow (gpm)	SWU Flow (gpm)	LSP Flow (gpm)	Landfill Flow (gpm)	Area 3a Storm flow Removed (gpm)	Area 3a Dry flow Removed (gpm)	Area 3b Storm flow Removed (gpm)	Area 3b Dry flow Removed (gpm)	Area 4a Storm flow Removed (gpm)	Area 4a Dry flow Removed (gpm)	Area 4b Storm flow Removed (gpm)	Area 4b Dry flow Removed (gpm)	Area 5 Storm flow Removed (gpm)	Area 5 Dry flow Removed (gpm)	Month	Summary Flow
2003 January	49	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	49	416
February	50	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	50	416
March	51	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	51	416
April	52	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	52	416
May	53	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	53	416
June	54	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	54	416
July	55	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	55	416
August	56	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	56	416
September	57	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	57	416
October	58	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	58	416
November	59	221	70	100	20	0	0	5	0	0	0	0	0	0	0	0	0	0	59	416
December	60	221	70	100	20	0	0	5	-55	-17.5	0	0	0	0	0	0	0	0	60	343.5
2004 January	61	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	61	302.25
February	62	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	62	302.25
March	63	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	63	302.25
April	64	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	64	302.25
May	65	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	65	302.25
June	66	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	66	302.25
July	67	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	67	302.25
August	68	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	68	302.25
September	69	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	69	302.25
October	70	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	70	302.25
November	71	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	71	302.25
December	72	221	70	100	20	0	0	0	-55	-17.5	0	0	-27.5	-8.75	0	0	0	0	72	302.25
2005 January	73	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	73	258.75
February	74	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	74	258.75
March	75	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	75	258.75
April	76	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	76	258.75
May	77	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	77	258.75
June	78	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	78	258.75
July	79	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	79	258.75
August	80	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	80	258.75
September	81	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	81	258.75
October	82	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	82	258.75
November	83	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	83	258.75
December	84	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	84	258.75
2006 January	85	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	85	258.75
February	86	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	0	0	86	258.75
March	87	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	-77	-24.5	87	157.25
April	88	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	-77	-24.5	88	157.25
May	89	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	0	0	-77	-24.5	89	157.25
June	90	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	90	121
July	91	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	91	121
August	92	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	92	121
September	93	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	93	121
October	94	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	94	121
November	95	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	95	121
December	96	221	70	100	20	0	0	0	-55	-17.5	-33	-10.5	-27.5	-8.75	-27.5	-8.75	-77	-24.5	96	121

ATTACHMENT A.3

CALCULATION OF AVERAGE MONTHLY AND ANNUAL RUNOFF VOLUMES FROM FEMP PRODUCTION AREAS

CALCULATION OF AVERAGE MONTHLY AND ANNUAL RUNOFF VOLUMES FROM FEMP PRODUCTION AREAS

Average Monthly and Annual Runoff Volumes from FEMP Production Areas

Original Basin Calculation

Source	Area (Ac.)	Orig. Runof Coeff. (C)	10-yr Storm Vol.	Area (Ac.)	New Runoff Coeff. (C)	January 3.21	February 2.82	March 3.98	April 3.66	May 4.17	June 3.97	July 4.00	August 3.26	September 2.72	October 2.66	November 3.29	December 3.12	Annual Rainfall 40.86	Sum of Monthly Volumes (CROSS-CHECK)
Paved Areas and Roofs (Note	76	0.8	6,768,550	76	0.9	5,961,690	5,237,372	7,391,752	6,797,440	7,744,625	7,373,180	7,428,897	6,054,551	5,051,650	4,940,216	6,110,267	5,794,539	75,886,179	75,886,179
Compacted Areas (Note B)	N/A	0.9	#VALUE!	5.86	0.9	459,678	403,829	569,943	524,118	597,151	568,511	572,807	466,838	389,509	380,917	471,134	446,789	5,851,224	5,851,224
Grassed Areas Including Gravel	80.2	0.3	2,678,476	74.34	0.3	1,943,825	1,707,659	2,410,100	2,216,323	2,525,155	2,404,045	2,422,211	1,974,102	1,647,104	1,610,771	1,992,269	1,889,325	24,742,888	24,742,888
Basin- Plastic and grassed	6.6	0.95	698,007	6.6	0.95	546,488	480,092	677,577	623,099	709,924	675,875	680,982	555,000	463,068	452,853	560,108	531,166	6,956,233	6,956,233
Total	162.8		#VALUE!	162.8															
Original Composite "C" =		0.56																	
Added/Deleted Source				Area (Ac.)	Runoff Coeff. (C)														
1. Coal Pile Runoff				1.65	0.8	115,050	101,072	142,648	131,179	149,458	142,289	143,365	116,842	97,488	95,338	117,917	111,824	1,464,470	1,464,470
2. Decontamination Pad				1.2	0.9	94,132	82,695	116,712	107,328	122,284	116,419	117,298	95,598	79,763	78,003	96,478	91,493	1,198,203	1,198,203
3. Parking Lot				-11	0.9	-862,876	-758,041	-1,069,859	-983,840	-1,120,933	-1,067,171	-1,075,235	-876,317	-731,160	-715,031	-884,381	-838,683	-10,983,526	-10,983,526
4. A1PI Stockpiles				12	0.4	418,364	367,535	518,719	477,013	543,482	517,416	521,326	424,881	354,502	346,682	428,791	406,634	5,325,346	5,325,346
5. OSDF Haul Road				2.5	0.8	174,318	153,140	216,133	198,756	226,451	215,590	217,219	177,034	147,709	144,451	178,663	169,431	2,218,894	2,218,894
6. RIMIA Area Drive				0.8	0.9	62,755	55,130	77,808	71,552	81,522	77,612	78,199	63,732	53,175	52,002	64,319	60,995	798,802	798,802
7. East Fence Line Area				1.75	0.4	61,011	53,599	75,647	69,564	79,258	75,457	76,027	61,962	51,698	50,558	62,532	59,301	776,613	776,613
8. Area South of AWWT Pad				1.5	0.75	98,054	86,141	121,575	111,800	127,379	121,269	122,186	99,581	83,086	81,254	100,498	95,305	1,248,128	1,248,128
9. Haul Road N.W.				0.5	0.8	34,864	30,628	43,227	39,751	45,290	43,118	43,444	35,407	29,542	28,890	35,733	33,886	443,779	443,779
10. Southern Waste Units (Note C)																			
Added/Deleted Areas Net Total:				10.9															
Total Drainage Area =				173.7															
New Composite Runoff Coeff. "C" =					0.60														
Total Runoff to SWRB =						9,107,352	8,000,852	11,291,982	10,384,084	11,831,047	11,263,610	11,348,726	9,249,211	7,717,133	7,546,903	9,334,327	8,852,006	115,927,233	115,927,233

Total Runoff using new coeff. = 40.86 x 0.60 x 173.7 x 43560 x 7.48/12 = 115,927,233

Average Annual Runoff Flow (gpm) = 115,927,233 /1440/365 221

Notes:

A) Additional research indicates that accepted runoff coefficient factor for paved areas is probably higher than originally used.

B) Compacted Areas are those areas that have been modified to increase the runoff Coefficient.
These include the following areas:

Plant 1 Pad	1.97
Haul Road (within the former production area)	2.03
TACO Trailer complex and adjacent parking lot	1.46
Eight-plex Trailers	0.4
total area	5.86

C) Southern Waste Units have separate basins to handle their runoff not ancticipated by the OMMP.

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Appendix B

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APPENDIX B

CALCULATIONS SUPPORTING REMEDIATION WASTEWATER FLOWS

APPENDIX B

This appendix was prepared to develop flow projections for the various remediation wastewater sources that will be treated in AWWT Phase II.

Calculation of Remediation Wastewater Flow Projections

Background

Remediation wastewater flows to AWWT Phase II are generated by several sources. Attachment B.1 of this appendix summarizes projections of all of the various remediation wastewater flows. Additionally, Attachment B.1 also presents adjusted flow projections which account for the 90th percentile rainfall throughout remediation. The rainfall impacted flow projections were factored up by 21 percent in order to account for the 90th percentile rainfall as summarized in Section 4.2. In generating the estimates for wastewater projections, the following sources and assumptions were used:

- WPRAP Wastewater flows - The contributions from WPRAP were projected according to the project phasing presented in Attachment B.2. The projection spreadsheet in Attachment B.1 breaks the total contribution of wastewater by phase into two separate components: Fixed flows, and Variable flows. The variable flows are those that are influenced by precipitation. Additionally, the phase-by-phase flows were time weighted in order to account for overlapping phases in the WPRAP remediation timeline.

- WPRAP Storm Water Management (SWM) Pond flow - This source of wastewater is currently operated by the ARWWP Wastewater Operations group and is always directed to the BSL for eventual treatment in AWWT Phase II. However, when control of this pond reverts to the ARASA contractor, it is anticipated that this flow will be directed to either Paddys Run or to the BSL. For the purpose of these flow projections, it was assumed that this flow would be directed to the BSL approximately one-half of the time. Therefore the estimated 11.8 gpm stream is reduced by 50 percent after May of 1999 to reflect the reduction of flow due to discharge to Paddys Run.

- OSDF Wastewater - Flows from the OSDF include stormwater runoff from active cells as well as leachate generated by all cells. This flow is transferred by the Leachate Conveyance system at an estimated 30 gpm average annual flow rate.

- SCEP Wastewater - The Soil Characterization/Excavation Project flow projection is based upon a 50 gpm average annual flow allocation in AWWT Phase II. This flow is anticipated to begin in June of 2000. This flow allocation is expected to be influenced by rainfall.

- Silos Project Wastewater - The Silos project wastewater projection is based on a 10 gpm average annual flow allocation in AWWT Phase II, and is currently being received via the High Nitrate Tank. This flow is expected to be influenced by rainfall.

- ARWWP General Sump Flows - the current flows from the general sump are expected to continue at a flow rate of 5 gpm. As the physical connections between the general sump and the BSL are severed , it is anticipated that this flow will continue by truck hauled batches of miscellaneous wastewaters.

- ARWWP Backwash Flows - This flow projection assumes that the current combined AWWT backwash flow rate is approximately 70 gpm. These flows are planned to be rerouted from AWWT Phase I to AWWT Phase II. This shift of flow is anticipated to occur by January of 2000.

These sources of remediation wastewaters are presented in Attachment B.1 and the projected flow is summarized graphically in Figures 5-3 and 5-4 (Shadow plots showing effect of backwash reroute). Figure 5-3 shows the average annual flow projection of remediation wastewaters assuming average amounts of rainfall while Figure 5-4 shows the same remediation wastewater flow projection prorated to account for excessive rainfall amounts (90^{th} percentile).

ATTACHMENT B.1

REMEDIATION WASTEWATER FLOW PROJECTION SPREADSHEET

REMEDIATION WASTEWATER FLOW PROJECTION SPREADSHEET

	Month	WPRAP Phase	WPRAP Total Flow (gpm)	WPRAP Fixed Flow (gpm)	WPRAP Variable Flow (gpm)	WPRAP SWM Pond Flow (gpm) (Note 1)	OSDF Flow (gpm)	SCEP Flow (gpm)	Silos Project Fixed Flow (gpm)	Silos Project Storm Flow (WPARCP) (gpm)	ARWWP Gen Sump Flow (gpm)	ARWWP Backwash Flow (gpm)	Total Average Annual Flow (gpm)	Total Ave. Annual Plus B/W Flow (gpm)	Subtotal of Rain Influenced Flows (gpm)	1.21 x Rain Influenced Flows (gpm)	Subtotal of Fixed Flows (gpm)	Total Wet Weather Flow (gpm)	Wet Weather Plus B/W Flow (gpm)
1999 January	1	N/A	0	0	0	11.8	30	0	10	6	5	70	132.8	132.8	62.8	75.988	70	145.988	145.988
February	2	1	83	34	49	11.8	30	0	10	6	5	70	215.8	215.8	111.8	135.278	104	239.278	239.278
March	3	1	83	34	49	11.8	30	0	10	6	5	70	215.8	215.8	111.8	135.278	104	239.278	239.278
April	4	1	83	34	49	11.8	30	0	10	6	5	70	215.8	215.8	111.8	135.278	104	239.278	239.278
May	5	1	83	34	49	11.8	30	0	10	6	5	70	215.8	215.8	111.8	135.278	104	239.278	239.278
June	6	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
July	7	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
August	8	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
September	9	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
October	10	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
November	11	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
December	12	2	80	34	46	5.9	30	0	10	6	5	70	206.9	206.9	102.9	124.509	104	228.509	228.509
2000 January	13	2	80	34	46	5.9	30	0	10	6	5	0	136.9	206.9	102.9	124.509	34	158.509	228.509
February	14	2	80	34	46	5.9	30	0	10	6	5	0	136.9	206.9	102.9	124.509	34	158.509	228.509
March	15	2	80	34	46	5.9	30	0	10	6	5	0	136.9	206.9	102.9	124.509	34	158.509	228.509
April	16	2	80	34	46	5.9	30	0	10	6	5	0	136.9	206.9	102.9	124.509	34	158.509	228.509
May	17	2	80	34	46	5.9	30	0	10	6	5	0	136.9	206.9	102.9	124.509	34	158.509	228.509
June	18	2	80	34	46	5.9	30	50	10	6	5	0	186.9	256.9	152.9	185.009	34	219.009	289.009
July	19	3	79	34	45	5.9	30	50	10	6	5	0	185.9	255.9	151.9	183.799	34	217.799	287.799
August	20	3	79	34	45	5.9	30	50	10	6	5	0	185.9	255.9	151.9	183.799	34	217.799	287.799
September	21	3	79	34	45	5.9	30	50	10	6	5	0	185.9	255.9	151.9	183.799	34	217.799	287.799
October	22	3	79	34	45	5.9	30	50	10	6	5	0	185.9	255.9	151.9	183.799	34	217.799	287.799
November	23	4	106	34	72	5.9	30	50	10	6	5	0	212.9	282.9	178.9	216.469	34	250.469	320.469
December	24	4	106	34	72	5.9	30	50	10	6	5	0	212.9	282.9	178.9	216.469	34	250.469	320.469
2001 January	25	4	106	34	72	5.9	30	50	10	6	5	0	212.9	282.9	178.9	216.469	34	250.469	320.469
February	26	4	106	34	72	5.9	30	50	10	6	5	0	212.9	282.9	178.9	216.469	34	250.469	320.469
March	27	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
April	28	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
May	29	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
June	30	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
July	31	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
August	32	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
September	33	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
October	34	5	124	34	90	5.9	30	50	10	6	5	0	230.9	300.9	196.9	238.249	34	272.249	342.249
November	35	6	120	34	86	5.9	30	50	10	6	5	0	226.9	296.9	192.9	233.409	34	267.409	337.409
December	36	6	120	34	86	5.9	30	50	10	6	5	0	226.9	296.9	192.9	233.409	34	267.409	337.409
2002 January	37	7	120	34	86	5.9	30	50	10	6	5	0	226.9	296.9	192.9	233.409	34	267.409	337.409
February	38	7	120	34	86	5.9	30	50	10	6	5	0	226.9	296.9	192.9	233.409	34	267.409	337.409
March	39	8	140	34	106	5.9	30	50	10	6	5	0	246.9	316.9	212.9	257.609	34	291.609	361.609
April	40	8	140	34	106	5.9	30	50	10	6	5	0	246.9	316.9	212.9	257.609	34	291.609	361.609
May	41	8	140	34	106	5.9	30	50	10	6	5	0	246.9	316.9	212.9	257.609	34	291.609	361.609
June	42	9	138	34	104	5.9	30	50	10	6	5	0	244.9	314.9	210.9	255.189	34	289.189	359.189
July	43	9	138	34	104	5.9	30	50	10	6	5	0	244.9	314.9	210.9	255.189	34	289.189	359.189
August	44	9	138	34	104	5.9	30	50	10	6	5	0	244.9	314.9	210.9	255.189	34	289.189	359.189
September	45	9	138	34	104	5.9	30	50	10	6	5	0	244.9	314.9	210.9	255.189	34	289.189	359.189
October	46	9	138	34	104	5.9	30	50	10	6	5	0	244.9	314.9	210.9	255.189	34	289.189	359.189
November	47	10	137	34	103	5.9	30	50	10	6	5	0	243.9	313.9	209.9	253.979	34	287.979	357.979
December	48	10	137	34	103	5.9	30	50	10	6	5	0	243.9	313.9	209.9	253.979	34	287.979	357.979

REMEDIATION WASTEWATER FLOW PROJECTION SPREADSHEET

(Continued)

	Month	WPRAP Phase	WPRAP Total Flow (gpm)	WPRAP Fixed Flow (gpm)	WPRAP Variable Flow (gpm)	WPRAP SWM Pond Flow (gpm)	OSDF Flow (gpm)	SCEP Flow (gpm)	Silos Project Fixed Flow (gpm)	Silos Project Storm Flow (WPARCP) (gpm)	ARWWP Gen Sump Flow (gpm)	ARWWP Backwash Flow (gpm)	Total Average Annual Flow (gpm)	Total Ave. Annual Plus B/W Flow (gpm)	Subtotal of Rain Influenced Flows (gpm)	1.21 x Rain Influenced Flows (gpm)	Subtotal of Fixed Flows (gpm)	Total Wet Weather Flow (gpm)	Wet Weather Plus B/W Flow (gpm)
2003 January	49	10	137	34	103	5.9	30	50	10	6	5	0	243.9	313.9	209.9	253.979	34	287.979	357.979
February	50	11	139	34	105	5.9	30	50	10	6	5	0	245.9	315.9	211.9	256.399	34	290.399	360.399
March	51	12	122	34	88	5.9	30	50	10	6	5	0	228.9	298.9	194.9	235.829	34	269.829	339.829
April	52	12	122	34	88	5.9	30	50	10	6	5	0	228.9	298.9	194.9	235.829	34	269.829	339.829
May	53	12	122	34	88	5.9	30	50	10	6	5	0	228.9	298.9	194.9	235.829	34	269.829	339.829
June	54	12	122	34	88	5.9	30	50	10	6	5	0	228.9	298.9	194.9	235.829	34	269.829	339.829
July	55	13	111	34	77	5.9	30	50	10	6	5	0	217.9	287.9	183.9	222.519	34	256.519	326.519
August	56	14	147	34	113	5.9	30	50	10	6	5	0	253.9	323.9	219.9	266.079	34	300.079	370.079
September	57	14	147	34	113	5.9	30	50	10	6	5	0	253.9	323.9	219.9	266.079	34	300.079	370.079
October	58	14	147	34	113	5.9	30	50	10	6	5	0	253.9	323.9	219.9	266.079	34	300.079	370.079
November	59	14	147	34	113	5.9	30	50	10	6	5	0	253.9	323.9	219.9	266.079	34	300.079	370.079
December	60	14	147	34	113	5.9	30	50	10	6	5	0	253.9	323.9	219.9	266.079	34	300.079	370.079
2004 January	61	16	126	34	92	5.9	30	50	10	6	5	0	232.9	302.9	198.9	240.669	34	274.669	344.669
February	62	16	126	34	92	5.9	30	50	10	6	5	0	232.9	302.9	198.9	240.669	34	274.669	344.669
March	63	17	125	34	91	5.9	30	50	10	6	5	0	231.9	301.9	197.9	239.459	34	273.459	343.459
April	64	17	125	34	91	5.9	30	50	10	6	5	0	231.9	301.9	197.9	239.459	34	273.459	343.459
May	65	18	114	34	80	5.9	30	50	10	6	5	0	220.9	290.9	186.9	226.149	34	260.149	330.149
June	66	18	114	34	80	5.9	30	50	10	6	5	0	220.9	290.9	186.9	226.149	34	260.149	330.149
July	67	18	114	34	80	5.9	30	50	10	6	5	0	220.9	290.9	186.9	226.149	34	260.149	330.149
August	68	18	114	34	80	5.9	30	50	10	6	5	0	220.9	290.9	186.9	226.149	34	260.149	330.149
September	69	19	113	34	79	5.9	30	50	10	6	5	0	219.9	289.9	185.9	224.939	34	258.939	328.939
October	70	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
November	71	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
December	72	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
2005 January	73	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
February	74	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
March	75	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
April	76	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
May	77	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
June	78	N/A	0	0	0	5.9	30	50	10	6	5	0	106.9	176.9	106.9	129.349	0	129.349	199.349
July	79	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
August	80	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
September	81	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
October	82	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
November	83	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
December	84	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
2006 January	85	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
February	86	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
March	87	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
April	88	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
May	89	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
June	90	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
July	91	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
August	92	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
September	93	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
October	94	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
November	95	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21
December	96	N/A	0	0	0	0	30	50	10	6	5	0	101	171	101	122.21	0	122.21	192.21

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ATTACHMENT B.2

WPRAP PHASE CALENDAR

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TABLE B.2-1

WPRAP PHASE CALENDAR

Phase	Start Date	End Date
1	2/22/99	6/9/99
2	6/11/99	6/21/00
3	6/21/00	10/20/00
4	10/20/00	3/1/01
5	3/1/01	11/15/01
6	11/15/01	1/3/02
7	1/3/02	3/6/02
8	3/6/02	6/3/02
9	6/3/02	10/31/02
10	10/31/02	2/12/03
11	2/12/03	3/5/03
12	3/5/03	7/21/03
13	7/21/03	8/4/03
14	8/4/03	1/8/04
15	1/8/04	1/9/04
16	1/9/04	2/23/04
17	2/23/04	5/11/04
18	5/11/04	8/31/04
19	8/31/04	9/20/04

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Appendix C

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APPENDIX C

ARWWP STANDARD OPERATING PROCEDURES

ARWWP STANDARD OPERATING PROCEDURES

PROCEDURE NO........FILENAME..

20-C-510	REMOVAL, TRANSPORT, AND STORAGE OF DECANT SUMP LIQUID FROM K-65 SILOS 1 AND 2
43-C-100	CLEANING GLASS AND PLASTIC LABORATORY WARE
43-C-101	STORING AND HANDLING CHEMICALS
43-C-102	SAMPLE PRESERVATION BY ACID ADDITION
43-C-104	HORIBA WATER QUALITY METER CALIBRATION, OPERATION, AND MAINTENANCE
43-C-105	ION EXCHANGE RESIN SLUICING AND ADDITION - SOUTH PLUME INTERIM TREATMENT (SPIT) SYSTEM
43-C-107	K-65 AREA ROUNDS AND OPERATIONS
43-C-108	IEMP SURFACE WATER SAMPLING
43-C-305	WATER PLANT LABORATORY PROCEDURES
43-C-306	STORM SEWER LIFT STATION
43-C-308	RESPONDING TO INDICATIONS OF OUT-OF-SPECIFICATION EXCURSIONS OF STORM SEWER WATER QUALITY
43-C-326	STORMWATER RETENTION BASIN CONTROL SYSTEM OPERATION
43-C-332	OPERATION OF THE HACH DR/3000 SPECTROPHOTOMETER
43-C-335	IAWWT (STORMWATER RETENTION BASIN) SYSTEM OPERATION
43-C-337	WASTE PIT AREA STORMWATER RUNOFF CONTROL SYSTEM OPERATION
43-C-340	AWWT PHASE I AND II OPERATIONS
43-C-341	ADVANCED WASTE WATER TREATMENT BASELINE VALVE LINE-UP
43-C-343	ADVANCED WASTE WATER TREATMENT (AWWT) BULK CHEMICAL SYSTEMS
43-C-344	AWWT SUMPS OPERATIONS AND RESPONSE TO CHEMICAL SPILLS
43-C-345	REGENERATION, SLUICE IN AND OUT OF ION EXCHANGE RESIN FOR AWWT PHASES I AND II
43-C-347	AWWT EMERGENCY SHOWER SYSTEM OPERATION
43-C-348	AWWT HEATING, VENTILATION AND AIR CONDITIONING SYSTEM OPERATION
43-C-349	AWWT PROCESS ARE MAKE-UP AIR SYSTEM OPERATION
43-C-350	AWWT STEAM AND CONDENSATE SYSTEM OPERATIONS
43-C-353	AWWT TREATED WATER SYSTEM OPERATION
43-C-356	RECEIVING SLURRIES AND CHEMICALS AT THE AWWT SLURRY DEWATERING FACILITY
43-C-357	PRETREATMENT OF MISCELLANEOUS SLURRIES AT THE AWWT SLURRY DEWATERING FACILITY
43-C-358	THICKENING, FILTRATION, AND DISCHARGE AT THE AWWT SLURRY DEWATERING FACILITY
43-C-359	PRETREATMENT OF AWWT SLURRY AT THE AWWT SLURRY DEWATERING FACILITY
43-C-360	BASELINE VALVE LINE-UP FOR THE AWWT SLURRY DEWATERING FACILITY
43-C-361	BUILDING UTILITIES AT THE AWWT SLURRY DEWATERING FACILITY
43-C-362	CLEANING SAMPLE TUBES AT THE AWWT
43-C-364	BACKWASHING IAWWT ION EXCHANGE VESSELS
43-C-365	LEACHATE CONVEYANCE SYSTEM OPERATION
43-C-367	AWWT EXPANSION (PHASE III 1800 GPM) SYSTEM OPERATIONS
43-C-368	NEW SEWAGE TREATMENT PLANT OPERATIONS
43-C-369	OPERATION OF EXTRACTION AND REINJECTION WELLS AT THE AWWT DCS
43-C-370	STARTUP AND SHUTDOWN OF AWWT PHASE I AND II OPERATIONS
43-C-371	SLUDGE DREDGE OPERATIONS
43-C-412	MANAGEMENT OF THE WATER COVER FOR WASTE PIT 6
43-C-413	HANDLING WASTE MATERIALS WITH THE INDUSTRIAL VACUUM LOADER TRUCK (SUPERSUCKER)
43-C-414	INDUSTRIAL VACUUM LOADER TRUCK (SUPERSUCKER) OPERATION
43-C-421	ION EXCHANGE RESIN SLUICING AND ADDITION FOR THE IAWWT (STORMWATER RETENTION BASIN) SYSTEM
43-C-502	INDUSTRIAL VACUUM LOADER TRUCK (GUZZLER) OPERATION
43-C-505	ENVIRONMENTAL SAMPLING AT THE SEWAGE TREATMENT PLANT AND THE PARSHALL FLUME
43-C-601	INSPECTION/OPERATION OF SURFACE IMPOUNDMENTS
43-C-701	GENERAL SUMP OPERATION
43-C-903	SOUTH PLUME INTERIM TREATMENT (SPIT) SYSTEM OPERATION
43-C-904	RECOVERY WELL FIELD
43-M-1001	DISSOLVED OXYGEN (DO) AZIDE MODIFICATION OF WINKLER METHOD

ARWWP STANDARD OPERATING PROCEDURES
(Continued)

PROCEDURE NO.	FILENAME
43-M-1002	DISSOLVED OXYGEN (DO), MEMBRANE ELECTRODE METHOD
43-M-1003	DPD METHOD FOR FREE AND TOTAL CHLORINE TEST
43-M-1004	TOTAL COLIFORM TESTING BY MEMBRANE FILTER METHOD
43-M-1005	FECAL COLIFORM TESTING OF WATER BY MEMBRANE FILTER METHOD
43-M-1006	BRPADAP TEST FOR SOLUBLE URANIUM BY SPECTROPHOTOMETER
43-M-1007	ALKALINITY (TOTAL AND PHENOPHALEIN) TESTING OF WATER
43-M-1008	TOTAL HARDNESS TESTING OF WATER BY EDTA TITRIMETRIC METHOD
43-M-1009	TOTAL PHOSPHORUS TESTING OF WATER BY ASCORBIC ACID METHOD WITH PERSULFATE PREDIGESTION
43-M-1010	STABILITY TEST OF WATER BY SATURATION WITH CALCIUM CARBONATE
43-M-1011	PH (HYDROGEN ION) TESTING OF WATER BY ELECTROMETRIC METHOD
43-M-1012	CONDUCTIVITY/RESISTIVITY TESTING OF WATER BY ELECTROMETRIC METHOD
43-M-1013	SPECTROPHOTOMETRIC TEST FOR NITRATES IN WATER USING MODIFIED CADMIUM REDUCTION METHOD
43-M-1014	TOTAL SUSPENDED (NON-FILTERABLE) SOLIDS IN WATER
43-M-1015	TOTAL DISSOLVED (FILTERABLE) SOLIDS IN WATER
43-M-1016	IGNITION TEST FOR VOLATILE AND FIXED SOLIDS IN WATER
43-M-1017	TOTAL SOLIDS IN WATER
43-M-1018	VOLUMETRIC MEASUREMENT OF SETTLEABLE SOLIDS IN WATER
43-M-1020	CHEMICAL OXYGEN DEMAND OF WATER BY REACTOR DIGESTION METHOD WITH COLORIMETRIC DETERMINATOR
43-M-1021	BICINCHONINATE METHOD FOR TESTING COPPER IN WATER BY SPECTROPHOTOMETER
43-M-1022	QUALITY TESTING OF REAGENT-GRADE WATER
43-M-1023	BIOCHEMICAL OXYGEN DEMAND (BOD) AND CARBONACEOUS BIOCHEMICAL OXYGEN DEMAND (CBOD)
43-M-1024	DETERMINATION OF URANIUM IN WATER: UA-3 LASER INDUCED PHOSPHORESCENCE
43-M-1025	AMMONIA NITROGEN IN WATER BY THE NESSLER METHOD
43-M-1026	IRON IN WATER BY 1,10 PHENANTHROLINE METHOD
43-M-1027	SULFATE IN WATER BY SULFAVER4 METHOD
43-M-1028	NITRATE ION-SELECTIVE ELECTRODE METHOD
43-M-1029	HEXAVALENT CHROMIUM BY COLORIMETRIC METHOD (DR3000)
43-M-1030	FLUORIDE BY ION-SELECTIVE ELECTRODE METHOD
43-M-1031	SOLUBLE URANIUM BY KINETIC PHOSPHORESCENCE ANALYZER (KPA)
43-M-1032	PH TESTING OF WATER BY ELECTROMETRIC METHOD WITH ORION 920A
43-M-1033	PH (HYDROGEN ION) TESTING OF WATER USING ORION 420A
43-M-1034	DETERMINATION OF SPECIFIC GRAVITY USING AN ANALYTICAL BALANCE
43-M-1035	DETERMINATION OF SPECIFIC GRAVITY - DMA-35 DENSITY METER
43-M-1036	WATER TEMPERATURE OF FEMP WASTEWATER
M-123	STANDING ORDERS FOR AWWT OPERATIONS
M-137	WATER TREATMENT PLANT LABORATORY QUALITY ASSURANCE PLAN
M-140	FACILITIES CLOSURE AND DEMOLITION PROJECTS DIVISION PROCEDURE SYSTEM
PO-S-04-006	AERATION FACILITY

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APPENDIX D

GROUNDWATER RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE PLAN

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GROUNDWATER RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

DECEMBER 1999

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

51400-OM-0001

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GROUNDWATER RESTORATION WELL PERFORMANCE MONITORING AND MAINTENANCE PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

DECEMBER 1999

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1.0 INTRODUCTION

The objective of this Performance Monitoring and Maintenance Plan (PMMP) is to document planned maintenance and monitoring requirements for the groundwater restoration wells to support successful long-term operation of the groundwater restoration system. The activities described within this document will become the basis for providing routine maintenance of the extraction wells comprising the various modules of the system and for monitoring system performance to determine if more extensive maintenance activities are required. Regularly scheduled maintenance of components of the restoration well system is required so that the difficulties associated with continuous operation will be minimized and thus manageable with the resulting system's online time maximized. Continuous operation of the well system, within practical limitations, is required to maintain groundwater restoration objectives at the FEMP.

Periodic revision of this document will be necessary as additional operating experience is gained and the various new modules of the groundwater restoration system are activated.

2.0 RESTORATION WELL DESCRIPTIONS

This section provides a general description of the extraction wells comprising the active groundwater restoration modules that are covered by this monitoring and maintenance plan. The active modules are the South Plume and the South Field.

2.1 SOUTH PLUME EXTRACTION WELLS

The South Plume Module includes six wells that are used to pump groundwater from the off-property portion of the Great Miami Aquifer plume to the FEMP Site's South Field valve house. In the valve house portions of the flow are routed to treatment or to the Great Miami River as necessary, to maintain compliance with discharge limitations. These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
Extraction Well 1	EW-1	3924
Extraction Well 2	EW-2	3925
Extraction Well 3	EW-3	3926
Extraction Well 4	EW-4	3927
Extraction Well 6	EW-6	32308
Extraction Well 7	EW-7	32309

Each of the South Plume extraction wells contains a submersible pump/motor assembly and has a pitless type adapter near the ground surface that transitions the vertical pump discharge piping to the underground force main. The underground force main from wells EW-1, EW-2, EW-3, and EW-4 passes through individual underground valve pits. These valve pits contain several components of the individual wells control system. EW-6 and EW-7 do not utilize underground valve pits to contain any control system components. All control components for these two wells are located in the South Plume Valve House building.

The design of the flow control systems for each of these six wells is identical; flow is controlled by a flow control loop consisting of a magnetic flow meter, a process control station (PCS), and a motor operated flow control valve. Each well can be controlled locally by the PCS or remotely by the Distributed Control System (DCS) located in Building 51 at the Advanced Wastewater Treatment (AWWT) Facility. The normal operational mode is to have the wells operated remotely from the

AWWT DCS, via the local PCS. Additionally, a local set point is input to the PCS so that the well can automatically revert to local control if communication with the DCS is interrupted.

The desired flow rate set point for each is entered into the DCS and PCS at the AWWT and the South Plume Valve House respectively. This value is compared continuously to the actual flow measured by the magnetic flow meter. When required, the DCS or PCS adjusts the position of the flow control valve to maintain the desired flow. Pump "Start" and "Stop" can be controlled by the DCS or the PCS and can also be controlled from the pump starter panel. The starter panels for EW-1 through EW-4 are located at the individual well heads while the starter panels for EW-6 and EW-7 are located in the South Plume Valve House.

In addition, each of the South Plume extraction wells is equipped with isolation valves, check valves, air releases and pressure indicating transmitters. The pressure indicating transmitters are tied to process interlocks that will shut the pumps down if high or low pressures are maintained. This interlock is intended to protect the pump/motor assemblies from damage due to closed discharge valves or to shut down the pumps if no system back pressure is sensed. Also, critical control components are protected by lightning/surge arresters to prevent damage to the control system during electrical storms.

Each of the South Plume extraction wells has been equipped with an installed pressure transducer that allows the water level within the extraction well to be monitored. This pressure transducer terminates at the wellhead and can be connected by cable to a Hermit data logger. However, the historical reliability of these connections for routine water level monitoring has not proven to be very high, therefore routine water level monitoring within the well may be performed with a manually-operated water level indicator.

Installation details of the South Plume extraction wells are shown in Figure 1.

2.2 SOUTH FIELD EXTRACTION WELLS

The South Field Module includes ten wells that are used to pump groundwater from the Great Miami Aquifer to the FEMP Site water treatment facilities or to the Great Miami River if treatment is not required to achieve discharge limitations. These wells are as follows:

Extraction Well ID	Common Well ID	Formal Site Well ID
Extraction Well 13	EW-13	31565
Extraction Well 14	EW-14	31564
Extraction Well 15	EW-15	31566
Extraction Well 16	EW-16	31563
Extraction Well 17	EW-17	31567
Extraction Well 18	EW-18	31550
Extraction Well 19	EW-19	31560
Extraction Well 20	EW-20	31561
Extraction Well 21	EW-21	31562
Extraction Well 22	EW-22	32276

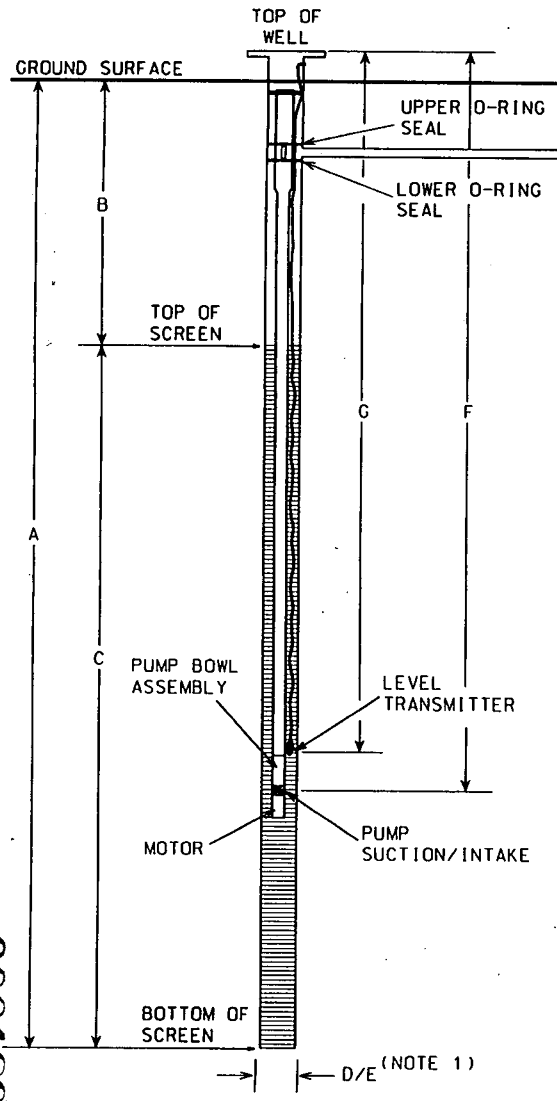
Each of the ten South Field extraction wells is of similar design with the exception of the well depth, screen length, and screen slot size. Each contains a submersible pump/motor assembly. Groundwater is pumped from the below grade pump to the well head at the ground surface via the vertical discharge piping. At the well head, this piping is routed horizontally through an ultrasonic flow meter and into the individual well houses. All of the individual wells control components are located at these well houses.

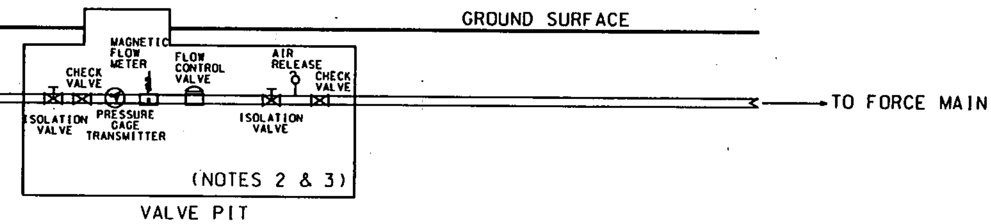
The flow control system for each of the ten extraction wells is identical; flow is controlled by a flow control loop consisting of an ultrasonic flow meter, a process control station (PCS) and a variable frequency drive (VFD). Each extraction well can be controlled locally by the PCS or remotely by the Distributed Control System (DCS) located in Building 51 at the Advanced Wastewater Treatment (AWWT) Facility. The normal operational mode is to have the wells operated remotely from the AWWT DCS, via the local PCS. Additionally, a local set point is input to the PCS so that the well can automatically revert to local control if communication with the DCS is interrupted.

The desired flow rate set point for each extraction well is entered into the DCS and PCS at the AWWT and the individual well houses, respectively. This value is compared continuously to the actual flow rate measured by the ultrasonic flow meter. When required, the DCS or PCS adjusts the pump motor speed via the VFD to maintain the desired flow. Pump "Start" and "Stop" can be controlled by the DCS or the PCS and can also be controlled at the VFD.

In addition, each extraction well is equipped with isolation valves, a check valve, air releases, a pressure indicating transmitter, and installed pressure transducers that allows water level within the extraction well to be monitored. This pressure transducer terminates at the well house and can be connected by cable to a Hermit data logger. However, the historical reliability of these connections for routine water level monitoring has not proven to be very high, therefore routine water level monitoring within the well may be performed with a manually-operated water level indicator.

Installation details of the South Field Extraction Wells are shown in Figure 2.





EXTRACTION WELL NUMBER	A WELL DEPTH BELOW GRADE (MEASURED)	B TOP OF SCREEN DEPTH BELOW GRADE	C SCREEN LENGTH	D SCREEN/ CASING DIAMETER	E (NOTE 1) INTERNAL SCREEN DIAMETER	F (NOTE 2) PUMP SUCTION DEPTH (BTOW)	G LEVEL TRANSMITTER SETTING (BTOW)	SLOT SIZE	SURFACE ELEVATION	TOP OF WELL ELEVATION
EW-1	55′	15′	40′	12"	10"PS	33′	27′	0.075	531.9	533.5
EW-2	65′	25′	40′	12"	12"TS	42′	36′	0.075	540.3	542.0
EW-3	109′	69′	40′	12"	10"PS	87′	81′	0.075	585.0	586.7
EW-4	114′	74′	40′	12"	N/A	92′	84′	0.050	589.0	591.8
EW-5	113′	78′	35′	12"	N/A	N/A	N/A	0.075	588.3	590.2
EW-6	(107′)	84.6′	25′	12"	N/A	82′	76′	0.035	581.4	581.7
EW-7	(112′)	74.5′	30′	12"	N/A	82′	76′	0.035	581.1	581.4

NOTES:

1: DIMENSION 'E' REPRESENTS THE NOMINAL SIZE OF THE SCREEN TELESCOPED INSIDE OF THE ORIGINAL SCREEN. PS = PIPE SIZE: TS = TELESCOPE SIZE

2: PROCESS CONTROL STATIONS (PCS's) ARE LOCATED IN THE SOUTH PLUME VALVE HOUSE

3: EXTRACTION WELLS EW-6 AND EW-7 FLOW CONTROL VALVE, FLOW METER, PRESSURE INDICATORS AND STARTER PANELS ARE LOCATED IN SOUTH PLUME VALVE HOUSE

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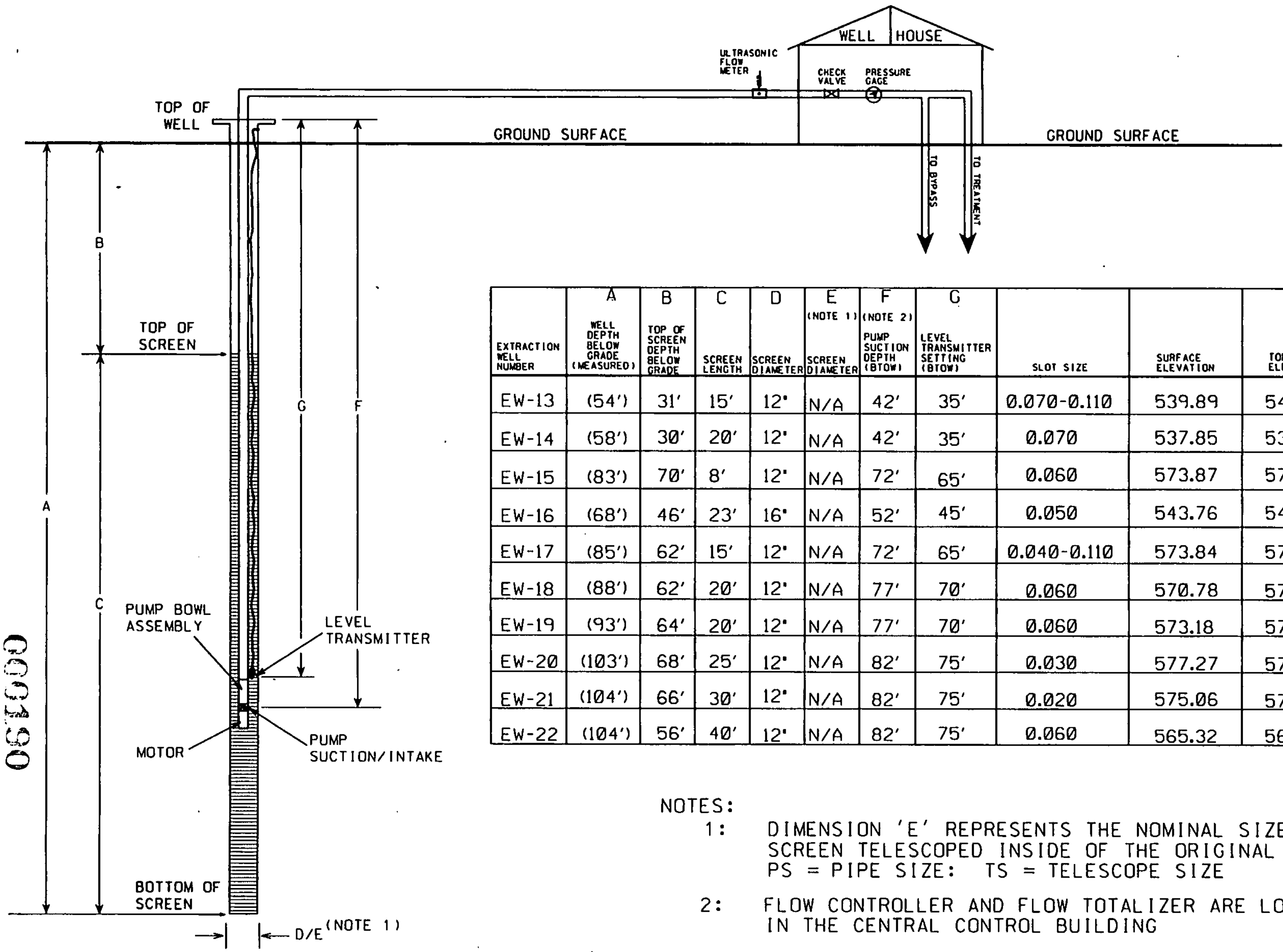
FIGURE 1. SOUTH PLUME MODULE, EXTRACTION WELL INSTALLATION DETAILS



EXTRACTION WELL NUMBER	A WELL DEPTH BELOW GRADE (MEASURED)	B TOP OF SCREEN DEPTH BELOW GRADE	C SCREEN LENGTH	D SCREEN DIAMETER	E (NOTE 1) SCREEN DIAMETER	F (NOTE 2) PUMP SUCTION DEPTH (BTOW)	G LEVEL TRANSMITTER SETTING (BTOW)	SLOT SIZE	SURFACE ELEVATION	TOP OF WELL ELEVATION
EW-13	(54')	31'	15'	12"	N/A	42'	35'	0.070-0.110	539.89	540.72
EW-14	(58')	30'	20'	12"	N/A	42'	35'	0.070	537.85	537.85
EW-15	(83')	70'	8'	12"	N/A	72'	65'	0.060	573.87	573.87
EW-16	(68')	46'	23'	16"	N/A	52'	45'	0.050	543.76	543.76
EW-17	(85')	62'	15'	12"	N/A	72'	65'	0.040-0.110	573.84	573.84
EW-18	(88')	62'	20'	12"	N/A	77'	70'	0.060	570.78	570.78
EW-19	(93')	64'	20'	12"	N/A	77'	70'	0.060	573.18	573.18
EW-20	(103')	68'	25'	12"	N/A	82'	75'	0.030	577.27	577.27
EW-21	(104')	66'	30'	12"	N/A	82'	75'	0.020	575.06	575.06
EW-22	(104')	56'	40'	12"	N/A	82'	75'	0.060	565.32	565.32

NOTES:

1: DIMENSION 'E' REPRESENTS THE NOMINAL SIZE OF THE SCREEN TELESCOPED INSIDE OF THE ORIGINAL SCREEN. PS = PIPE SIZE: TS = TELESCOPE SIZE

2: FLOW CONTROLLER AND FLOW TOTALIZER ARE LOCATED IN THE CENTRAL CONTROL BUILDING

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FIGURE 2. SOUTH FIELD MODULE, EXTRACTION WELL INSTALLATION DETAILS

3.0 FACTORS AFFECTING SYSTEM OPERATION

The original 5 extraction wells comprising the South Plume groundwater restoration module began pumping operations in August 1993, as part of the implementation of the Operable Unit 5 Removal Action No. 3, South Plume Removal Action. In the intervening time period, Fluor Daniel Fernald (FDF) has obtained valuable operational experience and knowledge that is being used to optimize long-term operation of extraction wells site wide. This experience base has resulted in identification of factors affecting operation life and efficiency, some of which were unknown at the start of pumping operations. These factors have either already been addressed or are incorporated into this plan.

In order to better understand the factors affecting large-scale groundwater pumping operations, FEMP consulted with Moody's of Dayton, a water well maintenance and installation contractor. Moody's has served the water well industry throughout the Great Miami Aquifer for more than 30 years and has extensive experience maintaining large-capacity wells for a number of major water supply systems. Frequencies for routine maintenance and monitoring activities were selected using input received from their evaluation of the South Plume Extraction well system and based on their experience working with systems of similar magnitude in the regional aquifer.

Several factors affect the performance of the extraction wells. In addition, a number of other specific requirements of the FEMP's system complicate these factors. All of these factors and requirements were considered in developing this maintenance and monitoring plan. First, all the FEMP's extraction wells are placed in and are extracting water from the upper most portions of the Great Miami Aquifer. This fact complicates both pump/motor cooling and iron fouling of the extraction well screen. Normal water well practice would place the screened section of the well deeply in the aquifer and the pump/motor assembly would be placed above the screen in a submerged section of blank casing. Since the extraction wells are intended to intercept a plume of contamination located near the top of the aquifer, the screened sections begin near the normal water level. In order to provide the required submergence of the pump/motor assembly, this assembly must be placed within the screened section. The high flow rates required for plume capture combined with the "surgical" removal of the contamination plume has led to difficulties in ensuring that the flow of water passing the motor is adequate for cooling.

Placement of the pump/motor assembly within a screen that is located on the surface of the aquifer also complicates the impacts of iron-fouling. Moody's has confirmed that iron fouling is prevalent throughout the regional aquifer and that the details of the FEMP installation further enhance the problem. Combined with the fact that this region of the Great Miami Aquifer contains some of the highest concentrations of iron and iron-fouling bacteria, fouling of the well screens and other downstream equipment has been experienced.

Continuous operation of the extraction wells also exacerbates the factors noted above. Normal water well industry practice does not require pumping wells to operate continuously. Typical water supply well systems pump between 6 and 10 hours per day and have spare wells that can be rotated in and out as demand requires (especially when maintenance is required). The FEMP's extraction well system however, runs continuously and has no spare wells to compensate for wells taken out of service for maintenance. In fact, when a well is shut down for an extended period to perform maintenance, the remaining wells must increase their flow to continue the planned capture of the plume.

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4.0 MAINTENANCE AND OPERATIONAL MONITORING

Several routine activities are performed to optimize performance of the extraction wells comprising the South Plume and South Field groundwater restoration modules. The following maintenance and operational monitoring activities are described in this section:

- Routine well/screen maintenance, which includes superchlorination of the well (semi-annually at a minimum)
- Routine system maintenance, which includes maintenance actions related to valves, instrumentation, and controls associated with each extraction well. This maintenance is performed by FDF Maintenance and Operations personnel, and;
- Operational monitoring, which includes quarterly monitoring of extraction well capacity and pump/motor assembly performance.

4.1 MAINTENANCE OF THE WELL AND SCREEN

Well and screen maintenance is required to maximize system on-stream factors, and to minimize well drawdown and major rehabilitation. The extraction well will be superchlorinated by the addition of sodium hypochlorite (12.5 percent chlorine). Superchlorination will be performed on each well every six months, or more frequently if water-level monitoring indicates excessive drawdown, (see Section 4.3). This maintenance action is anticipated to require an outage of 72-hours per extraction well. It is acknowledged in this plan that periodic, major rehabilitation efforts may be required every few years or when the drawdown within the well remains consistently excessive, even after superchlorination maintenance. These rehabilitation efforts are not considered to be routine maintenance within the context of this plan.

The routine maintenance of the extraction well and screen involves superchlorination of the well without removal of the pump/motor assembly. This serves to deter iron-bacteria growth and buildup on the screen and in the local formation and therefore serves to enhance long-term well production. The basic steps are detailed below:

Step 1:
Shutdown the extraction well pump and allow the static water level to stabilize.

Step 2:
Inject sodium hypochlorite to obtain a 2,000 to 3,000 milligrams per liter (mg/L) concentration of chlorine. This is determined for each well individually, based on the standing water volume in the well. The volume in each well is a function of the depth of water in each well and the diameter of the screen/casing.

Step 3:
Back surge the chlorinated water into the gravel pack and aquifer by starting the installed extraction well submersible pump and pumping until the water reaches the wellhead. Shut down the pump and open the sampling port at the well head to allow the water to backflow through the 6-inch drop pipe, pump, screen, and to dissipate into the gravel pack. Repeat this procedure for two hours with approximately five minutes between surges. Allow chlorine to remain in well for 24 hours.

Step 4:
Discharge water by pumping into force main. (Note: The FEMP facility owner and Environmental Compliance must be notified prior to discharge of these waters.) This water is sampled and analyzed to document its chlorine content. This sampling and analysis must be completed prior to discharging the bulk of the water within the well and will require that the main discharge valve be closed, the pump started, and samples taken from the sampling port at the well head.

4.2 MAINTENANCE OF PUMPS, PIPING, AND CONTROLS

These maintenance activities are directed primarily at the valves, instrumentation, and controls associated with each extraction well. These actions will be incorporated into the FDF Computerized Maintenance Management System (CMMS). This system provides automatic generation of preventative maintenance work orders to ensure that routine maintenance is performed when required. In addition to formal preventative maintenance activities, several routine system checks are performed by operations personnel, between scheduled preventative maintenance activities, to ensure that equipment is functioning properly.

The following is a list of preventative maintenance and operational checks that are routinely performed:

Process Control Station: Annual
The process control stations for each of the recovery and extractions wells are taken out of service annually. At this time, the operational setup parameters for the specific wells are verified and/or updated to reflect current operating conditions. This is anticipated to require an outage of four hours per well.

Flow Meters: Clean and Calibrate Quarterly

Cleaning and calibration of the flow meter is anticipated to require an outage of 4 hours per extraction well in the South Plume and 8 hours per extraction well in the South Field.

Check Valves: Inspect and Clean Seat Semi-Annually

Inspection and cleaning of the check valve is anticipated to require an outage of 4 hours per extraction well.

The piping configuration for extraction wells EW-1 through EW-4 includes two check valves. The original check valve cannot be inspected or maintained without removal from the piping system and, because of its location at the extreme end of the piping run in the valve pit, requires that the entire South Plume extraction well system be shut down and drained. The redundant check valve was installed between isolation valves and is a "swing-check" valve that is equipped with a removable inspection plate. Inspection and cleaning of this check valve requires that the individual extraction well be shut down for approximately four hours. Extraction wells EW-6 and EW-7 and all of the South Field Extraction wells have a single in line check valve that is removed, inspected and cleaned. This maintenance activity is anticipated to require each well to be shutdown for approximately 4 hours.

Flow Control Valves and Actuators: Disassemble and inspect annually

Extraction wells EW-1 through EW-4, EW-6 and EW-7 each utilize motor operated flow control valves. These are required to be inspected and cleaned annually to prevent the buildup of iron fouling bacteria encrustation. This maintenance activity will require each well to be shut down for approximately 8 hours.

Pressure Indicating Transmitters: Annual Calibration

Each extraction well has pressure indicating transmitters that are used in performance testing to determine the pump's discharge head (pressure). Accurate pressure sensing in the full range of pumping pressures is required for accurate testing. Annual testing and calibration of these transmitters is anticipated to require an outage of 2 hours per well.

Lightning Arresters: Monthly Test

Extraction wells EW-1 through EW-4, EW-6 and EW-7 each have lightning arresters installed to prevent damage from electrical storms. Routine testing of these devices is required to ensure that they are in working order. An outage of 2 hours per well is anticipated for this maintenance activity.

4.3 OPERATIONAL MONITORING

The main system performance indicators for the South Plume and South Field extraction well modules are gathered and summarized in performance tests conducted quarterly. These tests monitor the specific capacity of each well and the pump/motor assembly performance. Several of the parameters measured may be monitored more frequently to develop additional system data for trending purposes.

4.3.1 Parameters to Be Monitored

Extraction well operating parameters that are required to be routinely monitored include the following:

- Water level - static and pumping
- Flow
- Discharge pressure
- Motor amperage draw.

Water Level Monitoring:

Water level, both static and pumping, is perhaps the most critical parameter measured and therefore needs to be measured routinely. The drawdown from static water level to the pumping water level is used to calculate a specific capacity for the well and is a direct indication of the degree of fouling of the well screen and/or the adjacent formation. The installation depth of the extraction well pump/motor assemblies has been established, based upon an anticipated worst-case drawdown of 10 feet below the seasonal low-static water levels. Historical data were reviewed to determine seasonal lows. While each setting has some added submergence to be conservative, pumping levels are monitored routinely to ensure that adequate pump/motor submergence is maintained.

If the pumping water level measured during the quarterly performance testing approaches the top of the pump's bowl assembly, superchlorination maintenance will be performed. If, after superchlorination, pump submergence remains minimal, more extensive rehabilitation efforts may be necessary. Rehabilitation efforts include cleaning of the well utilizing dual swab and airlift pumping to remove debris. After cleaning, the well will be acid treated to break down encrustation on the well screen and within the local formation. This will then be followed by chlorination to inhibit future iron-fouling bacterial growth. These processes may if necessary, be repeated several times to ensure that the well has been rehabilitated to its optimal condition.

Flow Monitoring:

The ability of a extraction well pump/motor to sustain the desired flow is a key indicator of the health of the flow meter, controls, variable frequency drive, well and the pump/motor assembly. Specific testing to determine the ability of a pump/motor assembly to perform as expected will be completed quarterly. This testing is detailed in the performance testing description in Section 4.3.2.

Additionally, individual extraction well flow is monitored continuously by the flow controller for each well. The actual flow verses the controller set point is checked by operations personnel locally, in the field once per shift on first and second shift each day. Any significant deviation from the flow set point is investigated and required maintenance actions are determined then carried out.

Discharge Pressure Monitoring:

Pump discharge pressure, coupled with flow, is monitored quarterly to assess the pump/motor assemblies performance against the manufacturers published performance curves and is detailed in the performance testing description in Section 4.3.2.

Amperage:

As with flow and pressure, amperage is a good indicator of how the pump/motor assembly is performing. During performance testing, motor amperage draw is measured on each of the three phases of the electrical supply. Amperage draw is compared to the motor manufacturer' published specifications. Amperage should be below the manufacturer's full-load amperage and should be approximately equal across the phases of the motor. An imbalance of greater than 20 percent across the phases indicates a motor or electrical supply situation that triggers more extensive diagnosis. Additional diagnostics and repairs are not within the scope of this plan.

4.3.2 Performance Testing

Performance testing of the extraction wells is conducted quarterly to assess their condition; this testing requires an outage of approximately 4 hours per well. Performance testing is currently performed by Moody's of Dayton and is summarized in written reports. Static water-level measurements are made prior to each performance test. This measurement serves as the basis for computing drawdown within the extraction well. System flow, discharge pressure, pumping level, and motor amperage per phase are measured at each of at least five different flows for the extraction well. These five flows include maximum flow (discharge valve fully open) and zero flow conditions (discharge valve closed).

The results of these measurements are summarized in two ways. First, the flow and discharge head is plotted and compared to extraction well pump manufacturer and previously developed head/flow curves. Second, the static water level and pumping levels are used to calculate drawdown and specific capacity within the extraction well at various flows. As plugging of the well screen due to iron fouling and encrustation progresses, it is expected that drawdown within the well will increase for a given flow rate. Superchlorination maintenance as described in Section 4.1 will be completed to determine its effect on drawdown levels. If, after superchlorination, the drawdown remains excessive, more extensive rehabilitation efforts will likely be required.

Additionally, the amperage draw of the well at various flows is compared to previous readings and pump/motor manufacturers published information.

TABLE 4-1

PLANNED OUTAGES OF THE SOUTH PLUME MODULE WELLS (including EW-1 through 4, and EW-6, and EW-7)

Item	Description	PMMP Reference	Frequency	Duration per Event
1	Performance Testing	4.3.2	Quarterly	≈ 4 hours/well
2	Maint. of the well and screen [a]	4.1	Semi-Annually [a]	≈ 72 hours/well
3	Process Control Station	4.2	Annually	≈ 4 hours/well
4	Pressure Transmitter Calibration	4.2	Annually	≈ 2 hours/well
5	Magnetic Flow Meter Clean and Calibrate [b]	4.2	Quarterly [b]	≈ 4 hours/well
6	Check Valve Inspect/Clean	4.2	Semi-Annually	≈ 4 hours/well
7	Flow Control Valve and Actuator Cleaning	4.2	Annually	≈ 8 hours/well
8	Rehabilitation	4.1	Variable	≈ 3 weeks
9	Lightning Arrester Testing	4.2	Monthly	≈ 2 hours/well

[a]Well screen maintenance will be completed at a minimum frequency of twice per calendar year. This frequency is dependent upon individual well performance. The need for this maintenance activity will be based upon the monitoring of the specific capacity of the individual wells.

[b]Flow meter calibration may occur as a post maintenance test utilizing a portable flow meter.

TABLE 4-2

PLANNED OUTAGES OF THE SOUTH FIELD MODULE WELLS
(including EW-13 through EW-22)

Item	Description	PMMP Reference	Frequency	Duration per Event
1	Performance Testing	4.3.2	Quarterly	≈ 4 hours/well
2	Maint. of the well and screen [a]	4.1	Semi-Annually [a]	≈ 72 hours/well
3	Process Control Station	4.2	Annually	≈ 4 hours/well
4	Pressure Transmitter Calibration	4.2	Annually	≈ 2 hours/well
5	Ultrasonic Flow Meter Clean and Calibrate [b]	4.2	Quarterly [b]	≈ 8 hours/well
6	Check Valve Inspect/Clean	4.2	Semi-Annually	≈ 4 hours/well
7	Rehabilitation	4.1	Variable	≈ 3 weeks

[a]Well screen maintenance will be completed at a minimum frequency of twice per calendar year. This frequency is dependent upon individual well performance. The need for this maintenance activity will be based upon the monitoring of the specific capacity of the individual wells.
[b]Flow meter calibration may occur as a post maintenance test utilizing a portable flow meter.

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5.0 REGULATORY ISSUES

The current extraction well rehabilitation efforts and the proposed routine well/screen maintenance require the addition of chemicals to the well. The only proposed chemicals to be added are sodium hypochlorite and hydrochloric acid. The sodium hypochlorite is used for routine well screen maintenance to disinfect the well and inhibit the growth of iron-fouling bacteria. Non-routine, major well rehabilitation efforts require the use of both sodium hypochlorite and hydrochloric acid. The hydrochloric acid is used to break down flow-limiting encrustation on the well screen. The well is purged of these chemicals by pumping to the common force main and combining with other extraction well discharges. The combined flow is directed to discharge and/or treatment, and ultimately discharges to the Great Miami River via the Parshall Flume.

The use of these chemicals in well rehabilitation efforts to date has been monitored closely by FDF Environmental Compliance. Ohio EPA has been notified and has approved of the intended chemical additions and subsequent discharges. After the addition of these chemicals, the water pumped initially from the extraction well is turbid, contain iron residual, dissolved scale, and has a low pH. The discharge of this water will be documented through procedure EP-0005, Controlling Aqueous Wastewater Discharges into Wastewater Treatment System. This procedure requires advance review by FEMP Environmental Compliance and the treatment system facility owner. Adequate dilution of this stream by other water sources is anticipated so that chlorine, turbidity, and low pH will not exceed National Pollutant Discharge Elimination System (NPDES) outfall limits. The chlorine residual is expected to fall to acceptable limits prior to pumping.

In order to discharge chlorinated water, the amount of chlorine residual and rate of discharge must not produce a detectable level (currently defined by OEPA as 0.038 mg/L) of residual chlorine at the Parshall Flume (NPDES Outfall 4001). This requirement is tightly controlled through FEMP Environmental Compliance review using procedure EP-0005.

6.0 ORGANIZATIONAL ROLES AND RESPONSIBILITIES

This section defines the organizational roles and responsibilities associated with the completion of the work defined in this plan. Descriptions of the key responsibilities of the various project organizations involved are provided below:

The DOE Operable Unit 5 Team Leader is responsible for:

- Providing direction and oversight to the completion of the activities defined in this plan
- Acting as the point of contact within DOE and for the regulators and stakeholders for all communications concerning work carried out under this plan.

The FDF Aquifer Restoration/Wastewater Project Director is responsible for:

- Providing overall project management and technical guidance to the Fluor Daniel Fernald team
- Ensuring the necessary resources are allocated to the project for the efficient and safe completion of plan activities
- Oversight and auditing of plan activities to ensure that the work is being performed efficiently and in accordance with all regulatory requirements and commitments, DOE Orders, site policies and procedures, and safe working practices.
- Providing a technical lead for the collection and interpretation of data

The Fluor Daniel Fernald Aquifer Restoration/Wastewater Project Technical Lead is responsible for:

- The safe and prompt completion of work outlined in the plan
- Oversight and programmatic direction of activities
- Reporting to the DOE Operable Unit 5 Team Leader and Fluor Daniel Fernald Aquifer Restoration Project Director on the status of plan activities and on the identification of any problems encountered in the accomplishment of this plan
- Reporting to the Fluor Daniel Fernald Project Manager on the progress of plan activities
- Establishing and maintaining extraction well status files
- Interpreting and reporting data collected
- Coordinating maintenance activities with external service contractors as required.

The Groundwater Monitoring Team will be responsible for:

- Collection of water level data

- Compilation of water level data and reporting of data to FDF Technical Lead.

- Providing oversight of external service contractors during their performance of well maintenance.

The Wastewater Treatment Operations Team will be responsible for:

- Operation of the extraction well system
- Conducting preventive maintenance as scheduled in this plan
- Training and qualification of operations personnel.

7.0 PATH FORWARD

This plan contains monitoring and maintenance activities, and frequencies thereof, based on current projections. The need for and frequency of these activities may change based on future experience gained through the operation, maintenance, and monitoring of the extraction wells currently operational in the South Plume and the South Field Groundwater Restoration Modules. Parameter monitoring frequency may change, as well.

Data gathered from quarterly performance testing will be summarized in written reports submitted by the sub-contractor upon completion of each test. Each report will be added to existing reports on file in the extraction well files and compared to past performance. Additionally, water level readings and feedback from maintenance personnel regarding the condition of system components will be evaluated to determine if modifications to the frequencies of preventive maintenance activities are required. The data gathered over the next several months from the South Field extraction wells and the Optimized South Plume Module wells will be logged and trended.. This will be completed in order to provide for the identification of any required changes to monitoring and maintenance activities in this plan needed to ensure that the system continues to operates at an optimum on-stream factor.

This plan will be revised as necessary during the life of the groundwater restoration process at the FEMP. In addition to the above noted driver for plan revisions, a revised plan will be necessary when: re-injection wells are added to the groundwater remedy (at the close of the re-injection demonstration, provided that re-injection is shown to be a viable enhancement to the FEMP groundwater remedy) and/or new extraction/re-injection well modules are added to the groundwater restoration system. Development of the revised plan(s) will correlate to the individual project schedule driving the revision.

Maintenance feedback and component manufacturer suggestions have been used to develop a spare parts list and stock inventories of the most frequently used parts. The availability of spare parts will assist in minimizing downtimes associated with all maintenance activities.

--2697

LEGEND

- Remediation Wastewater Treatment Operations
- Stormwater Treatment Operations
- Sanitary Wastewater Treatment Operations
- Groundwater Treatment Operations
- Treatment Systems Used for More Than One Water Type

Process Control or Environmental Sample Point

Action Step

Operational Decision

Process or Document Name or Note

000205

NO.	REVISIONS	DATE	DWN.	BY	APPD.
3	OMMP REVISION NO. 1 FINAL	12-20-99	GES		
2	REVISED PER DAVE BRETTSCHNEIDERS REQUEST	4-13-99	LGM	GEP/DJB	
1	INCLUDE WELLPUMPING; CORRECT ERRORS	2-3-98	GES	GEP	

REF. DWG. NO.

NOTE: FLUOR DANIEL FERNALD CADD DRAWING, DO NOT REVISE MANUALLY.

CONFIGURATION MANAGEMENT DRAWING

SYSTEMS, STRUCTURES OR COMPONENTS DEPICTED ON THIS DRAWING ARE UNDER CONFIGURATION MANAGEMENT CONTROL. SEE NOTES.

DAVE BRETTSCHNEIDER 2-3-98
COGNIZANT ENGINEER DATE

APPROVALS

CIVIL & STR.		SAFETY ENG.	
ELECTRICAL		MAINTENANCE	
ENGINEER		FIRE PROTECT.	
INSTRUMENT		WASTE MANAGE	
MECHANICAL		SECURITY	
		PROJECTS	
CHECKED	GEP		
APPROVED	G.E. PAUL	3-5-98	

Fernald Environmental Management Project

FLUOR DANIEL FERNALD

U.S. DEPARTMENT OF ENERGY

FIGURE 5-2
WASTEWATER OPERATIONS
DECISION FLOW CHART

RES 3312
DATE 6-23-97
DRAWN C.G. / G.E.S.

51D-5500-F-01089 3

FORMAT REVISED 8/5/96 FDF5.DGN
FORMAT REVISED 6/29/98

FILE NAME: j:/res3312/51df1089.dgn